

# Robust Biometric Authentication using 3D Information



## Motivation

- Presentation Attack pose is an essential problem for face recognition systems at automated border control gates.
- 3D Information can be useful for Presentation Attack Detection (PAD).



Bona-fide Print-Photo Display-Photo Display-Video  
Top-Row 2D Images, Bottom-Row 3D Models.  
(PR-Net ECCV 2018) (SOTA)

## Research Questions

- Can we use 2D to 3D conversion using deep learning for Robust PAD?
  - What is the minimum predicted-depth resolution, deep learning architecture and features to be used?
- Can we detect digital morphs and generate a new PAI by using a low-cost digital AVATAR?
  - What is the deep-learning architecture and what is the lowest image quality at which digital morphs can be detected?
- Can we do a robust PAD on smartphones (low computational devices) using deep learning and 2D to 3D conversion?
  - What deep-learning architecture and maximum predicted depth-resolution from it?
- Can we use Image transformation techniques using deep learning for robust biometric authentication such as finger-photo to fingerprint?
- Can we use PAD for robust biometric authentication?
  - What is fusion scheme and does a ternary classifier improve authentication.

## Approach

- Evaluate existing state-of-the-art schemes using 2D to 3D conversion for PAD, develop deep-learning architecture and ground-truth 3D dataset for PAD.
- Detect Morph using 2D to 3D conversion and find relevant features which can be leveraged for this.
- Tune the deep-learning architecture for smartphones.
- Investigate the role of image-quality in finger-photo to fingerprint conversion and improve the performance.
- Use PAD for robust authentication including different modalities.

## Publications

- Robust Morph-Detection at Automated Border Control Gate using Deep Decomposed 3D Shape and Diffuse Reflectance, Jag Mohan Singh, Raghavendra Ramachandra, Kiran B. Raja, Christoph Busch, SITIS 2019.
- Detecting Finger-Vein Presentation Attacks Using 3D Shape & Diffuse Reflectance Decomposition, Jag Mohan Singh, Sushma Venkatesh, Kiran B Raja, Raghavendra Ramachandra, Christoph Busch, SITIS 2019.
- Face Presentation Attack Detection using Multi-Classier Fusion of Off-the-Shelf Deep Features. Raghavendra Ramachandra, Jag Mohan Singh, Sushma Venkatesh, Kiran B Raja,, Christoph Busch, CVIP 2019.



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