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Streamlining for innovation Jon Atle Gulla NorwAl Center Director Trondheim 2025-03-17

After four years of operation, NorwAI has established itself as a focal point for artificial intelligence research in Norway. The three universities and the two research institutes, together with user partners, have made significant research advancements, which are also reflected in publications, conferences, and recently established collaborations with other strong Norwegian and international communities.

In 2020, artificial intelligence was still somewhat exotic with an unproved track record, but we have succeeded in putting the technology on the agenda, and the research center is today a strong contributor to the political debate on artificial intelligence in general and large language models in particular.

Now, an SFI is not only supposed to produce excellent research but also to create and implement resulting innovations with the partners. In this context, it may be useful to reflect a bit on how we have steered the ship in

the first four years and what changes we plan for the remaining years.

One of the challenges in the early years was the difficult connection between research and innovation. Organizationally, we started with a separate work package for the innovations that were to be specifically worked on. This proved to be challenging, as we lacked PhD candidates in the work package and the innovation activities were not sufficiently anchored in the research of the other work packages. An early change was to dissolve this work package and







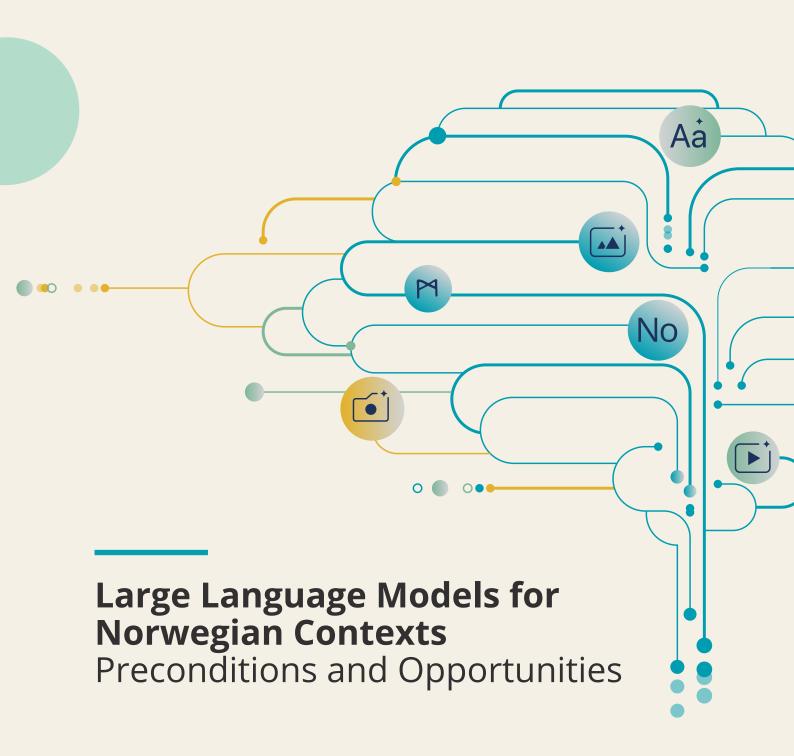
integrate research and innovation activities into each individual work package. Later, we merged work packages and introduced use cases to concentrate efforts around activities with a clear innovation goal.

In recent months, we have had good discussions within the consortium on how to increase the focus on innovation going forward. We have also received valuable input from the Research Council's expert panel, which has conducted a thorough analysis of NorwAl's activities and results. One of the objectives will be to get our two advisory boards more actively involved in the center. Use cases will continue to be very important, and we want to use them dynamically to make the research more relevant to planned innovations, and the innovations more realistic based on ongoing research.

On the language model side, we will gradually place more emphasis on adapting language models to specific domains and applications. Health is an interesting domain here, but

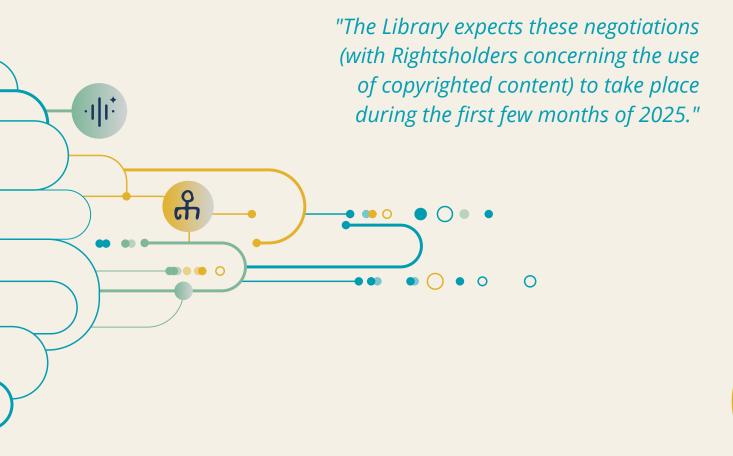
finance, construction, and marine also constitute good domains to assess the extent to which smaller, fine-tuned models can be good and safe alternatives to the large international models.

As part of this, it is now more important than ever to establish good collaborative projects within the consortium and with external parties, as well as to leverage and strengthen our international network. We have therefore taken on prominent roles in several applications for new research centers on applied artificial intelligence targeting important sectors in Norwegian society. We envision more collaboration with the maritime sector and health, and we are strengthening our relationships with the construction and energy sectors. And last but not least, we are aiming for a strong and productive collaboration with the National Library and the University of Oslo in the establishment of a national center for language modeling. 2025 will be an exciting year for NorwAl.





Svein Arne Brygfjeld
Special advisor on Al
The National Library of Norway



Large language models and the opportunities they bring have become a popular public talking point ever since OpenAl launched ChatGPT. The technology has quickly gained traction in many areas of society, both in Norway and internationally. A key question that arises is whether Norway, as a nation, can afford to be entirely dependent on major tech companies located in completely different parts of the world.

Large language models reflect not only language but also society. The models absorb many characteristics from their training data and acquire properties that make them applicable in many fields.

A double edged sword

This is also a double-edged sword. If the models are primarily trained on data that reflect English-speaking cultures, they will naturally perform in ways that mirror those cultures. Additionally,

international services appear to adapt to local or national political conditions, exemplified by DeepSeek's way of covering Chinese political issues. Training large language models on content that sufficiently reflects the Norwegian languages, and Norwegian culture is becoming increasingly important for Norway as a nation.

Norway is relatively digitized as a country. This means that, in principle, there is abundant access to digital content that can be used as training data

for language models. We also have institutions entrusted with a special societal responsibility for such content, such as the National Library of Norway (Nasjonalbiblioteket), which by law is tasked with collecting and preserving published material. The National Library is also in a unique position internationally due to its digitization program. So far, this program has resulted in the digitization of nearly all published books in Norway, along with large portions of newspapers and journals published in print. Thus, the foundation for establishing a robust data platform for training language models is quite strong in Norway, especially considering the prevalence of the Norwegian languages.

Limitations

However, as is generally the case, there are limitations regarding the rights to use content for training. In most cases, it is not possible to use content from more recent literature and newspapers to train language models without infringing upon the rights of those who hold them—typically authors, publishers, and media companies.

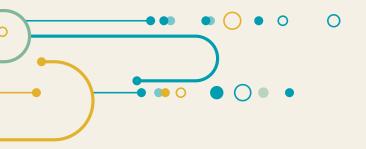
With a view to possibly establishing a compensation scheme for using copyrighted content to train language models, the government asked the National Library in late

2023 to carry out a research project to explore how beneficial such content might be. Along with the Language Technology Group (LTG) at the University of Oslo, NorwAl, and Sigma2, the National Library conducted a research project called Mimir in the first half of 2024. During this short period, new training datasets were created based on the Library's collection and data harvested from the Internet, new evaluation data were developed for Norwegian language and Norwegian contexts, a total of 17 large language models were trained, all were evaluated using the same methodology, and the project was summarized and documented. The research groups at NorwAI and the University of Oslo provided substantial voluntary resources in what should be viewed as a national effort.

Negotiations

Rights-holders, both from the newspaper and literary sectors, were able to closely follow the project. Through meetings during the project's execution, they could monitor and to some extent influence the process. This was an important measure to prepare for any subsequent negotiations. In collaboration with the rights-holders' organizations, and based on Mimir's results, the National Library established principles and a shared understanding during autumn 2024 for a potential agreement on using copyrighted content in training language models. This effort also aims to better facilitate further research in this area.

This work contributed to the Norwegian Parliament (Stortinget), in its 2025 national budget, asking the National Library to provide



language models for use in Norwegian society. Initially, NOK 20 million has been allocated for organizational and internal computing resources at the National Library, and NOK 20 million for computing resources through Sigma2. Compared to the major international tech giants, these amounts are small, but in a Norwegian national context, it could be an effective measure to ensure access to large language models tailored to Norwegian needs.

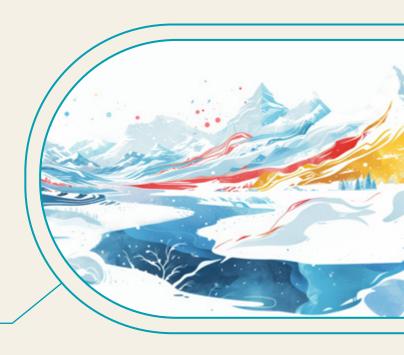
Additionally, based on experiences from Mimir and the processes with the rights-holders, the government has asked the National Library to negotiate with rights-holders concerning the use of copyrighted content. The Library expects these negotiations to take place during the first few months of 2025. If successful agreements are reached and the Parliament provides funding, it will create entirely new opportunities for developing language models adapted to Norwegian contexts that reflect our current era.

The Sámi challenge

Both the work on making language models available to the public and the negotiations over using content for training include the Sámi languages used in Norway. This is strongly advocated at the political level, yet it presents unique technological challenges. The amount of digital content available for training Sámi language models is small, and for some Sámi languages, it is insufficient. These challenges illustrate the need for close collaboration between the National Library, as the provider of language models to Norwegian society, and strong research communities in the field.

Based on the practical experiences from their collaboration, the National Library, together with NorwAl and UiO/LTG, has taken the initiative to apply for funding to establish a research center for language modeling. Several other institutions, both nationally and internationally, support the application to the Research Council of Norway. The application also spans fields such as law, education, and Sámi languages.

Norway has a long and commendable tradition of cooperation. The initiatives we now see in the field of language models are very positive, and they point toward robust development in Norway. Together with recent news about language models that require less computational power for both training and use, Norway as a nation should be well equipped to develop and employ language models at the highest international level.



Three steps for NorLLM In the giant leap of LLMs



Rolf Dyrnes Svendsen
Communications Manager
NorwAl



OSLO MAY 15TH

There were expectations in the air when Cecilie Myrseth, Minister of Trade and Industry, opened the much-awaited launch of NorLLM language models from NorwAI. 150 digital minds were gathered at the top of the Schibsted HQ in Oslo with a long list of disappointed people waiting in vain to be let in.

To the lucky audience attending, the Minister expressed her hopes for action and innovative initiatives in a rapidly changing digital landscape where artificial intelligence led the way by the introduction of language models.

Two tracks

In 2024, NorwAl's language modeling efforts diverged into two distinct tracks. From the beginning in 2021 – long before ChatGPT surfaced in late 2022 - there research work had

concentrated on the need to train a Norwegian generative model that is sufficiently large to support the Norwegian language at the same level as English and other major languages supported by international models.

Simultaneously, a demand for smaller models emerged. They would easily be optimized for specific use cases and controlled locally using proprietary data and custom adaptations.



Four test models were built as steppingstones to the future before taking on the big leap – a series of six models for the ecosystem of AI developers for further experiments and research with the NorLLMs as platforms.

That was the focal point of the Oslo meeting: the launchwas a milestone in NorwAl's efforts to build Norwegian models based on Norwegian data and in respect of national values and standards.



Preview at Techport, Trondheim



TRONDHEIM FEBRUARY 14TH

The milestone was heralded by an introduction in NorwAl's hometown Trondheim in February. At an innovation breakfast at Techport the recurring morning event for the city's ecosystem - the models, their potential and the tech ecosystem preliminary testing results were presented for a supportive audience by the hundreds.

Interesting enough, Simen Eide, Head of the Al enablement program at Schibsted, a NorwAl partner, had experimented with both NorLLMs and competing models from abroad. The NorwAl team was encouraged by his reports: training smaller models to specific tasks gave promising results also compared with the larger, more generic LLMs. The team was on to something.

Strong supporter

Also present in Trondheim was Åse Wetås, CEO of The Norwegian Language Council. She had long stressed the importance of developing language models that could handle specialized terminology and language for professional use across various societal sectors. She emphasized the need for relevant training data from all fields to ensure the models' accuracy and reliability. She also highlighted the challenges of creating Norwegian language models due to the limited amount of Norwegian text, especially in specialized fields, compared to English. She suggests that systematic efforts are needed to develop and make available texts that can improve language technology in Norwegian for different professional areas.



Schibsted's Simen Eide has tested NorwAl's new language models.



The Director of the Language Council, Ase Wetaas, Ase Wetaas, has long cheered for Norwegian language models.



Smaller models that allow for local adaptation open up new applications, according to NorwAl's Jon Atle Gulla.



Research Director Terje Brasethvik spoke at NorwAl Innovate in the fall of 2024 about thousands of downloads of NorwAl's language models.



TRONDHEIM SEPTEMBER 25TH

The demand and curiosity for Norwegian generative language models was notable. The six models NorwAl published before summer had been downloaded more than 10 000 times when come September.

- A broad selection of models for applied research was a goal in itself for us. We wanted to present both models built from scratch often referred to as "cold models". However, we also wanted to use ready ("warm") models and give them "a Norwegian clothing" with our own data. Testing both categories is important for us when evaluating the models, says Research Director Terje Brasethvik summing up the downloads at the NorwAl Innovate Conference in September.

The models were made public for Scandinavian companies, public services and interested individuals in June. The models were published at Hugging Face, and players would fill in a brief registration for identification.

Considerable interest

Downloads were done by a broad group of institutions, organizations and companies. Of course, many of them were various types of consultants wanting to keep up with the latest research and results. But another significant group were public institutions from ministries, directorates, specialized agencies and down to counties and municipalities resonating

the innovating the want for more efficiency by digitalization in the public sector. Not surprisingly, also the health sector showed a strong interest in NorLLM. The free and open distribution also attracted many actors from individuals to digital leaders.

The numbers of downloads proved there is considerable interest and need for smaller models, says Professor Jon Atle Gulla, head of SFI NorwAI, looking forward to a dialogue with people and companies that have experiences they will forward to NorwAI.

Promising

Terje Brasethvik uses the word "promising" when characterizing the results so far. One of the testing partners of NorwAl, SpareBank1 SMN, has tested the models in a RAG search context letting the NorLLM summarize and generate answers.

- Smaller models with 7 billion parameters like the NorLLMs can be downloaded even to laptops. That gives a lot of flexibility for local testing and further developments. You can protect your sensitive data, whether they are sensitive to competition or privacy or copyright reasons, says Terje Brasethvik.

You can read about the next stepping stones for NorLLM into 2025 in the next article in the Annual Report.



Large Language Models in 2025 and Beyond





NorwAl's Norwegian large language models were launched in May 2024 and have been downloaded and tested by organizations across the country. The feedback has generally been positive and encouraging, but several have commented that they generally cannot replace the large international models. This was of course not the intention when we started training Norwegian models either. Some have also questioned which training data we have used and how we have balanced the various sources, and this is a debate that is both important and difficult and which we now carry forward in the plans for 2025.

The MIMIR project, a collaborative project between the National Library, the LTG group at the University of Oslo, and NorwAl, investigated the importance of high-quality Norwegian textual data for the training of Norwegian language models. The resulting models compared well with the international ones, but perhaps the most interesting and promising aspect was that the collaboration between the three parties worked so well.

A national center

Subsequently, the three partners have submitted an application to establish a national center for language modeling, and the National Library has gradually taken on a large and important role in the management of Norwegian text for training large language models. The major players in language models in Norway are now coming together to ensure that we have access to good Norwegian language models, where copyright issues are properly handled, and the models can be run locally and used in critical Norwegian applications. We hope that this center will be funded and expect that many of the Norwegian generic models will be trained here going forward.

Our new focus

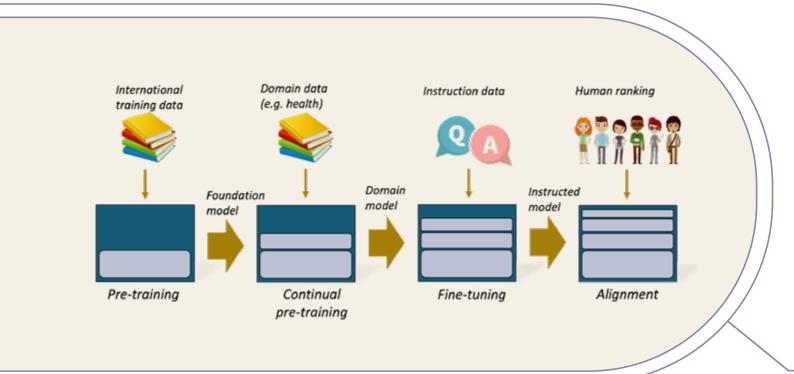
For NorwAI, this means that we can focus more on adapting language models and using the models in new innovative solutions. Specifically, we are now planning the following development paths for 2025:

- ♦ A new generic language model of moderate size. We have seen that some of the training data in the published models were not as free from copyrighted content as we had hoped. Therefore, we want to train and publish a new model with a clean dataset and even more quality content from media houses. We have not yet concluded which architecture or size will be the basis for the model, but we realize that our partners and external parties find it useful if the model is small enough to run locally.
- At the same time, we are planning several domain-adapted language models. This requires close collaboration with domain experts both in collecting training data and evaluating the models in interesting applications. Along the way, a methodology will be defined that can later be used in other domains and applications than those we have identified so far:

- ♦ Health: We have for quite some time been in dialogue with various actors in the health sector to train language models for specific health applications. Experiments in the sector have shown that international language models do not sufficiently understand the professional terminology used. Our work is well underway, and we plan to have the first fine-tuned model ready by summer for further adaptation and testing.
- ♦ Construction: In the construction industry, legislation and standards are important and vary somewhat from country to country. There is now a large project on project management in the construction industry, and new projects are planned to fine-tune construction-specific models that can help the industry comply with regulations and adhere to relevant standards in contracts and project documentation.
- Finance: NorwAl has long considered creating its own finance language models. New resources will now be hired to follow up on this, and we will begin the work of mapping needs and planning the training itself in 2025.
- Ocean and Marine Sector: This is a sector that is very important for the Norwegian society, and we are involved in several center applications that include training and finetuning language models for managing ocean data and supporting maritime activities. It is still somewhat unclear what can be initiated in 2025, but the goal is to establish good cooperation with the sector and lay out a plan for how multimodal models can be trained and utilized in a domain where the data are extremely complex, fragmented, and difficult to collect.

"...we want to train and publish a new model with a clean dataset and even more quality content from media houses."





The four steps for domain-adapted LLMs

As the figure shows, continual pre-training and fine-tuning with instruction data are central to the work ahead. Alignment will only be addressed to a limited extent by NorwAl, as this requires resources that are currently not available to the center.

An API test periode

Several smaller companies and public agencies have requested easier access to the models than what they get through Huggingface. They are asking for APIs and encouraging us to host the models for those who, for various reasons, cannot run them locally themselves. This is

something we have deliberately avoided and considered outside NorwAl's scope, even though it makes it difficult for small and resource-poor organizations to use the models. Now we are starting discussions with our partners to see if we can find a solution that makes the models available via an API during a pilot period. NorwAl neither has the mandate nor the resources to permanently offer language models via APIs to the Norwegian society, but it is interesting to explore both technical possibilities and market needs, so that permanent hosting services may be developed in collaboration with other actors at a later stage.



Political interest and discussions: Ministers visited NorwAl in planning the digital future

Politicians often came to meet with NorwAl's leadership and events the last years. The rapid international digital developments attracted a political interest and discussions on the digital path for the country for the future.

The new digital strategy launched by the Government in late September 2024 said it will build a national infrastructure for artificial intelligence that can be used for research, business development and a more modern public sector.

To reach these ambitious goals, both language models and a national digital platform for

researchers and industry were vital. Several ministers visited NorwAl to discuss the plans beforehand.

At the end of 2023 Minister of Digitalisation and Public Governance Karianne Oldernes Tung visited NTNU to learn more more about NorwAl and our work with Norwegian language models as well as Al solutions for Norwegian industry.





NorwAl chair Sven Størmer Thalow (left) made a good point when discussing with minister Oddmund Hoel (center) and NorwAl director Jon Atle Gulla. Photo: Morten Antonsen, Adresseavisen





Minister Oddmund Hoel at the NorwAl Innovate Conference 2024.



Minister of Research and Higher Education Oddmund Hoel meets with Heri Ramampiaro, head of Department of Computer Science at NTNU at the NorwAl premises in February 2024.

In February 2024 Minister of Research and Higher Education Oddmund Hoel visited NorwAl ahead of the Government's budget discussions for the development of Norwegian language models and infrastructure.

NorLLM launch

In May 2024 Minister of Trade and Industry Cecilie Myrseth officially opened NorwAl's launch of a series of free Norwegian LLMs in Oslo.

In September Minister Oddmund Hoel followed up on his interest in NorwAl by giving the main keynote at NorwAl Innovate answering the question "What will it take for Norway to succeed?"

The actions

In the state budget for 2025, later approved by the Storting, the Government proposed to allow a total of NOK 40 million for training, updating and making Norwegian and Sámi language models available. The models were to be used in the development of Al-based tools and services.

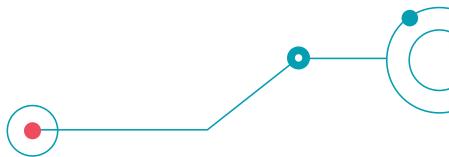
Also, another NOK 200 million was allowed for building more compute power in a new infrastructure. Minister Oddmund Hoel stated:

"This is a big step forward for Norway as a nation of knowledge. To keep up with the Al race, we must be less dependent on foreign players. We have to make sure that we have enough computing power ourselves. It is crucial to ensure Norwegian knowledge readiness and national security", said Research and Higher Education Minister Oddmund Hoel (Sp).

One more billion

On top of that, the Government also increased budgets for AI research to NOK 1 billion to 4-6 new AI centers in the year to come. The race for this money was one of the main objectives for our researchers by autumn 2024. The decisions are expected before summer 2025.







Pål Nedregotten
Director of Technology and Product
NRK - The Norwegian Broadcasting Corporation

To harness the values inherent in AI and language models, a much greater level of organisational maturity is required than often is the case today, argues Pål Nedregotten, Director of Technology and Product at The Norwegian Broadcasting Corporation.

It is easy to be dazzled by Al's capabilities. Similarly, it is just as easy to be frightened—whether for fears for our jobs, industries, or societal structures. Al has the potential to impact everything from economic conditions to workplace tools, legal systems, and security frameworks, for good or bad.

The benefits and limitations of AI have become clearer as we gain experience. Development is progressing rapidly—hardly a month goes by without a breakthrough—but the direction seems set. At the same time, there is a sense that this is just the beginning—that AI has only started to reveal its possibilities and risks.

How to scale Al

This is where we should pause and evaluate.

Understanding how AI can be scaled is crucial for ensuring its long-term success and impact. Many organisations focus on individual projects, but real value likely lies elsewhere – in streamlining technological infrastructure, ensuring easy access to secure AI-powered services, and fostering a culture that embraces innovation while upholding ethical standards.

Success will not be determined by isolated projects, but by how well organisations (re-) structure themselves to extract continuous, long-term value. The key is enabling large parts of an organisation to create innovative solutions through standardised approaches and APIs. Every industry, regulatory authority, and business will undergo this journey to some extent. NRK is no exception.

The Four Phases of Al Maturity

In our experience, this development can be divided into four phases: the Hero Phase, the Mobilisation Phase, the Maturing Phase, and the Maturity Phase. Al maturity will inevitably vary across a large organisation like the NRK, but for many important tasks, we're currently somewhere in the third phase, aiming to transition into the fourth—where Al is fully integrated into operations.

1. The Hero Phase

In this initial phase, individual experts experiment with Al-driven solutions that provide value in specific areas. These efforts often occur in isolation, leading to impressive but fragmented results. While these solutions can be time-saving, they rely on a handful of individuals who recognise Al's potential early on. At this stage, there is no centralised structure guiding Al initiatives strategically.

2. The Mobilisation Phase

In the second phase, organisations recognise the need for structure. Al initiatives shift from isolated efforts to being guided by governance frameworks and leadership directives. Ethical considerations are discussed, legal uncertainties are addressed, and resources are allocated towards a unified strategy. We begin to see Al's potential for delivering significant value and cost savings across multiple departments. Dedicated roles emerge to coordinate efforts.

3. The Maturing Phase

The third phase marks the transition towards industrialisation and scaling. All moves beyond experimentation, delivering clear value in some areas while resource limitations persist in others. We slowly recognise the need for a holistic approach with strategic grounding. The need for a cultural shift and organisational adjustment becomes apparent. At this stage, pain points become evident, and the path to full maturity is often unclear.

4. The Maturity Phase

The final phase represents a fully Al-mature organisation. By this stage, governance models, ethical frameworks, and technical infrastructures support large-scale Al implementation. Al benefits are integrated and fully understood in workflows, supported by a culture that embraces the opportunities and understands the risks. The goal is to extract secure, consistent value at scale, shifting Al from an isolated tool to a core driver of business strategy and operational efficiency.

Where We Are Heading

A fully mature AI approach should create tangible value—whether in positioning, editorial output, or operational efficiencies. AI should accelerate and simplify processes, reduce costs and risks, and unlock opportunities that were previously unseen or unattainable.

Achieving this requires a holistic strategic mindset that considers Al's impact across the organisation and lays out the path towards realising the value inherent in Al. It also necessitates fostering a culture where individuals, teams, and editorial offices understand Al's potential in their work. Finally, it calls for a commitment to streamlining technology to democratise access, ensuring that innovation can be realised as quickly as possible.

As AI continues to evolve, organisations must ensure they are not merely reacting to trends but instead developing structured, scalable, and ethical approaches that position them for long-term success. *That is the path we're on.*





Large Language Models on the Nordics:

Catching up or lagging behind?



Magnus Sahlgren
Head of Research,
NLU at Al Sweden

Large Language Models (LLMs) are currently at the absolute peak of public interest and hype, with new and increasingly powerful models being produced and made accessible at an unprecedented and astonishing pace, generating applications and products that seemed like mere science fiction only a few years (or even months!) ago.

We are rapidly approaching the point in history where it is perfectly feasible to instruct a computer program based on an LLM (an "agent") to autonomously and reliably perform independent digital tasks and duties; in effect, we are approaching the dawn of digital coworkers and LLM-based personal assistants.

Regardless of what we think about the increasingly common claims about impending AGI (Artificial General Intelligence) and Superintelligence, it is obvious that LLMs are (and will be) having a significant impact on language technology and language processing solutions.

Current developments of LLMs are driven exclusively by private companies with access

to astronomical economic and computational resources. Historically, most models produced by such actors have been proprietary and only made accessible via commercial websites and APIs (Application Program Interfaces; a way for computers to talk to each other).

A surprising shift

However, 2023 saw a surprising shift in this trend, with an increasing number of companies releasing their models as open weight (which means that the models are freely available for download, modification and use). During 2024, such open models became increasingly competent, prompting some commentators to argue that the performance gap between proprietary and open models may be slowly closing - which happened sooner than anyone

We are approaching the dawn of digital co-workers and LLM-based personal assistants.



could have imagined, already at the start of 2025, when the Chinese company DeepSeek shocked the world by releasing a new breed of remarkably powerful open models that for the first time rivalled the performance of the leading proprietary ones from the US, with a minor stock crash for US tech companies as a somewhat unexpected side effect.

The Nordics

So how are the Nordic countries doing in this development? Are we catching up, or are we lagging behind?

The fact is that there have been some relatively early initiatives around LLMs in the Nordic countries. In Sweden, as an example, the national center for applied AI (AI Sweden) led the development of a national model called GPT-SW3 already in 2022. The development of GPT-SW3 was based on a collaboration between AI Sweden, the WASP WARA for media and language, and RISE, with technical support from Nvidia and the National Supercomputer Center (NSC), and the resulting GPT-SW3 models were not only the first LLMs for the Scandinavian languages, but they were also the first LLMs to represent a smaller language family, and the first LLMs to be produced by a national initiative.

Finland has also been early in this development, with a range of models developed for the Finnish language (including FinGPT, Poro, Viking and Ahma), and Norway and Denmark have also embarked on initiatives to develop national LLMs. Compared to the rest of Europe, the Nordic region is at the forefront of national LLM development, and organisations from the Nordic countries play important roles in the

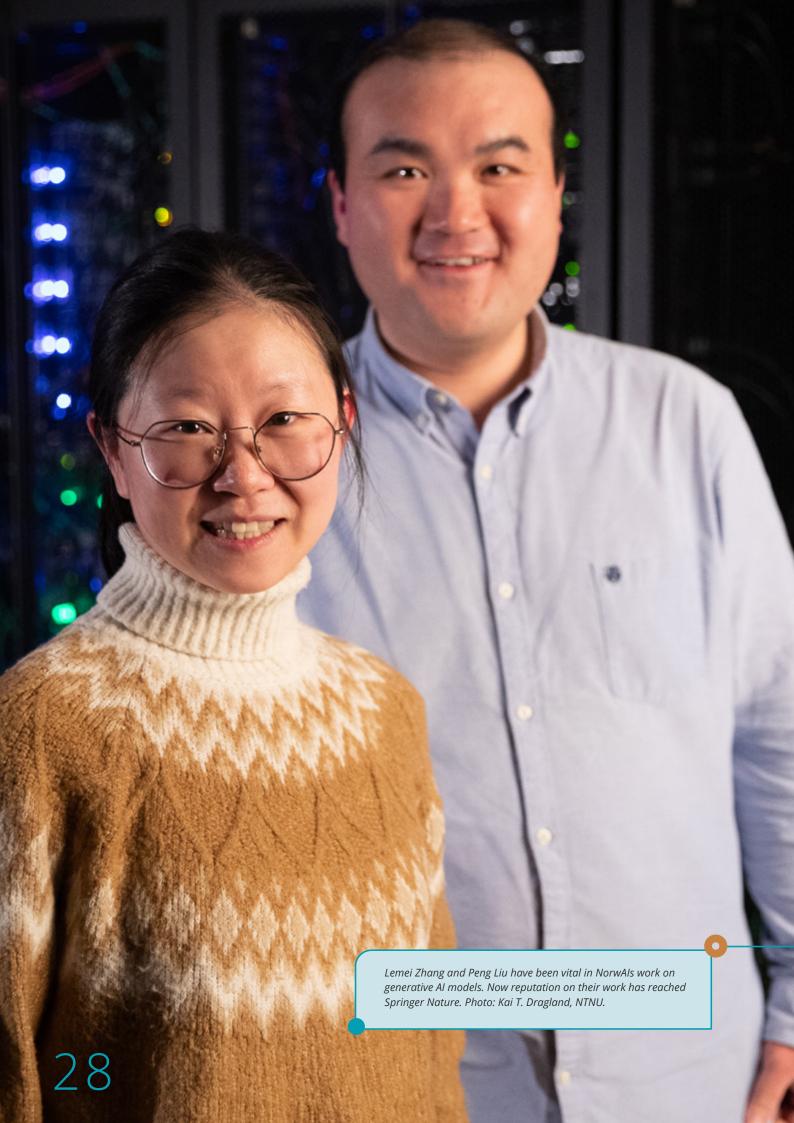
leading European LLM initiatives such as High-Performance Language Technologies, TrustLLM, DeployAl, and others.

Less promising?

This is of course very positive and promising for Nordic AI. What is perhaps less promising is the amount of resources needed to build current state of the art LLMs compared to what is actually available in the Nordic region. The amount of data and computing resources needed to train a leading LLM far exceeds what is available for LLM development in the Nordic languages.

Furthermore, the legal compliance landscape is very different in Europe and the Nordic region compared to that in the US and in China, making it difficult (if not impossible) for Nordic and European actors to compete. What is needed in order to remedy this situation is better support from policy makers, bigger investments in data and computing infrastructure, and wider collaboration on such resources across the Nordic region.

After all, the Scandinavian languages are practically the same, and so is our culture; it makes perfect sense for us to collaborate rather than to compete on resources. Furthermore, outsourcing the development of our future Al and language processing solutions to the US and China puts our cultural and linguistic sovereignty at risk; if you can influence how people use language, you can influence their culture, values, and decisions, and the potential for such influence is better kept at national control and scrutiny, with transparency, openness and accountability as guiding principles.



Nice tribute to a hard-working couple: Writing for Springer Nature



Rolf Dyrnes Svendsen Communications Manager NorwAl

After successfully giving tutorials at the ECAI conference 2024 in Spain last autumn, scientists Lemei Zhang and Peng Liu were invited to write for the German publisher Springer Nature to reach an even larger audience

Lemei and Peng, both prominent researchers at the Department of Computer Science at NTNU and working for NorwAl, have been invited to write a textbook on large language models (LLMs). Or rather, the "Next gen of personalization with multimodal foundations models" as the working title reads.

Springer Nature is a quality academic publisher, dedicated to providing the best possible service to the whole global research community.

As generative LLMs are architecture-built from scratch and prepared for specific purposes, foundation models (FMs) are pretrained with large and professional datasets with less finetuning. In addition, FMs are multimodal models.

- Peng and I and our three cowriters are very pleased to be given this mission by such a respected publisher. Springer asked us for this mission after we gave tutorials on the topic at the 27th European Conference on Artificial Intelligence (ECAI'24) held at Santiago de Compostela in Spain this autumn, says post doc Lemei.





Pivotal role

She and Peng have worked intensively with LLMs the last years and have played a pivotal role at developing the NorLLM portfolio of the Norwegian Research Center for Al Innovation (NorwAl).

One of the cowriters is Jon Atle Gulla, professor at NTNU, and Director of NorwAl, who has supervised both Lemei and Peng for years in their academic career, writing the concluding chapter in the book. Also cowriting, with one chapter each are Yong Zheng, Associate Professor at Illinois Institute of Technology, and Yashar Deldjoo, Assistant Professor at Polytechnic University of Bari.

The starting point for the project was the tutorial in Spain the two did in 2024. Lemei and Peng will write one chapter each and one together.

- Kickoff is in February, and the contract says we must be finished by the end of June. We are now designing the writing process with the three other writers. There is a lot of work ahead, says Peng Liu.

Their primary goal for the book is to write a basic concept for how to use FMs for personalization tasks. Target groups for the book are master's students and other graduate students as well as people with some programming skills. And of course, other researchers and professional industrial people working on foundation models and personalization.

Trained models

As researchers Lemei and Peng have worked on different datasets and architectures and tested which are useful and which have advantages compared to others. When NorwAl launched its six Norwegian NorLLMs models in May last year, the two trained the models and gained many experiences, also on which data influence the performance of models the most. This experience constitutes much of the knowledge basic for the upcoming book. And by the way, to this date, more than 10 000 users have downloaded these models.

- We also want to use the book for educational purposes and create material for upcoming



courses. When we write, we will share some codes and possibly some exercises. Readers will be able to learn by themselves, say the writers.

The book is divided into six chapters:

- The Evolution of Personalization in the Age of AI (Yong)
- Foundation Models: The Basics (Lemei)
- Adaptive Foundation Models for Personalization (Lemei, Peng)
- Benchmarking and Evaluation (Peng)
- Ethics, Privacy, and Security (Yashar)
- Prospects and Challenges (Jon Atle)

At a peak

Language models are now at a technology innovation peak. New models are launched continuously. Both Lemei and Peng worked with the Mimir project where researchers from the National Library, the Language Technology Group (LTG) at the University of Oslo, NorwAl, and Sigma2 created new training datasets based on the Library's collection and data harvested from the Internet. New evaluation data were developed for Norwegian language and Norwegian contexts, a total of 17 large language

models were trained, all were evaluated using the same methodology, and the project was summarized and documented by the National Library, the University of Oslo and NorwAI.

Do we have an established methodology for evaluation of foundation models, Peng?

There are some existing evaluation frameworks, such as EleutherAl's Im-evaluation-harness, and generic benchmarks for assessing LLMs on text+image multimodal tasks. However, given the potential societal harms and risks posed by LLMs, holistic assessment frameworks are needed to capture their multifaceted implications—balancing rigorous measurement with social considerations in real-world contexts.

A date for publishing is not set yet. The writers hope that the book will be available the coming autumn.





User Simulation in the Age of Generative Al

Advancements in generative artificial intelligence (AI) are creating amazing new opportunities across many fields but also introducing complex challenges. One key challenge is personalization.

Creating AI that truly understands and caters to individual users is difficult because people's preferences are complex and vary widely. Also, interactive AI systems need large volumes of data about how people interact with them to learn effectively, posing challenges in data collection and privacy. Finally, evaluating these AI systems at scale, with repeatable and reproducible experiments, is particularly difficult due to their interactive nature.

User simulation offers a powerful solution. It involves using an intelligent agent – a kind of AI itself – to mimic how a real user would behave when interacting with an AI system. For example, user simulation can be used to generate realistic conversations for dialogue systems, automatically assess the relevance of search results, or even simulate the behavior of entire communities. This makes it a crucial tool for safe and responsible AI development, and a driver of innovation. The potential of user simulation is clear, and there's been a surge of interest and activity in the field, with a growing number of workshops and tutorials dedicated to the topic.

In this article, we first explore the role of user simulation in bringing together multiple research fields, both inside and outside of computer science. Then, we discuss how user simulation might play a part in the quest for Artificial General Intelligence (AGI) – the ultimate goal of developing AI systems with human-like intelligence.

User Simulation: An Interdisciplinary Research Field

User simulation research inherently crosses boundaries between many fields. Future research will benefit greatly from integrating insights and approaches from these diverse areas.

Intelligent Agents: User simulators can be regarded as intelligent agents, benefiting from techniques in multi-agent systems for simulating communities of users. Conversely, building upon user simulation research, intelligent agents can benefit from even more precise modeling of individual behaviour. A user simulation agent can also serve as the foundation for implementing a human digital twin, enabling the creation of virtual representations of individuals with diverse applications.

- ♦ Machine Learning: Machine learning is crucial for user simulation. Some applications, like user modeling, might use machine learning in specific components. Others, like data augmentation, might use end-to-end learning directly from data. User simulation can streamline many machine learning tasks that rely on human involvement, reducing reliance on human labor and saving costs. Examples include using LLMs for data labeling and relevance assessment, and reward models in reinforcement learning which essentially function as specialized user simulators.
- Knowledge Representation: Realistic simulation needs to model what users know about the world, the specific area of application, and the AI system itself. Representing and reasoning about this knowledge formally is a fundamental AI challenge. Also, user knowledge changes as they interact with the AI system, requiring dynamic updates to the knowledge model.
- ♦ HCI and Psychology: Psychology and Human-Computer Interaction (HCI) are fundamental for building realistic user simulators. They provide insights from user studies and computational cognitive models that explain behaviours like web navigation. Conversely, interpretable user simulators can be used to analyze interaction data to gain a deeper understanding of behaviour, such as mining search engine logs. Simulators can also act as testable "computational models" of users, allowing researchers to formulate and

validate hypotheses about user behaviour.

Software Systems: User simulators are software systems that can become complex, needing efficient algorithms, data structures, and good engineering practices. They offer significant benefits for developing interactive systems by simulating diverse user behaviours and finding potential flaws before deployment. This leads to more robust and user-friendly systems, potentially reducing the need for human testers.

User Simulation: A Step Towards AGI

The goal of developing a realistic user simulator is closely aligned with the broader goal of creating intelligent agents with human-like intelligence - the pursuit of AGI. A sophisticated user simulator that mimics human behaviour would respond to system interactions and choose appropriate actions to complete a task. Similarly, an intelligent agent designed to assist a user would respond to the user's actions and choose appropriate actions to support them. Because of this similarity, the technical challenges in building intelligent user simulators mirror those in developing intelligent task agents. We therefore expect broader connections between user simulation research and various other fields of Al.

The Importance of User Simulation in Human-Al Collaboration

To fully realize the potential of human-Al collaboration, Al agents need to do more than just perform at a superhuman level. They must also account for the natural variability in human behaviour, including mistakes, different problem-solving approaches, and individual preferences.

Recent research in chess, a long-standing testbed for AI, highlights this challenge. Studies have shown that human players paired with AI agents tailored to their skill level outperform those partnered with more powerful AI agents that are not adjusted for skill compatibility.* This suggests that simply providing the most powerful AI assistance isn't always best. Instead, simulating the user's knowledge, preferences, and decision-making processes, and adjusting the AI's assistance accordingly, can lead to more effective collaboration.

This approach requires user simulation agents to be closely integrated with task agents. The task agent can use the user simulation agent to get feedback and optimize its interaction strategy. Likewise, the user simulation agent must adapt to model how new Al systems behave over time. This interdependence between research on intelligent task agents and user simulation is inherent and may persist until AGI is achieved.

LLMs as Building Blocks for Intelligent Agent

The emergence of LLMs could accelerate this integration, as these models may serve as a foundational building block for both types of agents. LLMs have already fueled their extensive adoption as both task agents and simulation tools in various domains and applications.

As LLMs are increasingly used to build intelligent agents, it's crucial to recognize their limitations. LLM-generated responses can be unpredictable and sometimes unsafe, raising concerns about the safety of intelligent task agents and the realism of user simulators. For user simulation, current LLMs may exhibit unrealistic or incoherent behaviours and lack the natural variation seen in real human

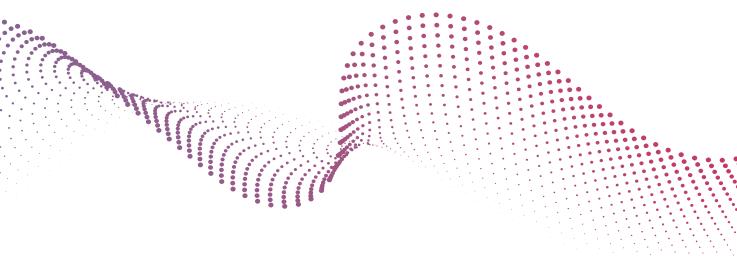
interactions. Furthermore, LLMs often possess more knowledge than average humans and generate overly "perfect" responses. This might be a feature for an intelligent task agent, but it would likely lead to the simulation of unrealistic "superusers" by a user simulation agent. While prompting techniques can guide LLM behaviour, ensuring strict adherence to instructions remains a challenge. More fundamentally, LLMs have insufficient knowledge of human behaviour. They might be aware of concepts like patience or satisfaction, but they lack the training data to model the human dynamics of these behaviours. Similarly, LLMs lack a deep understanding of human cognitive processes, such as decision-making, memory, attention, and may fail to accurately simulate things like cognitive biases or the limitations of working memory.

To overcome this, LLMs must be extended with components that capture a wider range of human cognitive abilities. The human brain has two systems: System 1, which is intuitive and fast but not always reliable, and System 2, which is logical and deliberate but slower. Current LLMs seem to simulate System 1 well, but they lack the deliberate reasoning and planning of System 2. Integrating System 2 functionality into LLMs is crucial for more realistic user simulation, and neurosymbolic approaches represent a promising future direction.



Hamade et al., 2024. Designing Skill-Compatible Al: Methodologies and Frameworks in Chess. In The Twelfth International Conference on Learning Representations (ICLR '24)





The year 2025 may be the year we will become more realistic about artificial intelligence. The big "wow effect" from November 2022 is history. Instead, attention will shift to what results we can see from the technology in the near future.

Professor Eric Monteiro, who has joined NorwAl's work package "Al in Society", says that it is a challenge to operationalize Al in the further work. For NorwAl, an important part of this operationalization is to get Al methods and models from the lab and into practical work routines in businesses.

- We can assume that "Society" is in a way everything and nothing. It is abstract, it is all-encompassing and airy. When we are going to work further with "Al in Society", it is crucial to expand what is understood as Al research, says Fric Monteiro.

A broader concept

Established fields within computer science have partly consisted of developing technology and hoping that someone will use it. This emphasizes the necessity of including learning, both iteration and interactive forms of learning in general, to the AI research field:

- We have developed AI tools and that is where it ends as far as many are concerned. Now we must include implementation processes so that our research is put into use without which it cannot have social consequences. The concept of AI has become broader in recent years; it includes not only technology, but also ecological processes and its impact on society.

Professor Eric Monteiro says there is an interesting debate going on whether AI will really have a great effect on society as the earliest predictions indicated at AI's last breakthrough in 2022. The British magazine "The Economist" asks whether the AI bubble will burst in 2025, or whether it will start to deliver and writes in a commentary article before the start of the new year:

Today's mania for artificial intelligence (Al) began with the launch of ChatGPT at the end of November 2022. OpenAl's chatbot attracted 100m users within weeks, faster than any product in history. Investors also piled in. Spending on Al data centers between 2024 and 2027 is expected to exceed \$1.4trn; the market value of Nvidia, the leading maker of Al chips, has increased eight-fold, to more than \$3trn.

And yet most companies are still not sure what the technology can or cannot do, or how best to use it. Across the economy, only 5% of American businesses say they are using Al in their products and services. Few Al startups are turning a profit. And the energy and data constraints on Al model-making are becoming steadily more painful.

There is still a long way to go between convincing results in practical use, in businesses, both qualitatively and quantitatively, it is claimed in the debate that has arisen about AI. For example, it is rhetorically said that the enormous investments are not neutral but are driven by someone who has an interest in them.

A bubble?

- Some say that what looks like a bubble is probably a bubble?
- It is difficult to conduct a sober assessment of what is happening in and around AI right now. The use of resources around AI is enormous. There is clear signs of a hype of expectations. Those of us who have been around for a while know that the subject is colored by a mismatch: computer science goes in waves, it is cyclical with inflated expectations and results that are long in coming, says Eric Monteiro, who remembers a similar uproar from the mid-80s and into the 90s.
- It was like a hot summer with sensational new results in computer science, but which was followed by a long winter period, to use such an image. It may well turn out that we are facing something similar now. It takes time to create results, says Eric Monteiro.
- How do we approach this?
- I think we have to speak explicitly about our expectations. Not everything in our field has been followed by tangible results, especially not in the short term (while we simultaneously tend to under-estimated long-term, cumulate effects). We have to consider whether our investments are in proportion to the results,

have a sober conversation about lines and a call for sobriety, understand that we are in a phase of enlightenment and understanding about what we are facing, and by no means let stock prices be our witnesses to the truth, says Eric Monteiro.

Professional profile

He has been a professor at NTNU since 1992 with a professional profile in the digitalization of such important national sectors as health and energy, oil and gas. Now the impact of AI in the framework of NorwAI is his coming project:

- We must put pressure on following up on, for example, the language models we have developed. We must know what is happening out there with all those who have downloaded our models. We need to get more interactive thinking in the extension of our research, he says.
- I also think we need to think of NorwAl's partnership as a cluster community where companies and organizations have different roles that are complementary. We need to look for both short-term and long-term effects. The latter can be gradual processes. We also need to develop how we measure the effect of the services that are developed. In this game, you have to be patient, says Eric Monteiro.

In the work package "AI in Society" he will collaborate with the University of Oslo, which has so far submitted contributions to the field. In the coming period, NorwAI will invest more capacity to increase the weight of the work package with an additional fellow in addition to Eric Monteiro himself.



Consortium

A POWERHOUSE

Some of the largest and technologically most ambitious companies and research institutes in Norway have joined the consortium.

RESEARCH PARTNERS

NTNU, the Norwegian University of Science and Technology, Department of Computer Science is host for the center, the other research partners are Norwegian Computing Center (NR), SINTEF, University of Oslo and University of Stavanger.

INDUSTRIAL PARTNERS

The group of industrial partners in NorwAl consisted in 2024 of ANEO, Cognite, Digital Norway, DNB, DNV, Kongsberg Digital, NRK, Schibsted, SpareBank 1 SMN, Statnett and Telenor.



















Schibsted





Statnett







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Sven Størmer ThaulowChief Data and Technology Officer,
Schibsted Media Group

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Odd Erik Gundersen Chief Al Officer, Aneo (from May -24)



Odd Are Svensen Research Director, SINTEF (from May -24)



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Trond Runar Hagen Research Director, SINTEF (until April -24)



Liv Dingsør CEO, Digital Norway



Astrid Undheim Executive Director, Sparebank1 SMN



Karl Aksel Festø Head of CoE Advanced Analytics, DNB



Arild Nebb ErvikChief Data Officer, Statnett
(from August -24)



Frank Børre PedersenVice President & Program Director
"Future of Digital Assurance", DNV



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Technology Development, Statnett
(until July -24)



Stein-Roar Skånhaug Bjørnstad CTO, Kongsberg Digital



Dagfinn Myhre Senior Vice President, Telenor Research



Anders Løland Research Director, NR



Stephan OepenHead of Department of Informatics, University of Oslo



Pål NedregottenDirector of Technology, NRK



Tom RyenHead of Department of Electrical Engineering and Computer Science, University of Stavanger

Organization CHAIR **Executive Board** CHAIR CHAIR Scientific Advisory Board Al Innovation Board Research Director Center Director **Innovation Director** Communications Administrative Program Manager Coordinator Manager Representatives for Research Area Leaders MANAGEMENT TEAM ("NorwAl Core")





CenterManagement Team

The Center Management Team is responsible for the day-to-day operation of the center and consists of:



Jon Atle Gulla Professor, NTNU, Center director



Rolf Dyrnes Svendsen Head of NxtMedia Lab, Communications Manager



Kerstin BachProfessor, NTNU,
Research director
(on sabbatical from Aug -24)



Özlem Özgöbek Associate Professor, NTNU, Program Manager



Terje BrasethvikAdjunct Associate Professor, NTNU, acting Research director (from Aug -24)



Benjamin Kille Associate Professor, NTNU, Program Manager



Arne Jørgen BerreChief Scientist, SINTEF,
Innovation Director (until Aug -24)



Signe Riemer-Sørensen Research Manager, SINTEF, Research Area Representative



Till Christopher LechResearch Manager, SINTEF,
Innovation Director (from Aug -24)



Jon Espen Ingvaldsen Adjunct Associate Professor, NTNU, Research Area Representative



Karolina Storesund Senior Advisor, NTNU, Administrative Coordinator



Eric MonteiroProfessor, NTNU,
Research Area Representative

Research strategy



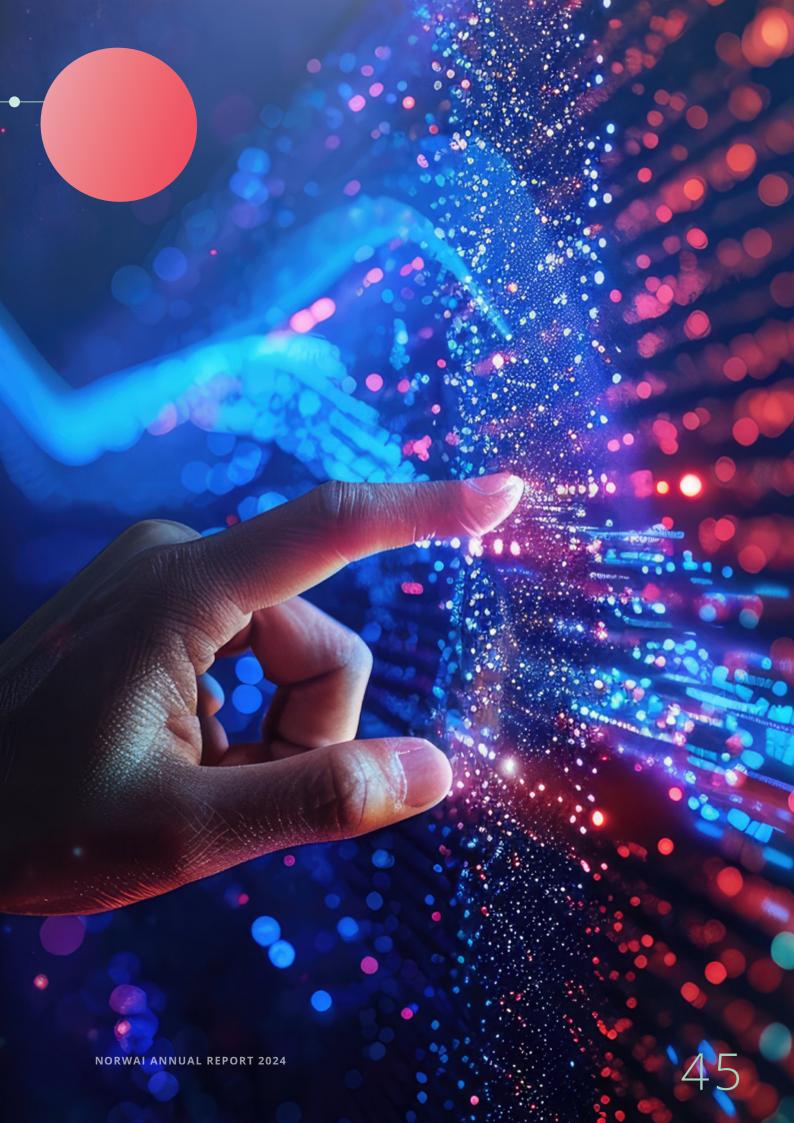
Our approach to research at NorwAl is fundamentally multi-disciplinary, consisting of both technical-oriented and socio-economic research. Current research on Al is diverse and reflect many disciplines or perspectives covering theoretical contributions from a wide range of disciplines together with more applied work from system designers and application developers working with data from many different domains.

Research in NorwAl focus on generic research areas within Al that can support the innovation activities in the center. The research areas will be evaluated every year in the center's lifetime, making sure new areas can be added based on

research needs from future innovation areas or in case of integrating new partners. Existing areas might also be merged or concluded and come to an end.

Our research is partner-driven and rooted in a strategic and systematic approach towards innovation to create lasting value and impact.







The Scientific Advisory Board

An Ambitious Board

The overall goal of the Scientific Advisory Board of NorwAl is to provide external scientific reviews of research activities, evaluate plans and progress, and contribute to shaping the center's research ambitions. The chairperson of the Scientific Advisory Board is professor Christian S. Jensen at Aalborg University.

CHAIR OF THE SCIENTIFIC ADVISORY BOARD



Christian S. Jensen Professor, Aalborg University

MEMBERS OF THE SCIENTIFIC ADVISORY BOARD



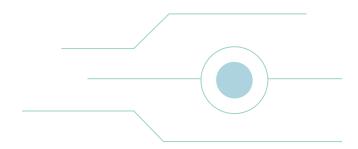
Concha BielzaProfessor, Technical University of Madrid



Maarten De Rijke Professor, University of Amsterdam



Virginia Dignum Professor, Umeå University



Research first then innovation emerges

Translating strategy to action is a challenge. When preparing for the underway evaluation of all research-based innovations (SFI's) initiatives during 2020-2021 by the Norwegian Research Council, the advisory boards of NorwAl were asked to make an assessment. What were their overall impressions from autumn 2020 till autumn 2024?

NorwAl demonstrates an appropriate balance between breadth and depth in its research. It covers diverse Al fields such as machine learning, large language models, trust and ethics in Al, and hybrid systems, applied across industries like finance, media, and energy. At the same time, it dives deeply into complex challenges like fairness, transparency, and bias, covering both foundational and applied Al research, wrote Professor Christian S. Jensen, head of the Scientific Advisory Board.

The Innovation Advisory Board commented on scientific strategies stating that NorwAl's innovation methodology is rooted in Norway's local ecosystem of knowledge sharing and collaboration across Al research disciplines and industries.



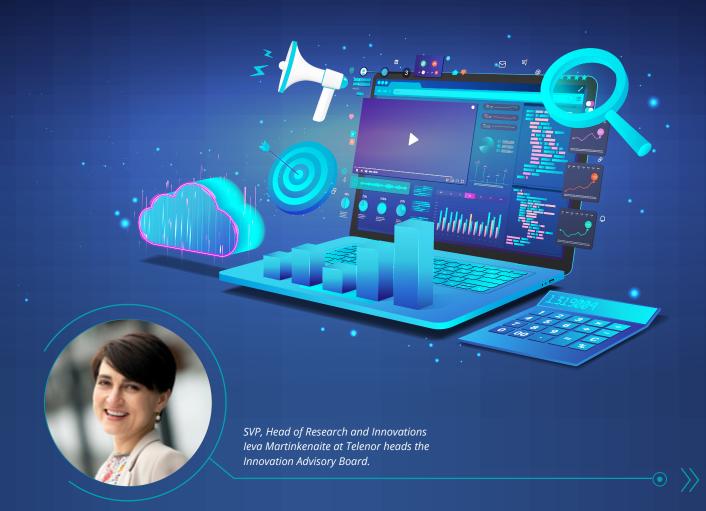
Professor Christian S. Jensen at the Aalborg University heads the Scientific Advisory Board.

Well considered

The Scientific Board also notes that the work package design is well considered:

Each work package focuses on a critical area of Al, such as trust, societal impact, language models, hybrid Al analytics, and data platforms, with resources allocated to address both fundamental research and industry needs. The interdisciplinary approach and collaboration with industry partners in the work packages ensure that high-priority areas receive the necessary attention, while also fostering innovation in emerging fields. This design facilitates both scientific advances and practical applications, the Scientific Board says.

The Innovation Board notes that NorwAl centers on combining existing and new knowledge to drive Al advancements. The methodology relies on "boundary objects," like shared models and prototypes, which bridge gaps and foster communication between different sectors. Critical to this process are "boundary spanners," individuals who connect distinct knowledge domains, facilitating interdisciplinary collaboration.



Parameters

The Scientific Board evaluates NorwAl according to well-known academic parameters.

The center has published regularly since its start in 2020. There is a consistent output of articles in top journals and in top international conferences. The quantity and quality of publications appear to be at a strong, if not exceptional, level, especially given that the center started only in 2020.

Dissemination beyond the scientific community include organizing their own NorwAl Innovate conference, which is very well attended. They also organize workshops and forums to present and discuss Al research. This all contributes to public awareness and understanding of Al and the center's innovations.

Researchers at NorwAl collaborate with researchers from prominent European institutions and participate in significant EU

projects, including strategic Horizon Europe projects and Marie Sktodowska-Curie networks from the excellence pillar. These collaborations facilitate cutting-edge research. The center also engages in exchange programs with international universities and hosts visiting researchers. These efforts contribute to the global outlook and visibility of NorwAl.

NorwAl Large Language Models (NorLLM). NorwAl has built a set of LLMs of different sizes and with different architectures and is collaborating with other national research centers such as the National Library and the Language Technology Group at University of Oslo to expand the scope and capabilities of LLMs while protecting the distinctive features of the Norwegian language. The developed LLMs serve an important role in answering many research questions and provide a basis for innovation in many important domains associated with the Norwegian public and private sector.

Publications in 2024



JOURNAL PAPERS

NAME	TITLE	TYPE/PLACE	DATE
Bauer, Susanne	Seeing Like a Model Fish: How Digital Extractions Mediate Metabolic Relations	Science, Technology, & Human Values	2024-03-28
Bayrak, Betül; Bach, Kerstin	Evaluation of Instance-based Explanations: An In-depth Analysis of Counterfactual Evaluation Metrics, Challenges, and the CEval Toolkit	IEEE Access	2024-06-06
Doan, Tu My; Baumgartner, David; Kille, Benjamin Uwe; Gulla, Jon Atle.	Automatically Detecting Political Viewpoints in Norwegian Text.	Lecture Notes in Computer Science (LNCS) 2024	2024-04-16
Skjæveland, G., Martin; Balog, Krisztian; Bernard, Nolwenn; Lajewska, Weronica; Linjordet, Trond	An ecosystem for personal knowledge graphs: A survey and research roadmap	Al Open	2024-02-01
Vassøy, Bjørnar; Langseth, Helge	Consumer-side fairness in recommender systems: a systematic survey of methods and evaluation	Artificial Intelligence Review	2024-03-29

PUBLISHED CONFERENCE PAPERS

NAME	TITLE	TYPE/PLACE	DATE
Aurora, S.R., Nguyen, N., & Bui, T. M. H.	Artificial intelligence in the workplace: Insights for firms & human resource managers.	the 65th Annual Meeting of the Western Academy of Management, Long Beach, CA.	2024-03-16
Bernard, Nolwenn	Leveraging User Simulation to Develop and Evaluate Conversational Information Access Agents.	Proceedings of the 17th ACM International Conference on Web Search and Data Mining. Association for Computing Machinery (ACM) 2024	2024-03-08
Bernard, Nolwenn; Balog, Krisztian	Identifying Breakdowns in Conversational Recommender Systems using User Simulation	CUI '24: Proceedings of the 6th ACM Conference on Conversational User Interfaces	2024-07-08
Bernard, Nolwenn; Balog, Krisztian	Towards a Formal Characterization of User Simulation Objectives in Conversational Information Access	Proceedings of the 2024 ACM SIGIR International Conference on Theory of Information Retrieval (ICTIR '24). Association for Computing Machinery	2024-07-13
Bernard, Nolwenn; Kostric, Ivica; Balog, Krisztian	IAI MovieBot 2.0: An Enhanced Research Platform with Trainable Neural Components and Transparent User Modeling	Proceedings of the 17th ACM International Conference on Web Search and Data Mining. Association for Computing Machinery (ACM) 2024	2024-03-08
Bernard, Nolwenn; Kostric, Ivica; Lajewska, Weronika; Balog, Krisztian; Galuscakova, Petra; Setty, Vinay; Skjæveland, Martin G	PKG API: A Tool for Personal Knowledge Graph Management	WWW '24: Companion Proceedings of the ACM on Web Conference 2024	2024-05-13
Casolo, Simone; Stasik, Alexander Johannes; Zhang, Zhenyou; Riemer-Sørensen, Signe	Testing Topological Data Analysis for Condition Monitoring of Wind Turbines	European Conference of the Prognostics and Health Management Society	2024-07-05
Lajewska, Weronika; Balog, Krisztian	Towards Reliable and Factual Response Generation: Detecting Unanswerable Questions in Information-Seeking Conversations	Advances in Information Retrieval - 46th European Conference on Information Retrieval, ECIR 2024	2024-03-23
Lajewska, Weronika; Spina, Damiano; Trippas, Johanne R.; Balog, Krisztian	Explainability for Transparent Conversational Information- Seeking	SIGIR '24: Proceedings of the 47th International ACM SIGIR Conference on Research and Development in Information Retrieval	2024-07-11
Liu, Peng; Zhang, Lemei; Farup, Terje; Lauvrak, Even; Ingvaldsen, Jon Espen; Eide, Simen; Gulla, Jon Atle; Yang, Zhirong	NLEBench+NorGLM: A Comprehensive Empirical Analysis and Benchmark Dataset for Generative Language Models in Norwegian	Proceedings of the 2024 Conference on Empirical Methods in Natural Language Processing	2024-11-12
Ottersen, Stuart Gallina; Bach, Kerstin	Automatic Adjusting Global Similarity Measures in Learning CBR Systems	Case-Based Reasoning Research and Development	2024-06-24

PUBLISHED CONFERENCE PAPERS

NAME	TITLE	TYPE/PLACE	DATE
Rønningstad, Egil; Klinger, Roman; Øvrelid, Lilja; Velldal, Erik	Entity-Level Sentiment: More than the Sum of Its Parts.	The 14th Workshop on Computational Approaches to Subjectivity, Sentiment, & Social Media Analysis Proceedings of the Workshop. Association for Computational Linguistics 2024	2024-08-15
Rønningstad, Egil; Velldal, Erik; Øvrelid, Lilja.	A GPT among Annotators: LLM- based Entity-Level Sentiment Annotation	Proceedings of The 18th Linguistic Annotation Workshop (LAW-XVIII)	2024-03-22
Sekulić, Ivan; Lajewska, Weronika; Balog, Krisztian; Crestani, Fabio	Estimating the Usefulness of Clarifying Questions and Answers for Conversational Search	Advances in Information Retrieval - 46th European Conference on Information Retrieval, ECIR 2024	2024-03-23

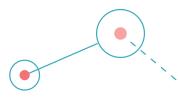
BOOKS

NAME	TITLE	TYPE/PLACE	DATE
Westphal, Florian; Peretz- Andersson, Einav; Riveiro, Maria; Bach, Kerstin; Heintz, Fredrik (editors)	14th Scandinavian Conference on Artificial Intelligence SCAI 2024	Linköping University Electronic Press	2024-06-14









The Innovation Advisory Board

Exclusive group of innovators to advise NorwAl on innovation



The Innovation Advisory Board consists of a generous mix of internationally recognized experts from both abroad and Norway as its advisors. The Norwegians are well connected to the industry partners in NorwAI. The other two are prominent members of the AI community in both Europe and the US East Coast.

CHAIR OF THE INNOVATION ADVISORY BOARD



leva MartinkenaiteSVP Head of Research and Innovation, Telenor

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John Markus Lervik Founder & Chief Strategy and development officer, Cognite



Saskia Steinacker Global Head Strategy & Digital Transformation, Bayer



Øystein Larsen Indrevær Senior Vice President Data-driven Sales, DNB







Medbric:

Al agents for the healthcare of the future



Rolf Dyrnes Svendsen
Communications Manager
NorwAl

In September 2024, Medbric was founded following a successful research and pilot project involving over 400 general practitioners (GPs) who tested prototypes of AI agents. This project was a collaboration between NorwAI at NTNU and the Antibiotic Center for Primary Medicine (ASP) at UiO. Its goal was to utilize generative language models to streamline administrative tasks and provide support in clinical practice.

Today, Medbric is one of the leading players at the forefront of developments in generative artificial intelligence in the healthcare sector.

Innovation through technology

Medbric develops solutions centered around generative AI models, tailored to improve the efficiency of healthcare professionals' workflows. The technology spans from small, energy-efficient models for simpler tasks, to larger, more complex models that offer high accuracy and support more intricate reasoning.

"We prioritize using the smallest, most energyefficient models to minimize costs, reduce energy consumption, and enhance response times and scalability—key to providing sustainable solutions," says Jon Espen Ingvaldsen, Technology Manager and Founder.

By integrating Al models, data, and established IT systems, Medbric has built a platform where specialized agents collaborate to handle relevant tasks. This has significantly reduced the time spent on administrative duties while



improving documentation quality and enabling a stronger focus on patient care.

- Our vision is to create an ecosystem of Al agents working seamlessly together to support healthcare professionals. This is the future of healthcare, says Jorunn Thaulow, Doctor, Founder, and CEO.

From research to practice

The 400 GPs who participated in the pilot project played a crucial role in shaping Medbric's technology. Their feedback helped refine solutions that address real needs in clinical practice, including tasks such as record-keeping, managing patient referrals, and simplifying various workflows.

- The feedback from doctors highlights that this technology allows them to focus more on patients and less on paperwork. This is the essence of what we aim to achieve, explains Jon Espen Ingvaldsen.

Designed for safety and trust

Medbric takes privacy and data security seriously. All solutions are developed in line with "Privacy by Design" principles, featuring data minimization, encryption, and secure access management. This ensures that both healthcare professionals and patients can trust that their data is handled securely and responsibly.

A sustainable future for healthcare

Medbric plays a vital role in addressing the challenges facing Norway's healthcare system. By optimizing administrative processes, Medbric's technology allows healthcare professionals to spend more time with patients, helping to alleviate pressure on the healthcare system and improve care quality. This is essential for creating a sustainable healthcare system capable of meeting the demands of an aging population and rising healthcare needs.

Ambitious plans for 2025

Medbric is planning to launch several specialized Al agents and knowledge support tools designed



to provide healthcare professionals with quick and accurate access to reliable knowledge sources. This will assist doctors in making wellinformed decisions, minimizing errors, and ensuring the best patient care.

Looking to expand internationally, Medbric aims to enter markets outside of Norway starting with its Scandinavian neighbors. The company has already identified significant potential in Sweden and Denmark.

- The healthcare sectors in Sweden and Denmark face challenges similar to those in Norway. We believe our technology can make a transformative impact there as well, says Jorunn Thaulow.

Medbric's future looks promising, with the company committed to not just innovation, but also making a meaningful difference in the healthcare landscape.

Editor's note: CTO Jon Espen Ingvaldsen also holds a position as Adjunct Associate Professor at NorwAl.

NorwAl Innovation in 2024: Navigating a Rapidly Evolving Al Landscape



Till Christopher Lech
Research Manager at SINTEF Digital
Innovation Director, NorwAl

The year 2024 has been a remarkable period for the AI landscape, marked by advancements and groundbreaking initiatives at breathtaking pace – really culminating in the events of the first weeks of 2025. The launch of the Stargate Project, a \$500 billion investment in AI infrastructure by OpenAI, SoftBank, Oracle, and MGX, has set a new benchmark for AI development. Similarly, DeepSeek has emerged as a formidable player, with its open-source AI models rivaling the best in the industry.

These developments, coupled with the European Union's InvestAl initiative, which mobilizes €200 billion for Al investments, underscore the global commitment to advancing Al technology.

Multimodal and neuro-symbolic

Beyond these major initiatives, the AI landscape has seen significant advancements in areas that will foster innovation such as multimodal generative AI and neuro-symbolic AI. Multimodal generative AI systems, which can understand and generate outputs across multiple types of data such as text, images, audio, and video, have opened new frontiers in AI capabilities. These systems enhance contextual comprehension and enable seamless natural interactions, making AI more intuitive and human-like. On the

other hand, neuro-symbolic AI, which combines symbolic reasoning with neural networks, has made strides in areas like learning, inference, and knowledge representation. This approach aims to develop AI systems with more human-like reasoning capabilities, enhancing explainability and trustworthiness.

A direct outcome

At NorwAI, we have made all efforts to be at the forefront of these transformative changes, contributing to the AI revolution with tangible innovations. One of our most significant achievements this year is the AI-startup Medbric, providing tools designed to assist doctors in the primary healthcare sector. Medbric is a direct outcome of our extensive research on



the Norwegian language models (NorLLM) and represents a significant leap forward in integrating AI into healthcare.

Medbric leverages advanced AI agents like Aila and Aisa to enhance the efficiency and quality of healthcare services. Aila transcribes doctor-patient consultations into organized medical notes, while Aisa provides relevant medical information from various databases. This innovation has not only improved communication between doctors and patients but also reduced administrative burdens, allowing healthcare professionals to focus more on patient care. The success of Medbric is a testament to the potential of AI in transforming healthcare and underscores the importance of our research on Norwegian LLMs.

Beyond Medbric

Our achievements in 2024 extend beyond Medbric. We have made significant strides in developing trustworthy AI frameworks, while pushing the state-of-the-art in hybrid analytics. These innovations highlight our commitment to advancing AI technology in a responsible and impactful manner.

In this context, it is essential to acknowledge the contributions of the InnoEco Work Package. The InnoEco section in this annual report delves into the re-boot of the AI innovation ecosystem among NorwAI partners, facilitating knowledge sharing and collaboration, under the branding NorwAI Innovation 2.0. This ecosystem is crucial for integrating research findings, innovations, business solutions, and change models within the AI domain. InnoEco's work emphasizes the importance of boundary objects and boundary spanners in overcoming knowledge boundaries, driving AI innovation.

In conclusion, 2024 has been a year of remarkable achievements and transformative advancements in the AI landscape. At NorwAI, we are proud to be at the forefront of these changes, driving innovation and contributing to the global AI revolution. As we continue to push the boundaries of AI technology, we remain committed to our core values of trustworthiness, sustainability, and collaboration. Together, we can shape a future where AI serves as a force for good, enhancing the quality of life and driving progress across various sectors.



NorwAl Innovation in 2024: Strengthening Collaboration and Advancing Research



Nhien NguyenWork package leader INNOECO
NorwAl



Till Christopher Lech Innovation Director NorwAl Innovation remains a key focus at NorwAI, supporting the advancement of artificial intelligence research and its application in industry. Over the past year, efforts have been directed toward enhancing collaboration between academia and industry, refining methodologies, and ensuring that research leads to practical applications.

Introducing NorwAl Innovation 2.0

In 2024, NorwAl introduced *NorwAl Innovation* 2.0, a structured approach designed to facilitate knowledge exchange and collaboration. Based on the SECI model (Nonaka & Takeuchi), this approach emphasizes an iterative process of Socialization, Externalization, Combination, and Internalization of knowledge for Al innovation. Through interactive workshops, interdisciplinary

engagement, and dedicated industry-research forums, the goal has been to create a more effective innovation environment. These activities are organized by the InnoEco Work package, which is a joint work of innovation specialists from NTNU and SINTEF: Nhien Nguyen, Till Christopher Lech; Lisa Græslie, and Zacharoula Papamitsiou.





A key takeaway from this work has been the importance of addressing knowledge boundaries across disciplines. To improve communication and collaboration, two important factors have been identified: boundary objects and boundary spanners.

- ♦ Boundary Objects: These serve as shared reference points that enable different stakeholders to align their understanding and collaborate effectively. For instance the Norwegian Large Language Model (NorLLM) has become a boundary object, linking partners around Al-driven business applications. Especially, industry-specific use cases are considered important boundary objects bridging research and business needs.
- ♦ Boundary Spanners: Individuals who can translate and integrate knowledge across disciplines play a key role in collaboration. At NorwAI, this role is filled by innovation facilitators, work package leaders, and industry liaisons. These individuals help align research insights with industry challenges and opportunities.

Enhancing Industry-Research Collaboration: Innovation Touchpoints

To strengthen industry engagement in Al innovation, *Innovation Touchpoints* have been introduced as structured sessions that enhance interaction between long-term research and

industry needs. Recognizing that some industry partners seek more direct alignment between research and business challenges, these forums provide a platform for structured dialogue.

Key elements of *Innovation Touchpoints* include:

- Regular updates on NorwAl's research activities and administrative developments.
- Presentations of ongoing or deployed innovations, including challenges and lessons learned.
- Opportunities for industry partners to receive direct feedback from the research community.

The success of these initiatives relies on active participation from researchers, including PhDs and postdocs. Encouraging broader engagement beyond existing platforms such as the *NorwAl Forum* and *NorwAl Innovate* is a priority to ensure a productive innovation ecosystem.

Data Governance for AI Innovation

Access to high-quality data is an important factor in Al innovation. Ensuring secure and effective data sharing between companies and researchers requires a robust governance framework. In 2024, efforts have focused on developing a comprehensive data management plan that includes:



- Establishing better data transfer agreements that balance research needs with corporate data protection requirements.
- Exploring privacy-preserving technologies such as federated learning and synthetic data generation to mitigate risks associated with data sharing.
- Organizing workshops and discussions to share best practices for secure Al data environments.

By addressing these areas, industry partners can collaborate on AI research while maintaining data security and compliance with internal policies.

Medbric: A Result of NorwAl Research

One example of innovation stemming from NorwAl's research ecosystem is the startup *Medbric*, which originated from work on the Norwegian Large Language Model. Medbric applies Al technologies to develop

solutions in the healthcare sector, illustrating how research outcomes can contribute to industry advancements. This development highlights the role of structured innovation efforts in supporting knowledge transfer and commercialization.

Looking Ahead

As NorwAl Innovation 2.0 continues to evolve, the focus remains on strengthening industry engagement, refining innovation methodologies, and ensuring that Al research contributes effectively to industry advancements. Expanding *Innovation Touchpoints*, further developing data governance frameworks, and supporting innovation-driven startups will remain key priorities.

By maintaining a strong connection between research and industry, NorwAl aims to facilitate continued progress in Al-driven innovation in Norway.





NorwAl objectives

The objective of the NorwAl research center is to provide a strong and robust arena for industry, research and academic institutions to collaborate on the development of Al ideas and techniques, share results, and iteratively explore how technology can transform existing businesses and enable entirely new business avenues.

The primary objective – or mission – of NorwAl is to:

Accelerate the innovation of sustainable and trustworthy artificial intelligence solutions across Norwegian industries.

This primary objective is further broken down into objectives and secondary objectives, as shown on the next page.

Artificial intelligence constitutes a paradigm shift in computer science, enabling substantially shorter development cycles, extremely powerful solutions, and immediate transfer of technologies from one domain to another. The innovation cycles become very dynamic, representing both challenges and opportunities at the same time. New systems may completely transform existing practices, render old value chains worthless, or open for brand new business opportunities. NorwAl supports innovation as a platform for continuous

interaction between industry and academia, and will act as an ecosystem for creating alliances, joint venturing and building synergies among all partners. NorwAl will thereby enhance the ability of the business sector to innovate and create value through a greater focus on long-term research.

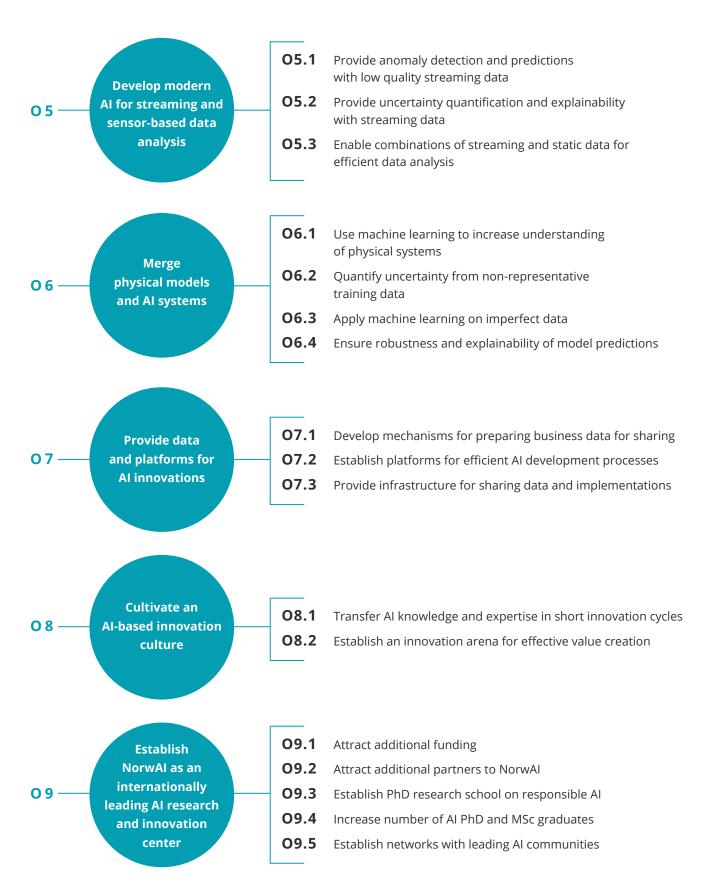
NorwAl acknowledges that the deep impact of Al makes it necessary to ensure efficient sharing of knowledge and enable businesses to adapt their innovation processes to this new situation and provides the skills for business transformation. At the same time, it is critical that the technology is applied with care and with respect for the needs of individuals and societies. The objectives of true personalization of services by providing data and platforms for Al innovations address the Al research needed to implement, deploy and evaluate companies' use case innovations. Finally, the overall quality and reputation of the research center will affect the center's ability to help companies develop and deploy research-based innovations and establish NorwAI as an international leading AI research and innovation center.

NorwAl objectives

OBJECTIVES SECONDARY OBJECTIVES **Understanding** 01.1 Understanding how contributions from NorwAl can affect society at large 01 impact on society 01.2 Understanding fear of unethical AI uses and consequences 02.1 Validate need for trust in Al 02.2 Establish trust in safe and responsible Al **Reinforce common** 02.3 Create guidelines for sustainable and beneficial use of Al 02 understanding of safe 02.4 Ensure privacy-preserving technologies and responsible Al 02.5 Develop principles for explainable and transparent Al 02.6 Develop principles for independent assurance of AI deployment 03.1 Develop truly explainable, fair and transparent personalization techniques **Provide true** 03-03.2 personalization of Enable proactivity in customer relations services 03.3 Provide and individualized experience that provably respects privacy concerns 04.1 Develop large-scale Scandinavian language models **Develop language** processing capabilities 04.2 Enable human-like content creation and conversations for Scandinavian 04.3 Develop individualized content languages

OBJECTIVES

SECONDARY OBJECTIVES



March 2024: Doctoral thesis of Yujie Xing Multi-turn Generation-Based Conversational Agents in Open Domains

Yujie Xing, a PhD candidate at the Department of Computer Science, NTNU, successfully defended her thesis on "Multi-Turn Generation-Based Conversational Agents in Open Domains" on March 18, 2024. The thesis proposes and evaluates novel methods for improving the quality and diversity of chatbot responses in open domains.

The thesis addresses the challenges of building conversational agents that can generate natural and engaging responses in open domains, where the topics and intents of the users are not predefined or restricted. The thesis contributes to the field by proposing and evaluating several methods for improving various aspects of generation-based conversational agents:

- Novel insights into methods for training on multiple corpora from different domains (interleaved learning, labeled learning, and multi-task labeled learning), metrics for evaluating those, and methods for identifying domains when answering user queries.
- Methods for improving the training and evaluating context awareness in conversational agents based on distraction attention score, which measures how well the agent focuses on the relevant parts of the dialogue history.
- Combining document extraction and generation for improving the quality of system answers, evaluating also novel alternatives such as prompt-based tuning and instruction-based tuning, as well as their combinations. These methods leverage external knowledge sources and natural language instructions to guide the generation process.

The results show that the methods can improve the quality and diversity of the chatbot responses, as well as their ability to handle different domains and contexts. The application of this work is in the role of chatbots or personalized assistants or avatars that can interact with users in natural





language and provide useful information or services. Such conversational agents have the potential to enhance the user experience and satisfaction in various domains and scenarios, such as e-commerce, education, entertainment, finance, games, and social media.

Yujie Xing also gave a trial lecture the same day on "The role of academic research on conversational Al in the age of ChatGPT".

The thesis was supervised by Professor Jon Atle

Gulla and co- supervised by Professor Kjetil Nørvåg, both from NorwAI, NTNU as well as Doctors Aria Rahmati and Peng Liu. The thesis has been part of the DNB collaboration project and has received funding from NorwAI.

The Assessment Committee consisted of first opponent Professor Staffan Larsson, University of Gothenburg, Sweden and second opponent Professor Lucie Flek, University of Bonn, Germany. Administrator and internal member was Associate Professor Terje Brasethvik, NTNU.



June 2024: Doctoral thesis of Nils Barlaug

Performance and Interpretability of Entity Matching with Deep Learning

Entity matching is the problem of identifying which records refer to the same real-world entity. It is a key data integration task and, despite decades of research, is still challenging.

In recent years, deep learning has emerged as the new state-of-the-art paradigm to tackle entity matching. This new paradigm brings about new strengths, weaknesses, trade-offs, and characteristics compared to classical methods.

In this thesis, the use of deep learning for entity matching with the goal of gaining insight into what these new methods contribute to the task, how they differ from classical methods, and what their current limitations are. We put special focus on interpretability and blocking because these are, in our opinion, aspects that highlight the contrasts the most.



Through a combination of literature analysis and experimental work this thesis provides three main contributions:

- Insight and overview of how new deep learning methods compare to classical methods for entity matching.
- ♦ A state-of-the-art model-agnostic explainability method tailored to entity matching.
- A state-of-the-art blocking method based on set similarity joins.

The hope is that these contributions are valuable to practitioners and the research community and further the development of deep learning for entity matching.

The Assessment Committee consisted of Professor Angela Bonifati, Université Claude Bernand Lyon, France as first opponent and Associate Professor Konstantinos Stefanidis, Tampere University, Finland as the second.

Administrator/internal member was Associate Professor Knut Magne Risvik at Norwegian University of Science and Technology.

September 2024: Doctoral thesis of Tu My Doan

Viewpoints Detection in Political Speeches

Politics has significant impacts on our daily lives. It influences laws, policies, and resources allocation. The Internet and social media confront readers with an overwhelming amount of political texts. Readers struggle to analyze the information and increasingly rely on efficient processing methods.

This thesis aims at automatically analyzing political texts by leveraging Large Language Models (LLMs). The research investigates political party affiliations in Norwegian politics, studying the effectiveness of applying LLMs in political tasks. Ways to automatically identify political viewpoints in speeches are axplored, and to what extent training LLMs on extensive resources is an effective strategy. A set of LLMs are fine-tuned and tailored to Scandinavian politics namely SP-BERT, SP-T5, and SP-T5-keyword.

The multi-feature data set called nor-pvi, comprises political viewpoints, stances and summaries of speeches in Norwegian Parliament. The findings show that employing LLMs improves political party affiliations identification by up to 10.35% over the Naïve Bayes baseline for Norwegian. The SP-T5 model

with opinion keywords masking enhances the identification of political viewpoints compared to no keyword masking, resulting in marginal increase of 4.3/5.3/4.5 in ROUGE-1/2/L respectively. Domain-specific LLMs with limited resources achieves comparable performance to large scale generic LLMs. The results are part of a work towards a broader understanding, of automated political discourse analysis, particularly in underrepresented languages.

NorwAl PhD Tu My Doan defended her doctoral thesis "Viewpoints Detection in Political Speeches" at NTNU on September 27th 2024.

The Assessment Committee included Professor Vijayan Sugumaran (Oakland University, USA as first opponent and Professor Elena Cabrio (Université Côte d'Azur, France) as the second. Professor Eric Monteiro administered the defense at the Department of Computer Science at NTNU.

The thesis was supervised by Professor Jon Atle Gulla. Co-supervisors were Professor Kjetil Nørvåg and Associate Professors Özlem Özgöbek and Benjamin Kille.

Tu My Doans trial trial lecture was "Argument Mining Approaches and Merits".





E.g. Argument from the American election campaign in the fall of 2024. Image taken from Tu My's trial lecture.

What is Argumentation?

Claim

In Springfield, they are eating the dogs. The people that came in, they are eating the cats. They're eating – they are eating the pets of the people that live there.

Support Proposition

Thave seen people on television [saying] "My dog was taken and used for food"

Against Proposition

ABC News reached out to city managers who said that there has been no credible reports of specific claims of pets being harmed, injured or abused within the immigrant community [...]



GREETINGS

Best paper Honorary Mention at ICTIR '24

The paper, "Towards a Formal Characterization of User Simulation Objectives in Conversational Information Access" by Nolwenn Bernard and Krisztian Balog, has received the Best Paper Honorable Mention Award at the 14th International Conference on the Theory of Information Retrieval (ICTIR '24).

Nolwenn Bernard is a PhD-candidate financed by NorwAl. Professor Krisztian Balog heads NorwAl work package LAP, both working at the University of Stavanger.

This paper contributes to the field of user simulation in conversational information access by formally characterizing the distinct objectives of user simulators: (1) training aims to maximize behavioral similarity to real users and (2) evaluation focuses on the accurate prediction of real-world conversational agent performance.

An empirical study shows that optimizing for one objective does not necessarily lead to improved performance on the other. This finding highlights the need for distinct design considerations during the development of user simulators.

The International Conference on the Theory of Information Retrieval (ICTIR) is the premier event for research on information retrieval theory, bringing together leading researchers and practitioners to share and discuss the latest advances in the field. This award is a recognition of the high-quality research presented in this paper and its contribution to the field, highlighting the importance of user simulation as an emerging technology.





Nolwenn Bernard PhD candidate University of Stavanger



Krisztian BalogProfessor
University of Stavanger

Best Student Paper Award at PGM 2024

PhD Candidate Anna Rodum Bjøru won the PGM's Best Student Paper Award at the conference in Nijmegen in September this year. PGM 2024 was the twelfth edition of the International Conference on Probabilistic Graphical Models. The award is presented in collaboration with Bayes Fusion.

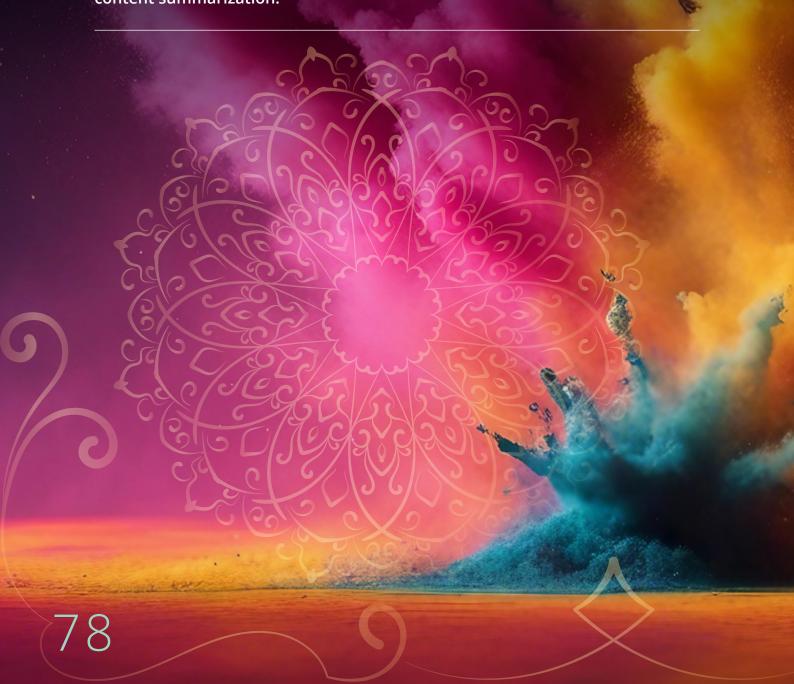
The topic for PhD candidate Anna Rodum Bjøru is Explainable deep bayesian learning funded by the NTNU Exaigon project. Professor Helge Langseth at the Department of Computer Science at NTNU was co-author of the paper. He is also Anna's supervisor for her PhD.

The paper "A Divide and Conquer Approach for Solving Structural Causal Models" was written together with Rafael Cabañas de Paz and Antonio Salmerón at the Universidad de Almería. Anna Rodum Bjøru and her co-writers did the paper in connection with a research stay in Almería in the period March-June 2024. The paper presents a method for calculating intervals for counterfactual probability, given incomplete causal models.



Travelling half the globe to get her PhD

Vandana Yadav is one of NorwAl's scholarship holders, born in India, a large continent in itself. She has travelled half the world for her educational ambitions. Now she heads for her PhD in Natural Language Processing for personalized content summarization.





- I started in my position in November 2023 and hope to get my PhD in 2026, says Vandana.

Her journey from India to Trondheim is not only a long distance. It is also a cultural travel to a region very, very different from her background in her homeland.

- What is your day like here at NTNU?
- In wintertime I usually get up early for my morning activities, but a won't arrive at my desk before 10-11 am. I like to walk to my work, and in the dark and cold months I prefer to do so when we have daylight. It helps me through this period of the year, she says. She usually works at her desk until early evening.

Reading days

Days are filled with reading, attending lectures, more reading, studying Norwegian, even more reading to really get into the core of her topics.

- Defining personalization and summarization is very subjective. My research work focuses on automatic text summarization techniques and personalization using machine learning and language models. Particularly, in news summarization techniques that can be personalized with respect to users and contexts primarily for English along with Norwegian (low-resource) language, says Vandana.

Most of automatic text summarization

techniques are focused on generating summaries that are not tailored according to the needs and interests of users. News summaries of articles can be personalized by presenting summary in specific style that user prefers, or present summary that includes information similar to what user has already read, or show summary in different language that user prefers, or adjust summaries based on user's age or knowledge level in a topic.

- Additionally, if users have not accessed news platforms for long, then, in such cases there is need to summarize multiple articles into single summary which users might be interested in. This motivates us to explore/investigate personalized summaries, says Vandana.

She has not defined the thesis she will be defending yet. She has had the opportunity to meet and talk with business professionals at NorwAl partner Schibsted to learn more of their news platforms, their usecases and the company's use of summarization – visits and contacts of great help for her work.

Life for an Indian

- Life for an Indian in Trondheim is a bit difficult. There are not many of us around. One of the places I have used to get socialized is the Saturday badminton sessions with the NTNU Sports where she has met with people from all countries, she says.



And of course, there has been skiing, different social events and activities – and a fascination of the Norwegian "bunad"

- They are so colorful and beautiful. I will get my own during my stay here. It was amazing – last year, after a trip abroad, I arrived at Trondheim on the 17th of May and took the bus to town. It was amazing, people out everywhere, and everybody looked so happy, she says.

Indians in Trondheim have their own traditions to maintain. According to Hindu traditions the Holi festivities at springtime marks the beginning of the new year and completion of spring for many people in India. This festival will be celebrated at a local temple in town. An elder brother who has studied in Stavanger and now lives in Oslo, also help her keep in touch with her family.

- I actually visited Stavanger before applying for a position at NTNU. I liked the country, and here I am, says Vandana.

Police

She took her bachelor at the Visvesrosay Technical University in Belgaum in the southwestern parts of India before working five years at a software consultancy company. She

worked on government projects for instance in digitalizing policing systems and later projects in the financial sector before starting looking for more educational opportunities.

She ended up in Finland and had to spend the first period at home due to covid restrictions for travelling to the Nordics. Her Master in Al in the summer of 2022 sharpened the appetite for more, and one year later, after a short work stop with software tools for a company working with asset management, Vandana was offered a scholarship at NTNU for a PhD.

Vandana also take part in the PERSEUS program where she belongs to "Big data and AI" research group. PERSEUS is a collaboration between NTNU, 11 top-level academic partners in 8 European countries, and 8 industrial partners within sectors of high societal relevance.

She now sees light at the end of her long educational tunnel:

- In 2027 I hope to work for a company and carry on with my research in personalization and summarization, Vandana Yadav says.

By Rolf D. Svendsen





NorwAl Innovate '24 A unique Al showroom

In 2024, NorwAl Innovate Conference again proved itself to the Norwegian Al community to be maybe the most interesting Al tech conference in the country. An extraordinary line-up of keynotes and a mixed academia and business audience provided a melting pot for cross professional collaboration, cross discipline exchange and cross generation meetings.

HOSTS



Professor Jon Atle GullaNorwAl Center Director



Rolf Dyrnes Svendsen NorwAl Communications Manager



Karolina Storesund NorwAl Administrative Coordinator



Founder and Chief Strategy & Development Officer, Cognite, made Al Agents his punchline on datadriven development in industry.

In 2024 NorwAl and Norwegian Open Al Lab at NTNU (NAIL) organized the event. There was also a close partnership with Norwegian Research Council who organized a matchmaking event for the Al-centre initiatives.

This year, more than 240 people attended the conference. NAIL also organized two follow-up workshops at the end of the conference, both fully sold out.

NorwAl Innovate is a unique showroom for what to expect from the research center itself.

The conference also examines specific Al verticals and invites national and international experts to discuss use cases and innovations in the ongoing Al transition in society. The 2024 version focused on implementations of Al in business, data-driven industry developments, research updates, lighting talks from partners and a discussion on the arriving Al Act.

Sidekicks like posters and prototype demos fueled NorwAl Innovate with the next generation Al talents. Above all, the lunch-to-lunch conference is a meet & greet event and a chance to get to know leading people in both the private and public sector concerned and engaged in Al developments.









KEY NOTE SPEAKERS



Alexandra Schultz Digdir



Jarle Roheim Håkonsen **IKT Norway**



Olaug Råd NCR



Terje Brasethvik NTNU



Andreas Hafver DNV



Jeriek Paul Van den Abeele Telenor



Pål Nedregotten NRK



Till Christopher Lech SINTEF



Aslak Sira Myhre National Library



John Markus Lervik Cognite



Pål S. Malm NCR



Tor Grande NTNU



Astrid Undheim SpareBank SMN



Kerstin Bach NTNU



Rebekka Borsch NHO



Weronika Lajewska UiS



Eirik Andreassen Digital Norway



Knut Eilif Halgunseth Sparebank 1 SMN



Roland Sauter Kongsberg Digital



NTNÜ



Gorm Grønnevet Telenor



Nhien Nguyen NTNU



Simen Eide Schibsted



Halvor Lund Statnett



Odd Erik Gundersen Aneo



Simone Casolo Cognite



Håkon Wium Lie Yeslogic



Oddmund Hoel

Government



Stine Helén Pettersen Ræder Bing









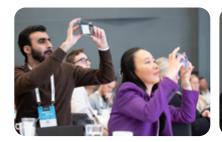






















NorwAl Innovate 2025 Trondheim September 23rd to 24th Scandic Nidelven Hotel SAVE THE DATE

Best poster award The winner takes it all

(Abdul) Kazeem Shamba, a doctoral researcher at NorwAl, was awarded the Best Poster Award at NorwAl Innovate '24.

He was supervised by professors Kerstin Bach and Gavin Taylor in his work "Seeing Through Time: Dynamic Margin Time Contrastive Representation Learning for Human Activity Recognition" that introduced a novel approach to time series representation learning, leveraging a dual-network architecture and a dynamic margin in contrastive loss to enhance

temporal pattern recognition. This method improves clustering quality and classification accuracy for human activity recognition tasks with inspiration from thermodynamics. With extensive international experience spanning several continents, Kazeem brings a global perspective to his work, with an ambition to advance machine learning and Al innovation in applied fields.

There were 12 contributions to the poster competition. The award was NOK 10 000 to the winner.

Abdul Kazeem Shamba and the winning poster.

Research director Terje Brasethvik handing PhD candidate Abdul Kazeem Shamba the award for Best Poster at NorwAl Innovate Conference 2024.



AUTHORS	TITLE
Abbas, S. F.; Bathen, T. F.; Elschot, M.	Weakly supervised diffusion model for prostate anomaly detection.
Ajraoui, A; Nguyen, N; Sætre, A. S.	Barriers and enablers to implementing Al in organizations: a systematic literature review.
Baumgartner, D.; Langseth, H.; Engø-Monsen, K.; Ramampiaro, H.	Normalizing Flows Conditioning is Everything.
Moradi, A; Abrahamsen, B. S.; Elschot, M	Semi-supervised Multi-task Federated Learning for Multi-organ Segmentation: a Student-Teacher Approach.
Nystad, E. J.; Martin-Requerda, F.	Exploring the Entity Matching Problem: From String-Matching to Pre-Trained Language Models.
Ogorodnyk, O.; Stendal, J. A.; Harik, E. H. C.; Leirmo, T.	Explainable AI for delivery route optimization using Reinforcement Learning.
Osadcha, K.; Osadcha, M.	Generative Artificial Intelligence VS Humans in the process of creating corporate identity elements.
Sarkhoosh, M. H.; Solberg, H. M.; Gautam, S.; Midoglu, C.; Sabet, S. S.; Halvorsen, P.	Automated Creation of Player-Specific Soccer Highlight Clips Using PlayerTV.
Shamba, A-K; Bach, K; Taylor, G.	Seeing Through Time: Unsupervised Contrastive Representation Learning.
Sharma, V.; Mishra, D.	Robot Vision: The Convergence of Computer Vision and Robotics.
Steppe, J. A.; Morais-Storz, M.; Nguyen, N.	Al-Augmented Creativity: Influence of Generative Al on Creativity.
Wang, S.; Ecclesia, S.; Sánchez-Díaz, X. Søraa, R. A.; Øztürk, P.	Investigating the Ethical Dimensions of Al: An Interdisciplinary Approach Combining CBR and "It Could be Otherwise".



NorwAl at **Arendalsuka 2024**

Al was a hot topic at the Arendal week in 2024. NorwAl was invited to attend four meetings at the largest political gathering in the country.



In addition to debates, the Arendal week is also a venue for cultivating relations and discussing projects. For NorwAl Arendal is also an

important recruiting arena for keynotes at the NorwAl Innovate and inviting participants at the event in Trondheim.



Jarle Roheim Håkonsen, moderator, Jon Espen Ingvaldsen, NorwAl, Editor-in-chief Gard Steiro, VG and Randi S. Øgrey, CEO of MBL discussed the future of the Norwegian language.



MONDAY, 12TH AUGUST, 13:00

"Are the Al-giants stealing our own language?" Debate on Norwegian language models vs foreign alternatives - organized by Kantega and ICT-Norway.

With i.a. Gard Steiro, editor-in-chief VG, Randi S. Øgrey, Mediebedriftenes Landsforening (MBL) and Jon Espen Ingvaldsen, NorwAI at Castelle. Panel moderator was Jarle Roheim Håkonsen at IKT Norway.

TUESDAY, 13TH AUGUST, 14:00

"Cooperation for building a national AI industry – what will we need to build national services for AI"- organized by SpareBank1 SMN, NorwAI and Kantega.

Panel participants were i.a. John Markus Lervik, Cognite and Jon Atle Gulla, Marit Collin, Kantega and Astrid Undheim, SpareBank1 SMN. Moderator was Ragna Vorkinnslien, SpareBank1 SMN. Location: SpareBank1 SR, Torvet Arendal.





THURSDAY, 15TH AUGUST, 13:00

"How to secure trust in Al systems" - organized by NTNU. With i.a. Minister of Research and Higher Education Oddmund Hoel, researcher Inga Strümke at IDI, NTNU and chair person of the NorwAl board Sven Størmer Thaulow, NorwAl. Moderator was Heri Ramampiaro, Departement of Computer Science (IDI), NTNU. Location: Clarion Tyholmen.

THURSDAY, 15TH AUGUST, 16:00

"Trust in knowledge? Debate on AI, knowledge and responsibility - organized by UHR (Universities Norway). Participants i.a. Erik Bolstad, SNL and research director Terje Brasethvik, NorwAI. Location: UIA-teltet.



Lingvistic researchers and data engineers from the greater Nordic region was gathered to share competence and challenges in Trondheim in November 2024.



In 2020 a large-scale Finnish speech donation campaign was organized with Yle, the Finnish State Broadcaster, and FIN-CLARIN (Language Bank of Finland) to collect speech data. Automatic Speech Recognition, also known as ASR, is the use of Machine Learning or Artificial Intelligence (AI) technology to process human speech into readable text. The target was to reach out many different speaker groups and variants of Finnish and let people speak freely, e.g. to describe images and videos.

Nordic cooperation to protect minority languages in the age of Al



Rolf Dyrnes Svendsen
Communications Manager
NorwAl

Yle did TV advertising and volunteers donated by recording their speech using the phone app and lahjoitapuhetta.fi website. The campaign was awarded several national prizes and also the best European Digital Audio Project prize by PRIX EUROPA 2021.

Professor Mikko Kurimo at Aalto University presented the project, reminding his audience how important it is that original texts are produced to create good language models. The event was the "Language technologies and AI in the Nordic Countries Conference" on November 5th at Dokkhuset in Trondheim that NorwAI coorganized with ASTIN (the working group for language technology in the Nordic region) to foster cooperation across national borders and languages.

The Conference was financed by the Nordic Council of Ministers with participants from all the Nordic countries also including Faroe Islands, Greenland and Ireland.

Borealium

The conference saw the launch of "Borealium" - a new language technology portal for small languages in the Nordic countries. It brings together language technology products, solutions and resources for small languages in the Nordics in an audience-friendly format. Recipes on how to use the products must be in a language that people without high technical competence can understand, and in many of the Nordic minority languages.

Unprecedented pressure

Historically, many languages die out gradually as successive generations of speakers become bilingual and then begin to lose proficiency in their traditional languages. According to Encyclopedia Brittanica, linguists estimate that of the world's approximately 6,900 languages, more than half are at risk of dying out by the end of the 21st century.

The forces of modernity and globalization have





strengthened to gradually cause vulnerability for spoken languages. In the times of AI, people around the world now face unprecedented pressure to adopt to common languages used in government, commerce, technology, entertainment, and diplomacy.

Arguably, the advent of large generative language models exacerbates this homogenizing effect, as the world languages English and Chinese dominate the training material for the time being. The Language Council of Norway who is one of the organizers of the conference, says in their invitation that the impact by LLMs has been greater and more sudden that expected.

From experiments to everyday products

The conference kicked off with a key note by Associate Professor Jussi Karlgren at the University of Helsinki who gave an overview of how learning and generative language models have, in the past two years, transitioned from engineering experiments to components in everyday consumer products. Thus, some of the optimism shown by language technologists

working with learning models since the fifties has been justified by this real-world impact. However, important research into the capabilities and limitations of these models is still needed, according to Jussi Karlgren.

Also interesting among a multifaceted agenda was a report on the current state and prospects of language technology for less resourced languages by Steinbór Steingrímsson at the The Árni Language Magnússon Institute for Icelandic Studies. The report was initiated by the previous year's Iclandic presidency of the Nordic Council of Ministers to compile a report of the Nordic minority languages and the languages of the island nations in the Nordic region.

Professor Jon Atle Gulla at NorwAl talked on the experiences six months after NorwAl launched six language models in Norwegian, and Magnus Sahlgren, head of research at the National Language Understanding at Al Sweden, brought a European perspective and discussing whether the Nordics are catching up or falling behind in the development of LLMs. He called for more data sharing.



Divvun and Giellatekno develops language technology tools for Sámi and other circum polar languages.



Phonetician Katri Hiovain-Asikainen at Divvun, the Arctic University of Norway (UiT) and engineer Maja Lisa Kappfjell at Divvun, UiT talked on Southern Sàmi Speech Synthesis.

International Excellence Award 2024

Cooperation across the Atlantic ocean



The Atlantic divides Toronto and Trondheim. But AI has built a bridge between the academic communities on both sides of the ocean. In 2024 eight Canadian students from the University of Waterloo, Ontario, Canada, took part in the international work-integrated-learning (IWIL AI) project funded by the Norwegian Directorate for Higher Education and Skills.

The Canadian students worked at NorwAl, SINTEF Digital and other partners. In return, Norwegian students went to Waterloo the other way around – everybody contributing to the Al talent pool on both sides of the ocean.

The program worked so well that NTNU in the autumn of 2024 received Waterloo's "Employer Impact Award for Impact in International Excellence".

NTNU received this award for cultivating an impactful partnership involving Waterloo and its students to help further Al innovation and progressive research, read the justification from the Canadian university.

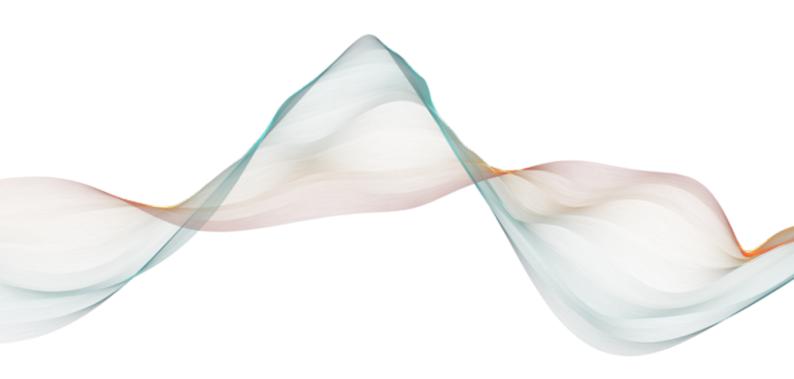
Day-to-day tasks

One of the students, Tony Li, reported home that his day-to-day tasks at NorwAl included researching information from academic papers,



Canadian Al student Kate Bendall peeking under the hood of Kaia, the social robot – understanding the black box of Al. **NORWAI ANNUAL REPORT 2024**





running code, getting data sets and training large language models (LLMs). An important aspect of Li's research involved ensuring the programs retained a human-centred focus.

The students from Canada are also joining different student activities to ease transitition to a new country smooth, comfortable and fun.

Artificial intelligence is gaining more importance for us to address societal challenges or other possible problems we may have," says Özlem Özgöbek project manager for IWIL AI, Associate Professor at the Department of Computer Science at NTNU and Program Manager at NorwAI.

Understand cultures

Through working abroad, students not only develop a sense of self, but an understanding of international cultures as well. The partnership with NTNU provides a meaningful work opportunity for students to gain new international experiences while making an impact by applying the skills they've learned from the co-op program. NTNU's partnership

is also about building AI skills in Canadian and Norwegian graduating talent, says Shabnam Ivković, director of international strategic initiatives at CEE.

The IWIL AI project continues through 2026. In January 2025 another six Canadians arrived and took up new tasks at SINTEF Digital in Oslo and NTNU in Trondheim.

The main activities within this project are a work-integrated-learning-based student exchange for bachelor's, master's and PhD students (in one of the partner organizations); dissemination and networking events with the participation of team members; supervision and performance evaluations for students by the host institutions.

The IWIL AI project (2023-2026) is lead by The Department of Computer Science at NTNU, and is in close connection to SFI NorwAI and the Waterloo Artificial Intelligence Institute. The main partner institution is the University of Waterloo, Co-operative and Experiential Education in Canada. Other partners include Cognite AS, SINTEF Digital and Aneo.



The quest for trustworthy language models



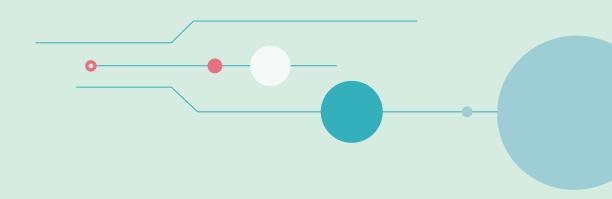
In late 2023, researchers from six Nordic and European countries launched TrustLLM, a project structured across ten work packages with the goal to build, study, and deploy trustworthy large language models (LLMs). Core components address large-scale data collection (WP2), model training (WP6), evaluation (WP7), and use case applications (WP8).

The first year delivered key outcomes: a multilingual dataset, a competitive baseline model, and an expanded evaluation benchmark. While LLMs require extensive training data, collecting appropriate text presents challenges. The partners gathered data across all target languages, including Faroese. The texts originated from sources available to the partners as well as the internet. A workshop in Copenhagen in October 2024 addressed

the known issues with internet-sourced texts, revealing significant national differences in copyright interpretation. This requires ongoing coordination to harmonize data collection across jurisdictions.

Compute access

Compute access proves crucial for model development. The consortium secured 900,000 GPU hours on Barcelona's MareNostrum cluster



hosted in the Torre Girona Chapel (possible to show image to make visually more appealing). This enabled training an initial 8-billion-parameter model based on Meta's Llama-3 architecture. The parameter count aligns with established scaling laws relating model size to available training data. Model evaluation continues while the consortium pursues additional compute resources.

The evaluation framework builds on ScandEval, extending its original focus on encoder models like BERT to assess generative capabilities comparable to Llama, Mistral, GPT, and DeepSeek. Given the multilingual model, the consortium needs to supply tests cases in all languages demanding a considerable effort from all partners.

Core questions

The baseline model establishes the foundation for investigating core questions: How do we measure model trustworthiness? How do we ensure alignment with European values? How effectively does the model serve intended use cases?

NorwAl's ongoing contributions to TrustLLM will help address these challenges. Lars Bungum and Peng Liu contribute from NorwAl's side. While Lars focuses primarily on the aspects of evaluation, Peng supports the application of the models to use cases formulated, among others, from NorwAl partners DNB and Schibsted.



Testing Trust LLM as translator to nynorsk

We tested the Trust LLM and bring you first the version given by the machine. *The words marked in red,* are words that the machine could have done better according to the second nynorsk version which is a text written by an authorized nynorsk editor.

The Prompt:

This is the mission statement of NorwAI: The Norwegian Research Center for AI Innovation (NorwAI) is the largest academic initiative on AI innovation in Norway. Hosted at NTNU in Trondheim, the center coordinates research and innovation activities among three universities, two research institutes and 11 companies. With its long and impressive history of research on Big Data and AI and its experience with

commercializing these technologies, NTNU is well positioned to lead this center of research-based innovation (SFI). Some of the largest and technologically most ambitious companies and research institutes in Norway have joined the consortium and promise to turn the center into a real powerhouse for Al-driven industrial innovation. Write a concise summary of it in nynorsk.

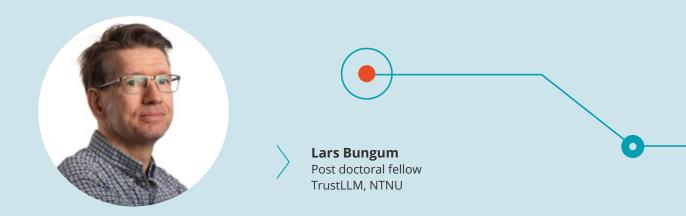
Trust LLM output:

Denne er *misjonsformuleringa* til NorwAl: Det norske forskingssenteret for Al innovasjon (NorwAl) er den største akademiske satsinga på *Al innovasjon* i Noreg. *Hostet* ved NTNU i Trondheim, koordinerer senteret forskings- og innovasjonsaktivitetar mellom tre universitet, to forskingsinstitutt og 11 bedrifter. Med sin lange og imponerande historie innan forsking på *datavitenskap* og Al og si erfaring med kommersialisering av desse teknologiane, er NTNU godt *plassert til* å leie dette senteret for forskingsbasert innovasjon (SFI). Nokre av dei største og mest ambisiøse selskapa og forskingsinstitutta i Noreg har slutta seg til konsortiet og lovar å gjere senteret til eit verkeleg kraftsenter for Al-driven industriell innovasjon. Skriv ei kortfatta formulering av det *i* nynorsk.

Output written by our editor:

Føremålet med NorwAl er stadfesta slik: Det norske forskingssenteret for Al-innovasjon (NorwAl) er den største akademiske satsinga på Al-innovasjon i Noreg. Med NTNU i Trondheim som vertsinstitusjon, koordinerer senteret forskings- og innovasjonsaktivitetar mellom tre universitet, to forskingsinstitutt og 11 bedrifter. Med si lange og imponerande historie innan forsking på datavitskap og Al og si erfaring med kommersialisering av slik teknologi, er NTNU godt posisjonert for å leie dette senteret for forskingsbasert innovasjon (SFI). Nokre av dei største og mest ambisiøse selskapa og forskingsinstitutta i Noreg har slutta seg til konsortiet og lovar å gjere senteret til eit ekte kraftsentrum for Al-driven industriell innovasjon. Skriv eit kortfatta samandrag på nynorsk.

How adept are Large Language Models at advanced language?



NorwAl is a partner in the European project TrustLLM, and has key responsibilities for the evaluation of the models that will be created as a joint effort between Germanic language communities.

Joined by colleague Abeer Kashar, an intern through the IWIL AI project exchange program, NTNU linguist Heming Bremnes from the Department of Electronic Systems, and me, Lars Bungum, who writes this article, we are working towards a dataset to explore LLMs' grasp of deeper linguistic relations. This work is coordinated with TrustLLM partner Noah-Manuel Michael from the University of Linköping and will later be extended to the other linguistic communities in the project.

Thus, an important result of this work is creating a framework within which deeper linguistic understanding challenges can be formulated across all languages in the project.

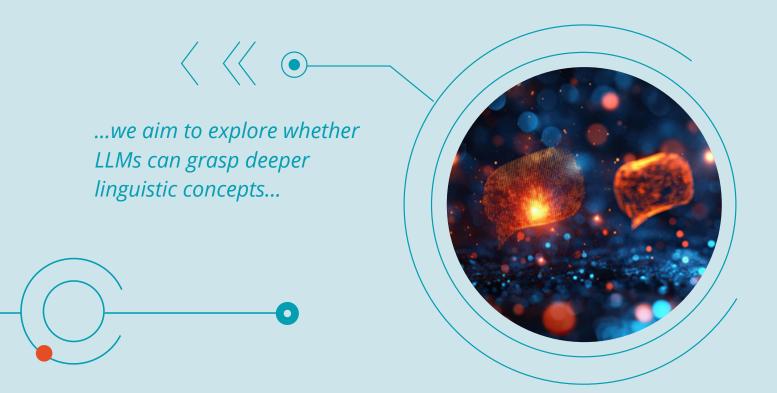
Measuring the "Linguistic Acceptability" (LA) is already a key indicator of the Natural Language Understanding (NLU) exhibited by these models. Several datasets have already been produced for Norwegian, such as the NoCoLA1 dataset from the University of Oslo and the ScaLA datasets from ScandEval2, which labels sentences as either correct or incorrect.

Additionally, NorwAl colleagues Lemei Zhang and Peng Liu have worked extensively on Natural Language Generations tasks such as summarization and conversation for Norwegian.

An inspiration

The Language Council of Norway (LCN) is already exploring the merits of closed-source LLMs in writing Norwegian text3, and we take this as inspiration for seeing how well our own models tackle such subtler relations.

LCN has demonstrated the snafus of LLMs choice of language norms, an important concept



for Norwegian, whose grammar is flexible. A possible extension of this work is to gauge the propensity of LLMs to select linguistic norms that are syntactically more similar to English constructions. In this project, we aim to explore whether LLMs can grasp deeper linguistic concepts, such as differences between the Mainland Scandinavian Languages regarding expressions of genericity ("elgen er et pattedyr") and pinpoint why and how some constructions are ungrammatical. Our method will be to address morphology, syntax, semantics, and possibly the pragmatics of language as independent concepts for evaluation.

Esoteric aspects

We will not shy away from more esoteric aspects of Norwegian, such as the applicability of garpegenitiv and nominalizations of the reflexive in constructions like sj.l-a and sj.l-en.

LLMs are already excelling at producing grammatical text with impressive fluency. As such, this research is part of the family of research that explores the advanced reasoning capability of LLMs.

Establishing how good they are at advanced tasks can reveal if there are still linguistic tasks humans are better at in a climate where LLMs increasingly proofread humans and not the opposite.

As such, it can also contribute to the understanding of why LLMs function as they do. Part of the democratization of LLMs is diversity among developers and evaluators, which behooves addressing deeper cultural and linguistic idiosyncrasies such as those outlined above. As it is a reasonable hope that LLMs will be able to provide the Norwegian society content in local languages (a pertinent example is teaching material in Nynorsk), these aspects of LLMs become increasingly important.

https://github.com/ltgoslo/nocola

https://scandeval.com/

https://sprakradet.no/aktuelt/ki-sprakets-fallgruver/

A unique insight of our internal work: NorwAl Forum will innovate across boundaries.

NorwAl Forums are bi-annual internal summits for NorwAl partners for sharing, discussing and setting goals for across industry and academic collaboration.

As the Trondheim Forums hosted by NTNU are research-focused, the Oslo Forums hosted by SINTEF Digital are focused on innovation.

Across boundaries

On November 14th 2024, NorwAl Innovation Director Till Christopher Lech at SINTEF Digital invited partners to a Forum in Oslo for a dialogue on innovation assignments. Here is a glimpse behind the curtains of our partner work.

The Forums roll between partners, this time the location was at Forskningsparken at Blindern. Together with Associate Professor Nhien Nguyen at NTNU, leader of the Al Innovation Ecosystems work package at NorwAl, they both asked how to innovate across boundaries. Boundary objects and boundary spanners are key to success.

Main topics

29 participants divided (almost) equally between industry professionals and academics in the

debates ignited by keynotes, panels, and group discussions. Examples:

What is the maturity of industrial AI? The keynote highlighted that its maturity is case-dependent and evolves over time: exemplified by simulator tuning, wind turbines and transformer temperature models that industry partners now are engaged in.

What are the challenges and opportunities in innovation through collaboration between academia and industry? Cultural differences and varying business models were noted, but also the potential for mutual benefits when aligning goals.

Tons of use case analytics presented at the session gave shared insights of a variety of ongoing radical and incremental innovation work within the partners. The groups were divided to further discussions with industry, finance and marketplace perspectives.



Data session

Data is a critical factor. A special data session dived into important perspectives such as

- preparing Al-ready data, emphasizing trust, legal compliance and synthetic data
- ♦ Al in organizational contexts and the importance of policy and guidelines
- collaborative writing on human values in LLMs
- data accessibility for researchers
- data infrastructure

Signe Riemer-Sørensen, research manager at SINTEF Digital, leads NorwAl's work package on Hybrid Al Analytics where heavy asset industries meet across companies boundaries. Photo: SINTEF - I concluded the workshop by stressing the importance of data access for NorwAl's R&I work. We must highlight the need for benchmarks, collaboration, and resource sharing to ensure AI is deployed effectively and to identify knowledge gaps and research problems, says host Till Christopher Lech of the NorwAl Forum in November 2024.



RecruitmentPhD-students

STARTED IN 2024



Ahmet Tüzen

Nationality: Turkey

Topic: Dynamic Graph Analytics

Started: December 2024

Main supervisor: Prof. Kjetil Nørvåg, NTNU

NorwAl Work Package: DATA



PhD Defences in 2024

The following PhD candidates, associated to the SFI, successfully defended their theses in 2024:

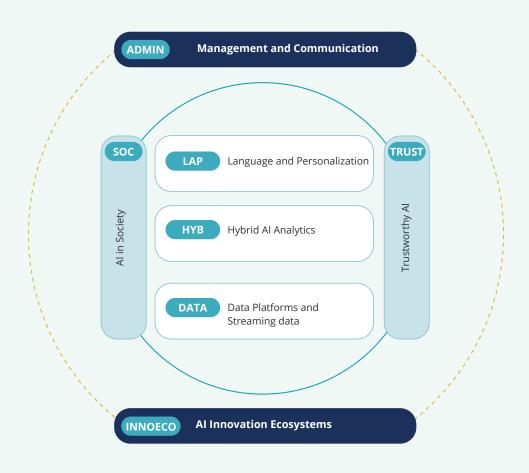


Read more about the work of these PhDs on page 70-75.



The work packages

NorwAl consists of seven work packages, which have been organized as described in this figure:



ADMIN: MANAGEMENT AND COMMUNICATION

This work package concerns the day-to-day operations of the center as well as communication.

Work package leader: Jon Atle Gulla, Professor, NTNU



SOC: AI IN SOCIETY

This work package examines societal aspects of artificial intelligence technologies as they are developed, debated, and implemented. We focus on selected empirical cases, including

- Values in language models
- Societal aspects of voice and speech emotion recognition technologies
- Standardization of AI technologies and ethical, legal, and social aspects.

Work package leader: Susanne Bauer, Professor, University of Oslo



TRUST: TRUSTWORTHY AI

The purpose of work package TRUST is to reinforce a common understanding of safe and responsible AI, specifically:

- Establish trust in safe and responsible AI
- Ensure privacy-preserving in AI technologies
- Create guidelines for sustainable and beneficial use of AI
- Develop principles for explainable and transparent Al
- Develop principles for independent assurance of AI deployment

Trust in Al is a necessary condition for the scalability and societal acceptance of these technologies. Without trust, innovation can be stalled. This research investigates, from an interdisciplinary perspective, the multiple dimensions of trust raised by the deployment of Al and builds tools, methods, and a framework for assuring the safe and responsible deployment of Al in industry and society. This work package aims to answer the question: How can such tools address the safety and needs of individuals, organizations and society at large, addressing both non-technical and technical issues? The research will address issues related to safety, explainability, transparency, bias, privacy and robustness, as well as human-machine interactions and co-behavior all in the context of industry regulations and societal expectations.

Work package leader: Andreas Hafver, Team Leader - Emerging Technologies, Group Research & Development, DNV



LAP: LANGUAGE AND PERSONALIZATION

The purpose for this work package is to develop personalization techniques and Scandinavian language processing capabilities to provide personalized content generation and:

- Develop truly explainable, fair and transparent personalization techniques
- Enable proactivity in customer relations
- Provide an individualized experience that provably respects privacy concerns
- Develop individualized content
- Develop large-scale Scandinavian language models
- Enable human-like content creation and conversations

Personalization and contextualization have been successfully employed in diverse applications over the past decade, and currently see an extended usage, for instance in proactive interaction with customers and individualization of news stories. LAP will contribute to developing such systems while ensuring that the system usage will be ethical and respecting users' requirements for privacy, fairness and accountability.

Building Scandinavian language models requires the compilation of large-scale reusable language resources, including general-purpose corpora from public sources (e.g., news and social media) as well as industry- and domain-specific text collections. We will address the scarcity of the latter by pre-training on the former and developing transfer learning methods. These large-scale language models will then be utilized in real-life scenarios by formulating a number of specific summarization, explanation, and conversational tasks based on our partners' use-cases. LAP will develop appropriate evaluation methodology with user-oriented evaluation measures and objectives. It will thus contribute to providing measurable quantification of the amount of domain-specific training material needed in order to provide a language service that is of sufficiently high quality.

Work package leader: Krisztian Balog, Professor, University of Stavanger



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HYB: HYBRID AI ANALYTICS

The purpose of work package HYB is to:

- Develop robust, stable and explainable data-driven models for physical systems
- Constrain models to enforce meaningful predictions
- Transfer data-driven models from simulations to reality
- Characterize and quantify uncertainty of data-driven models

This work package will develop methods to predict and reduce the uncertainty of data-driven models. The models will be constrained by existing knowledge, allowing to interpret the model (explainable AI) and reducing the amount of required training data. Applying these methods on real world applications will allow the industry partners to better predict the behavior of their facilities and improve their simulations, e.g. for condition monitoring, predictive maintenance, optimal utilization.

Work package leader: Signe Riemer-Sørensen, Research Manager, SINTEF



WP DATA: DATA PLATFORMS AND STREAMING DATA

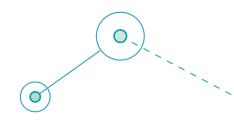
The purpose of this work package is twofold: 1) to develop modern AI for streaming and sensor-based data analysis and 2) to develop techniques and tools for the automatic creation and management of knowledge graphs.

The development of modern AI for streaming and sensor-based data will be done by

- 1. Providing anomaly detection and predictions with low quality streaming data
- 2. Providing uncertainty quantification and explainability with streaming data
- 3. Enabling combinations of streaming and static data for efficient data analysis

Streaming data can be used for automation, recommendations and decision making. Often this involves predictions and anomaly detection in multivariate time series, as well as providing explanations for the conclusions drawn. IoT sensors are increasingly instrumenting the physical world, and efforts have been made to use Al for solving these tasks also in low-quality data regimes. This research area will identify robust techniques for analysis of streaming data within several domains (including telco network, industrial IoT), with a particular focus on improving interpretability for cases with multivariate time series with low quality data.

Solving the research problems in DATA is crucial to successfully innovate how IoT data can be fully used in anomaly detection and contribute to breakthrough in applying AI in predictive maintenance and operational availability.



Real impact of data-driven AI depends on the availability of live data of sufficient quality and quantity in an automatically discoverable format that both humans and machines can understand. DATA will investigate how the semantics of data, through automatic creation and mapping of suitable knowledge graphs, can be leveraged to scale AI models from one situation to all similar situations and how complex graph-based structures can be efficiently stored and processed.

Work package leader:

Valeriya Naumova, Head of Data Science, Cognite (until June -24) Simone Casolo, Head of O&G Digital Services

- Industrial Data Science, Cognite (from July -24);





WP INNOECO: AI INNOVATION ECO SYSTEMS

The purpose of this work package is to

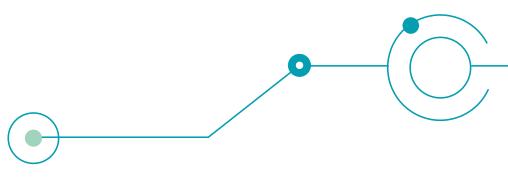
- Create an Innovation Ecosystem among NorwAl partners for sharing both research findings, innovations, business solutions and change models within the Al domain.
- Share this knowledge with a broader audience, emphasizing small and medium sized businesses.

Artificial Intelligence still evokes more myths associated with threats than the possibilities technology brings to the table. All experts are perceived speaking a foreign language when communicating to their organization, and most managers lack sufficient understanding of data driven business-models.

INNOECO will convey state of the art knowledge on Al-driven business models to a wide audience, including non-Al experts. This will be achieved by case analysis, conference presentations, and provision of a range of educational materials spanning from short tutorials to full university courses. The following topics will be covered: what Al is, its strategic impact on business model innovation, the business opportunities and limitations, implication on HR and teamwork, and innovation team dynamics, etc. To achieve these objectives, both Al and HR expertise will be convened.

Work package leader: Nhien Nguyen, Associate Professor, NTNU









Presentations and communication

NAME	TITLE	TYPE/PLACE	DATE
Ajraoui, Alae; Nguyen, Nhien; Sætre, Alf Steinar	Barriers and enablers to implementing Al in organizations: a systematic literature review	Poster, NorwAl Innovate 2024, Trondheim	2024-09-24
Andreassen, Eirik	What does it take for private and public companies to succeed in adopting Al technologies as part of their business model?	NorwAl Innovate 2024, Trondheim	2024-09-24
Bach, Kerstin	Developing Al-driven Healthcare Interventions: The selfBACK project	Talk at Nasjonalt samarbeidsforum for test i helse-IKT (NASTHI)	2024-01-23
Bach, Kerstin	A brief introduction to Al & the selfBACK case study	REHAB-24, Faglig Forum for helse- og sosialtjenesten	2024-01-24
Bach, Kerstin	Developing Trustworthy Al Applications: An Overview of the Recent Developments within NorwAl	Trustworthy Al Seminar, Mälardalen University, Västerås, Sweden	2024-01-30
Bach, Kerstin	Hemit Fredagsseminar: Hva er Al og hvordan kan vi bruke det?	Hemit HF fredagsseminar	2024-02-16
Bach, Kerstin	Basics of Al & an Example of Using Al for the Health Sector	Norwegian Association for Clinical Neurophysiology - spring meeting	2024-03-08
Bach, Kerstin	Current and Future Use of Artificial Intelligence in Health	ELIB Nettverksmøte	2024-03-14
Bach, Kerstin	Current and Future Trends in Al for Healthcare	NTNU European Conference 2024	2024-04-17
Bach, Kerstin	Artificial Intelligence in Health Care	Trondheim Techport Helse- teknologi: sam-arbeid, KI, kapital & eksport	2024-06-06
Bach, Kerstin	Panel: Al for Safety-Critical Systems: How "I" Should the Al be?	28th Ada-Europe International Conference on Reliable Software Technologies	2024-06-12
Bach, Kerstin	Beyond Big Data: Balancing Knowledge And Data For Effective Human Activity Recognition	ICAMPAM 2024	2024-06-20
Bach, Kerstin	Challenges converting health research to products	Norwegian Open Al Lab Partner Forum	2024-08-29

NAME	TITLE	TYPE/PLACE	DATE
Bach, Kerstin	Research Update from NorwAl	Presentation, NorwAl Innovate 2024, Trondheim	2024-09-24
Bach, Kerstin	Artificial Intelligence for Data Mining	ENGAGE.EU Task 5.4 Meeting, keynote at AI Crossroads in Research Support: Data, Ethics & Grants	2024-10-02
Bach, Kerstin	Involving Practitioners in Artificial Intelligence Development. Embracing Human-Aware Al in Industry 5.0 Workshop	ECAl, Santiago de Compostela	2024-10-19
Bach, Kerstin	Interdisciplinary Collaboration on Al and Health	LIACS Seminar, Leiden Institute of Advanced Computer Science	2024-11-26
Bach, Kerstin; Guo, Ying; Bolstad Johansen, Yngve; Petersen, Carl Jörg; Tjåland, Egil	BRU21 - Panel discussion: The Innovation Challenge: from Academia to Industry	BRU21 Conference 2024	2024-06-04
Baumgartner, David; Langseth, Helge, Engø-Monsen, Kenth; Ramampiaro, Heri	Normalizing Flows Conditioning is Everything	Poster, NorwAl Innovate 2024, Trondheim	2024-09-24
Bendall, Katherine Frances	Kaia Demonstration	CatchIDI, demo av Kaia	2024-02-29
Brasethvik, Terje	Kunstig intelligens, muligheter og begrensninger, en innføring	Luftkrigsskolen, Seminar: Luftmaktsseminaret 2024 - Kunstig intelligens, autonomi og verdensrom. Fra abstrakte muligheter til reell kampkraft	2024-02-07
Brasethvik, Terje	Kunstig intelligens på norsk	Rådgivende Ingeniørers Forening Trøndelags årsmøte	2024-05-28
Brasethvik, Terje	Samtale: Kan vi ha tillit til kunnskap? En debatt om Kl, kunnskap og ansvar	Arendalsuka, org: Universitets- og høgskolerådet (UHR), Store norske leksikon, Akademiet for yngre forskere	2024-08-15
Downing, Keith	The Ascent of Al: From Toys to Tools to Terror	NorwAl&NAIL seminar series on Al Research and Innovation	2024-03-01
Dunn, Benjamin	Assembling doughnuts in the brain from parts	NorwAl&NAIL seminar series on Al Research and Innovation	2024-05-24
Eide, Simen	Schibsted og norske språkmodeller	Trondheim Techports Innovasjonsfrukost: Kunstig intelligens & språk	2024-02-14
Festø, Karl Aksel	Kunstig intelligens i DNB	Lansering av NorLLM	2024-05-15
Grønnevet, Gorm	How to integrate research in business	NorwAl Innovate 2024, Trondheim	2024-09-24

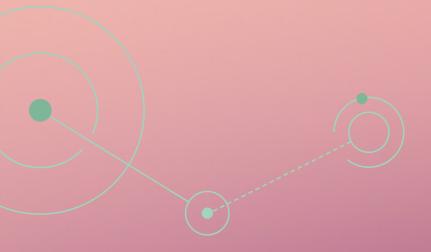
NAME	TITLE	TYPE/PLACE	DATE
Gulla, Jon Atle	Språkmodeller og innovasjon	Fagsamling Sparebank1 Finans Midt-Norge	2024-02-09
Gulla, Jon Atle	NorLLM: Vi lanserer store språkmodeller med norske data og norske verdier	Trondheim Techports Innovasjonsfrukost: Kunstig intelligens & språk	2024-02-14
Gulla, Jon Atle	Presentasjon: Norske store språkmodeller og KI-basert industri	Arendalsuka, org: SpareBank 1 SMN, NTNU - Norges teknisk- vitenskapelige universitet, Kantega, NorwAl - Norwegian Research Senter for Al innovation, SpareBank 1	2024-08-13
Gulla, Jon Atle	Opening and Highlights	NorwAl Innovate 2024, Trondheim	2024-09-24
Gulla, Jon Atle	NTNU LLM – NorwAl	Fagforum for kunstig intelligens i offentlig sektor, tema: målbarhet av gevinster ved å gjennomføre KI-tiltak	2024-10-16
Gulla, Jon Atle	Nye norske modellar 6 månader seinare: evaluering og erfaring	Språkteknologi og KI i Norden, Dokkhuset, Trondheim , 5-6 nov	2024-11-06
Gulla, Jon Atle; Lervik, John Markus, Undheim, Astrid, Halgunset, Knut Eilif	Debatt: Samarbeid for en Al- basert industri i Norge	Arendalsuka, org: SpareBank 1 SMN, NTNU - Norges teknisk- vitenskapelige universitet, Kantega, NorwAl - Norwegian Research Senter for Al innovation, SpareBank 1	2024-08-13
Gundersen, Odd Erik	Nothing to see here; is reproducibility even relevant for computer science?	NorwAl&NAIL seminar series on Al Research and Innovation	2024-03-15
Gundersen, Odd Erik	AI in renewable energy	NorwAl Innovate 2024, Trondheim	2024-09-24
Hafver, Andreas	DNV om sikkerhet i KI-systemer	Lansering av NorLLM	2024-05-15
Hafver, Andreas	Safe and responsible use of LLMs in industry	NorwAl Innovate 2024, Trondheim	2024-09-24
Harr, Anders	Schibsted om språkmodeller	Lansering av NorLLM	2024-05-15
Haugen, Pål	Life after PhD, Failtastic!	NorwAl&NAIL seminar series on Al Research and Innovation	2024-04-12
Ingvaldsen, Jon Espen	Deltagelse i paneldebatt og presentasjon om «Generativ Al og norske språkmodeller»	Norsk Dataforening, årlig konferanse (DND24)	2024-05-23
Ingvaldsen, Jon Espen	Presentasjon om språkmodeller Presentasjon for Hemit og Helseplattformen		2024-06-18

NAME	TITLE	TYPE/PLACE	DATE
Ingvaldsen, Jon Espen	Praktisk KI-bruk & Diskusjon om bruk av KI i norsk industri	Framtidsfredag	2024-06-21
Ingvaldsen, Jon Espen	Debatt: Derfor trenger vi norske språkmodeller for norsk Al- utvikling	Arendalsuka, org: Kantega AS, IKT-Norge	2024-08-12
Ingvaldsen, Jon Espen	Aifal "Al for allmennleger"	Al, Start-ups and snacks, Entrenprenørskolen	2024-10-03
Ingvaldsen, Jon Espen; Thaulow, Jorun	Aifal "Al for allmennleger"	Lansering av NorLLM	2024-05-15
Kille, Benjamin	Artificial Intelligence and Large Language Model: Developing Generative AI at NTNU	Guest lecture at the University Koblenz	2024-01-12
Kille, Benjamin	Om NorwAl	SINTEF Industri - instituttledermøte	2024-01-22
Kille, Benjamin	NorLLMApen norsk sprakmodell fra NorwAl	Generativ AI i offentlig sektor (GoForIT)	2024-03-05
Kille, Benjamin	Large Language Models: forskning på store språkmodeller på NTNU	Statsbygg frukostseminar, Trondheim	2024-03-15
Kille, Benjamin	Large Language Models: Creating Generative AI at NTNU	Nordea visits NAIL, talk	2024-03-19
Kille, Benjamin	Large Language Models (LLMs): How can they help Statens Vegvesen?	Statens Vegvesen visits NAIL, talk	2024-05-28
Kille, Benjamin	Generative Al Agents for Medication Optimisation	eHealth department av helsedirektoratet) visits NAIL, talk	2024-06-03
Kille, Benjamin	Large Language Models: Developing Generative Al at NTNU	Microsoft Trondheim, talk	2024-06-04
Kille, Benjamin	Developing Large Language Models at NTNU	SMN 1 and NAIL collaboration announcement event, talk	2024-06-17
Kille, Benjamin	Can ChatGPT predict the outcome of the US election?	Interview with Christian Ingebrethsen (NRK) for NRK's radio program, interview	2024-08-02
Kille, Benjamin	NorLLM: Potential for Oslo kommune	NTNU visits Oslo kommune to discuss collaboration about AI, talk	2024-08-21
Kille, Benjamin; Svendsen, Rolf D.	Norske språkmodeller - hvorfor, hvordan og hva kan de brukes til	Fagdag SIKT/ Kommunikasjonsforeningen	2024-11-06

NAME	TITLE	TYPE/PLACE	DATE
Łajewska, Weronika	Answering Complex Open- ended Questions in the Era of Generative LLMs	NorwAl Innovate 2024, Trondheim	2024-09-24
Lech, Till Christopher	Regulations for the Digital Economy – Impact on Industry	NorwAl Innovate 2024, Trondheim	2024-09-25
Lech, Till Christopher	Generative AI for Data and Knowledge Engineering Pipelines	ADRA Forum, Eindhoven	2024-11-04
Lervik, John Markus; Casolo, Simone	Energy Transition powered by Industrial Data & Al	NorwAl Innovate 2024, Trondheim	2024-09-25
Liu, Peng	Natural Language Processing with Knowledge Graphs	Guest lecture, INFO320 Research Topics in Semantic Information Systems, UiB	2024-02-15
Liu, Peng	Representation Learning in NLP (basics technologies)	Guest lecture, PROG2051 Artificial Intelligence, NTNU Gjøvik	2024-02-28
Liu, Peng	Examining the Incorporation of Norwegian Editorial Media Content in Public Generative Al System Training	Rapport: Generativ kunstig intelligens - Opphavsretten og de redaktørstyrte mediene. En kartlegging av dagens situasjon of fremtidsscenarier. Fagpressen, Norsk Journalistlag, Norsk Redaktørforening, Mediebedriftene	2024-09-17
Løland, Anders	Kunstig intelligens og personvern: et (u)lykkelig ekteskap?	Personverndagen	2024-01-30
Løland, Anders	Er føderert læring en trojansk personvernhest?	digi.no	2024-03-27
Lund, Halvor	Hybrid modelling in the power sector	NorwAl Innovate 2024, Trondheim	2024-09-24
Nedregotten, Pål	NRK om språkmodeller	Lansering av NorLLM	2024-05-15
Nedregotten, Pål	How NRK transforms LLMs into real-life value	NorwAl Innovate 2024, Trondheim	2024-09-24
Nguyen, Nhien	Facilitating innovation at NorwAl	SFI Forum	2024-05-29
Nguyen, Nhien	NorwAl Innovation 2.0 – A conversation with Nhien Nguyen, WP leader NorwAl	NorwAl Innovate 2024, Trondheim	2024-09-25
Nogueira, Idelfonso ; Santana, Vinicius	Scientific Machine Learning: Bridging Domain Knowledge and Artificial Intelligence for Sustainable Industrial Transition	NorwAl&NAIL seminar series on Al Research and Innovation	2024-05-31

NAME	TITLE	TYPE/PLACE	DATE
Nystad, Erik Johan; Martin- Requerda, Francisco	Exploring the Entity Matching Problem: From String-Matching to Pre-Trained Language Models	Poster, NorwAl Innovate 2024, Trondheim	2024-09-24
Riemer-Sørensen, Signe	Vi trenger Al for en grønnere fremtid	ICE Innovation Festival	2024-01-11
Riemer-Sørensen, Signe	Hybrid Al for industrial systems	Turing-NORA Digital Twins, Alan Turing Institute and the Norwegian Al Research Consortium/NORA	2024-03-18
Riemer-Sørensen, Signe	Kunstig intelligens i klimakampen	Havkonferansen Blått kompass	2024-06-07
Riemer-Sørensen, Signe	Hva skal vi bruke strømmen vår til?	Arendalsuka, org: SINTEF Digital, Nemonoor, NAINE	2024-08-12
Riemer-Sørensen, Signe	Grønn Digital Fremtid	Arendalsuka, org: UiO, "Kunstig intelligens - miljøversting eller løsningen?	2024-08-15
Riemer-Sørensen, Signe	Keynote: Artificial Intelligence with knowledge	Aqua2024	2024-08-30
Riemer-Sørensen, Signe	Hybrid Al for industrial systems	Kongsberg Technology Conference	2024-09-11
Riemer-Sørensen, Signe; Stasik, Alexander Johannes	Hybrid Al for Energisektoren	Statnett Tech Day	2024-04-30
Sauter, Roland	Bridging the gap between process simulators and real data with Hybrid ML	NorwAl Innovate 2024, Trondheim	2024-09-24
Shamba, Abdul-Kazeem; Bach, Kerstin; Taylor, Gavin	Seeing Through Time: Unsupervised Contrastive Representation Learning	NorwAl Innovate 2024, Trondheim	2024-09-24
Steppe, Jessica Annalena; Morais-Storz, Marta; Nguyen, Nhien	Al-Augmented Creativity: Influence of Generative Al on Creativity	NorwAl Innovate 2024, Trondheim	2024-09-24
Storesund, Karolina; Özgöbek, Özlem	NTNU and NorwAl	Meeting with Waterloo Al, University of Waterloo	2024-06-19
Thaulow, Jorunn; Ingvaldsen, Jon Espen	Introducing Medbric: Pioneering AI Agents for Healthcare	NorwAl Innovate 2024, Trondheim	2024-09-25
Thaulow, Sven Størmer; Gulla, Jon Atle	Lansering av norske store språkmodeller fra NorwAl	Lansering av NorLLM	2024-05-15
Tveten, Martin	skchange: A python toolbox for fast time series segmentation and anomaly detection	NSM24, Norsk Statistisk Forening	2024-06-20
Undheim, Astrid	SpareBank1 SMN om språkmodeller	Lansering av NorLLM	2024-05-15

NAME	TITLE	TYPE/PLACE	DATE
Undheim, Astrid	Transforming the finance industry through Al	NorwAl Innovate 2024, Trondheim	2024-09-24
Undheim, Astrid, Thaulow, Sven Størmer	Seminar: Hvordan sikre tillit til Kl- systemer?	Arendalsuka, org: NTNU, Telenor Maritime, GCE NODE	2024-08-15
Van der Abeele, Jeriek	Responsible AI from research to practice	NorwAl Innovate 2024, Trondheim	2024-09-25
Wettre, Jonas Engestøl; Strålberg, Allen; Bøhn, Einar Duenger; Gulla, Jon Atle; Kohn, Daniel; Lintvedt, Mona Naomi; Lyngstad, Cathrine Pihl; Riegler, Michael	perg, Allen; Bøhn, Einar Norge ger; Gulla, Jon Atle; , Daniel; Lintvedt, Mona ni; Lyngstad, Cathrine		2024-05-30
Zhang, Lemei	NLP for Recommender System	Guest lecture, PROG2051 Artificial Intelligence, NTNU Gjøvik	2024-02-21
Zhang, Lemei	Recommendation with Knowledge Graphs	Guest lecture, INFO320 Research Topics in Semantic Information Systems, UiB	2024-02-22
Özgöbek, Özlem	News in the age of Al	Guest lecture during research visit at the LORIA Lab, University if Larraine, Nancy	2024-03-15
Özgöbek, Özlem	Guest lecture in Design Thinking and Al Course PD6010 - Design Thinking a Artificial Intelligence		2024-09-06
Özgöbek, Özlem	Gemini Center on Trustworthy and Sustainable Al	Gemini Center on Trustworthy and Sustainable Al kick- off meeting and external stakeholder event	2024-09-23
Özgöbek, Özlem	About NorwAl	Al, Start-ups and snacks, Entrenprenørskolen	2024-10-03



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NorwAl in the media in 2024

Fastlegar tar lydopptak av pasientane (NRK Rogaland, 2024-10-28)

NTNUs superdatamaskin Idun skal bidra til å varme opp campus (digi.no, 20124-09-26)

Idun skal være med å varme opp campus i vinter (Universitetsavisa, 2024-09-23)

Ny rapport om generativ kunstig intelligens, opphavsretten og de redaktørstyrte mediene (Mediebedriftene.no, 2024-09-18)

Et samfunnsansvar å bidra til en norsk språkmodell (Bok365, 2024-09-11)

Utvalgte faglige godbiter fra første halvår 2024(Norsk redaktørforening, 2024-06-28)

Belgia inviterte til norsk-belgisk samarbeid innen livsvitenskap (lmi.no, 2024-06-18)

Abels tårn: Den store serien om KI (7.2:10) Chat GPTs norske utfordrer (2024-06-13)

Ny superdatamaskin blir viktig for KI-forskning, men er ikke nok for å møte framtidige behov (Universitetsavisa, 2024-06-10) Norsk gpt – nyheter i den norske modellen (Computerworld, 2024-06-04)

Lansering av NorLLM (Schibsted Youtube, 2024-05-15)

Schibsted og NRK har delt data - nå lanseres de ny norske språkmodellene (M24, 2024-05-15)

Lanserer norsk språkmodell (nrk.no, 2024-05-15)

Nå er neste generasjons språkmodeller trent på NTNU lansert (2024-05-15)

Norsk gpt – nyheter i den norske modellen (Computerworld, 2024-05-15)

Merkedag for norsk kunstig intelligens (NTNU Nyheter, 2024-05-14)



Vil gjøre kunstig intelligens mer intelligent (Driva.no, 2024-04-28)

Al-ekspertene er klare: Vi trenger norske språkmodeller (kode24, 2024-04-22)

Slik forenkler du arbeidshverdagen med ChatGPT

(Tendens, 2024-04-04)

Hoel på NTNU: Vil prioritere å løse flaskehalsen i KI-forskning

(Universitetsavisa, 2024-02-26)

Vi må peise på med milliarder hvis vi skal ta igjen amerikanerne

(Adressa, Midtnorsk debatt, 2024-02-26)

Hoel på NTNU: Vil prioritere å løse flaskehalsen i KI-forskning (Universitetsavisa, 2024-02-27) Fagdag om kunstig intelligens ønsker å belyse KI som venn og fiender (Under Dusken, 2024-01-23)

Tekniske ferdigheter er ikke nok for å møte fremtiden (Sikkerhet og Beredskap, 2024-01-22)

Dette har skjedd med AI til nå:- **Stor reguleringsiver**(kode24, 2024-01-16)

Seks teknologier og temaer som vil prege 2024 (digitalnorway.no, 2024-01-08)

Gjennombruddet for generativ kunstig intelligens – en tidslinje (Teknologirådet, 2024-01-04)



Internal seminars

NAME	TITLE	TYPE/PLACE	DATE
Balog, Krisztian	Recent work on Language & Personalization	NorwAl Forum April 2024	2024-04-23
Bauer, Susanne	Recent work on AI in Society	NorwAl Forum April 2024	2024-04-23
Bauer, Susanne	Introduction to Values of LLM	NorwAl Forum April 2024	2024-04-23
Baumgartner, David	Probabilistic Modeling in Multivariate Time Series Data	NorwAl Forum April 2024	2024-04-23
Hafver, Andreas	Recent work on Trustworthy Al	NorwAl Forum April 2024	2024-04-23
Hafver, Andreas	Trustworthy Industrial Al	NorwAl Forum April 2024	2024-04-23
Liu, Peng	The Rise and Promise of Norwegian Large Language Models - NorLLM	NorwAl Forum April 2024	2024-04-23
Michalowska, Katarzyna	Neural operator learning with recurrent neural networks	NorwAl Forum April 2024	2024-04-23
Naumova, Valeriya	Recent work on Data Platforms and Streaming Data	NorwAl Forum April 2024	2024-04-23

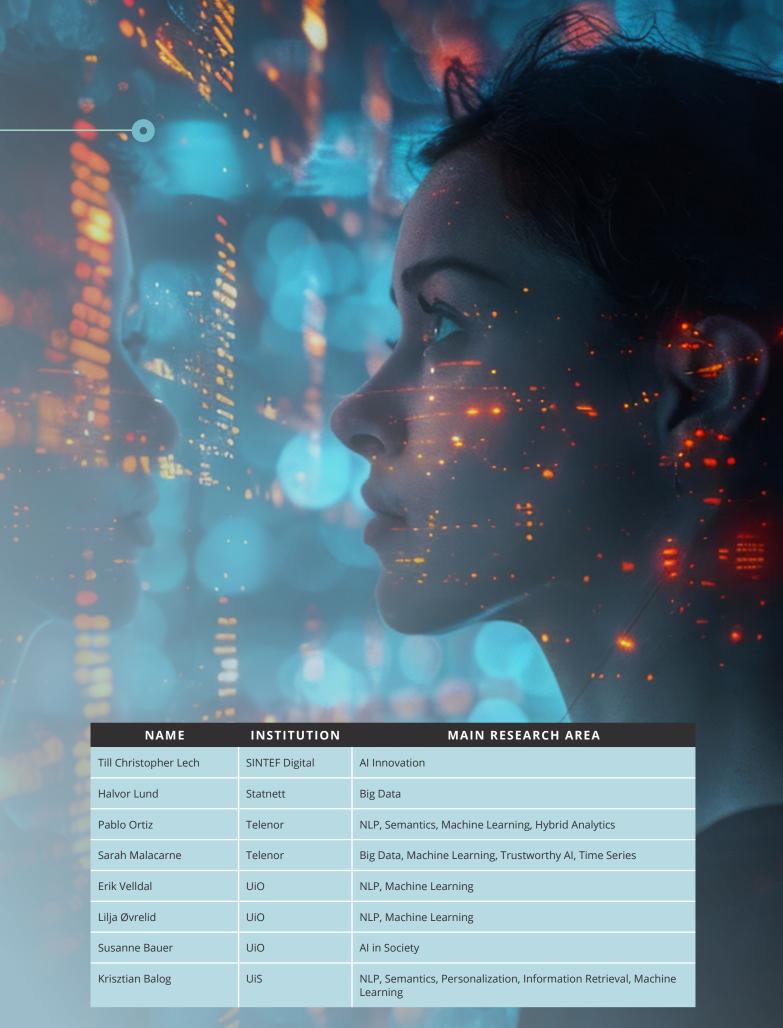
NAME	TITLE	TYPE/PLACE	DATE
Nguyen, Nhien; Berre, Arne Jørgen	Recent work on Al Innovation Ecosystems	NorwAl Forum April 2024	2024-04-23
Nguyen, Nhien; Ajraoui, Alae; Steppe, Jessica; Murgorgo, Serinha; Lauglo, Terje	Research updates: Al Innovation Implementation, Human-Al collaboration, Responsible Al	NorwAl Forum April 2024	2024-04-23
Stasik, Alexander	Recent work on Hybrid Al Analytics	NorwAl Forum April 2024	2024-04-23
Casolo, Simone	The role of data for innovation	NorwAl Forum November 2024	2024-11-14
Gonzalez, Jakoba	Al in an organisational perspective	NorwAl Forum November 2024	2024-11-14
Nguyen, Nhien	Innovation 2.0 – Creating an Innovation Ecosystem for NorwAl	NorwAl Forum November 2024	2024-11-14
Nguyen, Nhien; Riemer Sørensen, Signe; Throndsen, Eivind; Sauter, Roland	Panel: How to foster innovation in NorwAl?	NorwAl Forum November 2024	2024-11-14
Riemer-Sørensen, Signe	Industry Use Cases - Evolution or Revolution?	NorwAl Forum November 2024	2024-11-14
Throndsen, Eivind	Collaborating for innovation between NorwAl & industry	NorwAl Forum November 2024	2024-11-14
Wold, Kjersti	Deploying AI - how to exchange experiences across partners	NorwAl Forum November 2024	2024-11-14
Downing, Keith	The Ascent of Al: From Toys to Tools to Terror	NorwAl&NAIL seminar series on Al Research and Innovation	2024-03-01
Gundersen, Odd Erik	Nothing to see here; is reproducibility even relevant for computer science?	NorwAl&NAIL seminar series on Al Research and Innovation	2024-03-15
Haugen, Pål	Life after PhD, Failtastic!	NorwAl&NAIL seminar series on Al Research and Innovation	2024-04-12
Dunn, Benjamin	Assembling doughnuts in the brain from parts	NorwAl&NAIL seminar series on Al Research and Innovation	2024-05-24
Nogueira, Idelfonso ; Santana, Vinicius	Scientific Machine Learning: Bridging Domain Knowledge and Artificial Intelligence for Sustainable Industrial Transition	NorwAl&NAIL seminar series on Al Research and Innovation	2024-05-31
Kille, Benjamin; Svendsen, Torbjørn	Al and Language Technology	NorwAl&NAIL seminar series on Al Research and Innovation	2024-11-01
Vanhée, Loïs	From Minds to Machines — Psychology-grounded AI as a pathway for sustained development of AI methods, applications, education, and transdisciplinary collaborations	NorwAl&NAIL seminar series on Al Research and Innovation	2024-11-15
Åm, Heidrun	Al & Elections	NorwAl&NAIL seminar series on Al Research and Innovation	2024-11-22

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Personnel

KEY RESEARCHERS

NAME	INSTITUTION	MAIN RESEARCH AREA
Simone Casolo	Cognite	Machine Learning, Hybrid Analytics
Andreas Hafver	DNV	Trustworthy Al
Anders Løland	Norsk Regnesentral	Machine Learning, Statistics
Ildiko Pilán	Norsk Regnesentral	NLP, data privacy, clinical NLP, computer-assisted language learning, machine learning
Pierre Lison	Norsk Regnesentral	NLP, Privacy and Security, Machine Learning, Information Retreival, Semantics, Al and Society, Big Data
Benjamin Kille	NTNU	NLP, Personalization, Machine Learning
Boye Høverstad	NTNU	Machine Learning
Helge Langseth	NTNU	Machine Learning, Probabilistic Al
Jon Atle Gulla	NTNU	NLP, Personalization
Jon Espen Ingvaldsen	NTNU	Innovation processes
Kerstin Bach	NTNU	Al and Society, Innovation Processes, Personalization, Machine Learning, Trustworthy Al
Kjetil Nørvåg	NTNU	NLP, Data Mining, Database Systems, Big Data, Information Retrieval
Lemei Zhang	NTNU	Personalization, Big Data, Information Retrieval, Machine Learning
Nhien Ngyuen	NTNU	Innovation processes
Peng Liu	NTNU	Personalization, Big Data, Information Retrieval, Machine Learning
Terje Brasethvik	NTNU	Information retrieval, Semantics, Trustworthy Al
Özlem Özgöbek	NTNU	Personalization, recommender systems, trustworthy Al and disinformation detection
Francisco Martin-Recuerda	SINTEF Digital	Large Language Models for entity matching for ontologies in industrial systems and digital twins.
Alexander Johannes Stasik	SINTEF Digital	Machine Learning, Hybrid Analytics
Arne Jørgen Berre	SINTEF Digital	Al Innovation, Semantics and Standardization
Signe Reimer-Sørensen	SINTEF Digital	Machine Learning, Hybrid Analytics



VISITING RESEARCHERS

NAME	AFFILIATION	NATIONALITY	SEX	DURATION	TOPIC
Gavin Taylor	US Naval Academy	USA	M	2024-06-28 – 2025-06-27	Machine learning, including reinforcement learning, time series, and evasion of machine learning systems.

POSTDOCTORAL RESEARCHERS

Postdoctoral researchers with financial support from the center budget:

NAME	NATIONALITY	PERIOD	SEX	TOPIC
Abdulmajid Murad	Yemen	2023-03-23 - 2024-01-31	М	Deep Reinforcement Learning, Active Learning, and GFlowNet

Postdoctoral researchers working on projects in the center with financial support from other sources:

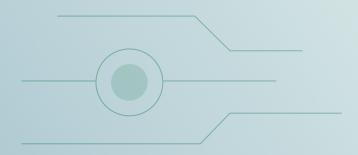
NAME	FUNDING	NATIONALITY	PERIOD	SEX	TOPIC
Lars Bungum	Horizon Europe, TrustLLM	Norway	2024-02-01 – 2026-10-31	М	Evaluating Trustworthy and Efficient Large Language Models
Lemei Zhang	NTNU	China	2022-04-04 – 2025-10-03	F	Streaming Data Analytics



PHD STUDENTS

PhD students with financial support from the center budget:

NAME	NATIONALITY	PERIOD	SEX	TOPIC
Baumgartner, David	Austria	2021-09-21 – 2025-08-31	М	Data analysis with noisy and low-quality data streams
Bernard, Nolwenn	France	2022-02-01 – 2025-01-31	F	Study of fairness and transparency in conversational recommender systems
Jedamski, Lena	Germany	2023-02-06 – 2026-02-05	F	Trustworthy Artificial Intelligence
Knaus, Tanja	Austria	2022-04-01 – 2025-03-31	F	Automation of affective data: infrastructure and data practices in voice recognition systems
Łajewska, Weronika	Poland	2022-02-01 – 2025-08-27	F	Personalizing Conversational Informational Access
Murgorgo , Serinha	Zimbabwe	2023-08-15 – 2026-08-14	F	Embracing Responsible AI: Integration of responsible AI principles in organisational practices
Michałowska, Katarzyna	Poland	2021-01-01 - 2024-12-31	F	Informed machine learning
Nikolov, Nikolay	Bulgaria	2021-01-01 – 2024-12-31	М	Flexible Deployment of Big Data Pipelines on the Cloud/Edge/Fog Continuum
Rønningstad, Egil	Norway	2021-10-14 – 2026-04-13	М	Entity-level Sentiment Analysis
Shamba , Abdul- Kazeem	Nigeria	2023-09-01 – 2027-08-31	М	Artificial Intelligence for Anomaly Detection
Steppe , Jessica Annalena	Germany	2023-08-15 – 2026-08-14	F	Al-Augmented Creativity in Innovation Teams
Tüzen, Ahmet	Turkiye	2024-12-17 – 2027-12-16	М	Dynamic Graph Analytics
Vassøy, Bjørnar	Norway	2021-08-02 – 2025-08-01	М	Fairness, Accountability, Transparency and Privacy in Personalization/ Recommender systems
Yadav, Vandana	India	2023-11-02 – 2027-11-01	F	Natural Language Processing for personalized content summarization



PHD STUDENTS

PhD students working on projects in the center with financial support from other sources:

NAME	FUNDING	NATIONALITY	PERIOD	SEX	TOPIC
Ajraoui, Alae	NTNU (IØT)	Marocco	2023-10-23 – 2026-10-22	М	Digital innovations implementation: A dynamic approach of continuous adaptation
Bayrak, Betül	NFR/NTNU (Exaigon)	Turkiye	2022-01-19 – 2025-01-18	F	Explainable Case-Based Reasoning
Bekkemoen, Yanzhe	NTNU	Norway	2019-10-01 – 2024-09-30	M	Probabilistic approaches to explainable AI and reinforcement learning.
Bjøru, Anna Rodum	NTNU	Norway	2021-11-11 – 2025-11-10	F	Explainable deep bayesian learning
Doan, Tu My	NTNU	Vietnam	2020-01-06 – 2024-01-05	F	Political Text Mining
Hermann, Tom	NTNU	France	2023-11-27 – 2027-11-26	M	Machine learning in healthcare
Killingberg, Ludvig	NTNU	Norway	2019-10-01 – 2024-09-30	M	Bayesian deep learning and reinforcement learning
Logacjov, Aleksej	NTNU	Germany	2021-05-01 – 2024-04-30	M	Self-supervised learning for Human Activity Recognition
Ottersen, Stuart	NTNU Helse: Al Ment	Norway	2023-02-01 – 2027-01-31	М	Using machine learning to predict response and dropout in RCT data from digital sleep therapy
Shadrooh, Shiva	DNB	Iran	2020-02-20 - 2024-09-30	F	Anomaly detection in streaming graphs
Sylvester, Sophia	NTNU Helse: Al Ment	Germany	2023-02-01 – 2027-01-31	F	Radar Data and Machine Learning in Psychiatric Care: Novel Approaches for Advancing Sleep/Wake Estimation and Aggression Prediction

MASTER'S DEGREES (2024)

Master students obtaining their degree on NorwAl topics in 2024:

NAME	SEX	PERIOD	TOPIC
Bjørgo, Anna Jansdatter	F	2023-08-01- 2024-06-30	Automating the Process of Traffic Incident Reporting
Bratvold, Mats Sørensen	М	2023-08-01- 2024-06-30	Leveraging Open Source Large Language Models For Check- Worthiness Detection
Egge, Torstein Martinsheimen	М	2023-08-01- 2024-06-30	Large Language Models for Optimizing Search
Eggen, Marte	F	2023-08-01- 2024-06-30	Explainable Al Approaches for Large Generative Transformer- Based Language Models
Finsås, Mats	М	2023-08-01- 2024-06-30	Optimizing RAG Systems for Technical Support with LLM-base Relevance Feedback and Multi-Agent Patterns
Grimstad, Astrid Weien (UiO)	F	2023-07-01- 2024-05-31	Future-proofing legislation in the EU Al Act
Güzel, Bora (UiS)	М	2023-07-01- 2024-05-31	Contextual Conversational Recommendation in the Movie Domain
Hammer, Henrik	М	2023-08-01- 2024-06-30	Predictive maintenance of cooling systems in retail stores
Hansen, Eskild Gundersen	М	2023-08-01- 2024-06-30	Quantifying performance variation in a deep learning model for wind turbine blade degradation
Høgset, Håkon Bygdås	М	2023-08-01- 2024-06-30	Machine Learning Approaches to Automated Sign Language Translation
Holmsen, Sven Herman	М	2023-08-01- 2024-06-30	Ethical Perceptions in Al Literacy - A comparative study of privacy and bias in generative artificial intelligence and recommender systems
Jarvie, Linn H (UiO)	F	2023-07-01- 2024-05-31	Governing algorithms: Transparency and algorithmic accountability on very large online platforms and very large online search engines.
Jekic, Aleksandra	F	2023-08-01- 2024-06-30	Inverse Physics-Informed Neural Networks for Control with Noise
Katralen, Jørgen Nordli	М	2023-08-01- 2024-06-30	Computer vision (ML) for extracting knowledge from satelite data
Kongelf, Fabian	М	2023-08-01- 2024-06-30	Forecasting wind speed with spatial weather data and neural networks
Kongsvik, Tobias Slettemoen	М	2023-08-01- 2024-06-30	Combining Lexical and Semantic Search for Blocking
Langholm, Jon Akselberg	М	2023-08-01- 2024-06-30	Fine-tuning Large Language Models for Norwegian Nynorsk using Multilingual Knowledge Distillation
Lundegaard, Mats	М	2023-08-01- 2024-06-30	Automating the Process of Traffic Incident Reporting
Maksim, Joachim	М	2023-08-01- 2024-06-30	Optimizing RAG Systems for Technical Support with LLM-base Relevance Feedback and Multi-Agent Patterns
Marstein, Mikkel	М	2023-08-01- 2024-06-30	Enhancing Fake News Detection through Dataset Augmentation Using Large Language Models

MASTER'S DEGREES (2024)

Master students obtaining their degree on NorwAl topics in 2024:

NAME	SEX	PERIOD	TOPIC
Nguyen, Daniel Bao Duy	M	2023-08-01- 2024-06-30	Predictive maintenance of cooling systems in retail stores
Nomeland, Olav	М	2023-08-01- 2024-06-30	Fine-Tuning Large Language Models to Enable Translation Between Norwegian Bokmål and Nynorsk
Pettersen, Mathias	М	2023-08-01- 2024-06-30	PLANNER Planning Layouts Autonomously using Novel Nuanced Evolutionary Reasoning
Rahman, Mahfujur	М	2023-08-01- 2024-06-30	A Novel Study on Identifying Vessel from SAR Satellite Imagery with Attention Mechanisms
Refsland, Simen	М	2023-08-01- 2024-06-30	Natural Language Processing for Political Texts
Risåsen, Jonatan André	М	2023-08-01- 2024-06-30	Fine-Tuning Large Language Models to Enable Translation Between Norwegian Bokmål and Nynorsk
Sagen, Lavrans Kaul	М	2023-08-01- 2024-06-30	Applied Option Pricing using Transformers
Saugestad, Aksel	М	2023-08-01- 2024-06-30	Evaluating multilingual models and Machine-translated datasets for abstractive summarization in Norwegian
Skibsted, Laura (UiO)	F	2023-07-01- 2024-05-31	Exploring the Nexus of Human-Technology Interaction, Work Systems Design, and Cloud Technology Adoption: A Case Study of the Human-Centered Digitalization Department at IFE.
Songe, Sunnøve (UiO)	F	2023-07-01- 2024-05-31	Amalysing digitally enhanced border governance in the EU (working title)
Stava, Tor Olav (UiS)	М	2023-08-01- 2024-06-30	Automatic Generation of Presentations for Research Papers
Steira, Erik	М	2023-08-01- 2024-06-30	Towards Conversational Recommendation in Education: Synthesizing Conversations from Structured Course Data and Benchmarking for Conversational Curriculum Recommendation
Strande, Tor Dyrdal	М	2023-08-01- 2024-06-30	Analyzing the Effects of Static Opponents in the Training of Al Systems for Playing the Imperfect Information Game of Cribbage
Sundt, Jonas Hvidsten	М	2023-08-01- 2024-06-30	Automatic Knowledge Extraction in Norwegian Finance



MASTER'S STUDENT ASSISTANTS

NAME	SEX	PERIOD	TOPIC
Even W. Lauvrak	М	2023-06-01 - 2024-12-31	NorGPTs fine-tuning and evaluation on Natural Language Understanding
Håkon Bygdås Høgset	М	2022-08-01 – 2024-09-30	"Kaia" the social robot
Henny Løfqvist	F	2023-08-21 - 2024-06-07	"Large-scale Language Model for Norwegian"
Ingrid Omdal	F	2023-08-21 - 2024-06-07	"Large-scale Language Model for Norwegian"
Marcus Tiedemann Økland Henriksbø	М	2023-08-22 - 2024-06-07	Data annotation for summarization and document-grounded question-answer
Marte Eggen	F	2022-08-01 – 2024-06-07	"Kaia" the social robot
Terje Nissen Farup	М	2023-07-01 – 2024-12-31	Fine-tuning the Norwegian generative language models for conversational tasks and evaluation
Vilhjalmur Arnar Vilhjalmsson	М	2023-07-12 - 2024-12-31	Demonstrator for anomaly detection
Vegard Vaeng Bernhardsen	М	2023-10-08 – 2024-06-07	Data preprocessing on NorLLM project

BACHELOR'S STUDENT ASSISTANTS

NAME	SEX	PERIOD	TOPIC
Kate Bendall	F	2024-01-01- 2024-04-30	Social robotics programming - Artificial intelligence specialist
Sineha Manivannan	F	2024-01-01- 2024-04-30	Front and Backend Developer for Al Supported Learning Platforms
Albert Kwesi Ndur-Osei	M	2024-01-01- 2024-04-30	Programmer/Software Developer in Artificial Intelligence Research
Shawn Benedict	M	2024-01-01- 2024-04-30	Programmer/Software Developer in Artificial Intelligence Research
Ken Jiang	М	2024-09-01 - 2024-12-31	Computational Linguist
Matia Lee	М	2024-09-01 - 2024-12-31	Social Robotics Programmer - Artificial Intelligence
Jeffrey Lu	М	2024-09-01 - 2024-12-31	Programmer/Software Developer in Artificial Intelligence Research
Darian Zhang	М	2024-09-01 - 2024-12-31	Programmer/Software Developer in Artificial Intelligence Research

Accounts



2024	FUNDING	COSTS
The Research Council	13 099	
The Norwegian University of Science and Technology (NTNU)	9 020	13 780
Research Partners*)	1 910	10 249
Enterprise partners**)	14 106	14 106
Total	38 135	38 135

All figures in 1000 NOK.

- *) Norwegian Computing Center (NR), SINTEF, University of Oslo and University of Stavanger.
- **) Aneo, Cognite, Digital Norway, DNB, DNV, Kongsberg Digital, NRK, Schibsted, Sparebank1 SMN, Statnett, Telenor.





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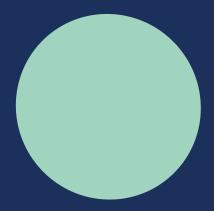
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