

# Master Thesis: “Learning Fingerprint Minutiae for Biometric Authentication via Deep Networks”

Airports and border checkpoints are examples of vital infrastructure hubs needing biometric technology to enforce national security. Fingerprints have proven to be highly distinctive and unique, stable over time and publicly accepted as reliable means of authentication. With the recent rise of novel (multi-spectral, touchless, mobile) sensing technology also biometric processing software is facing new challenges and demands. Traditional approaches in fingerprint segmentation and extraction derives landmarks (minutiae points) via a sequence of time-consuming steps fragile under varying skin and recording conditions. The aim of the project is to develop a novel more robust and fast fingerprint feature extractor for biometric authentication using deep learning integrating quality for the comparison stage. Also quality estimation is rather dependent on the employed sensor and correlation with recognition rates can be improved. With the availability of large databases and access to synthetic fingerprint generation tools, however, it is interesting to look at whether position, type and local quality of bifurcation, termination and other characteristic minutiae landmarks in human fingerprints can be learned from a large set of training data. The motivation for using deep learning is to study the impact of surrounding information within a minutiae point.

## Description

- Familiarization with the state-of-the-art in deep learning and fingerprint biometric recognition (literature review);
- Selection and development of prospective deep network models dedicated for detecting (localization, orientation) and estimating the quality of minutiae points.
- Training the developed network with (a) synthetically generated fingerprint data (software with source code is available), potentially integrating new noise models simulating realistic conditions (dry/wet fingers; rotation/distortion); and (b) merging fingerprint data from publicly available large-scale fingerprint databases, assembling a large and representative fingerprint dataset.
- Validation through comparison with existing open-source fingerprint extraction packages using challenging public datasets (considering accuracy/execution time performance – goal: fast execution on mobile devices); Test with captured fingerprint samples.

## Candidate profile

- Master student in (applied) computer science, telematics or related field;
- Background/Interest in image processing and machine learning;
- Experience in programming (Matlab, C++, Python);
- Disciplined, self-motivated work style;

## Contact

- Dr. Peter Wild, Digital Safety & Security Department, Austrian Institute of Technology GmbH, [peter.wild@ait.ac.at](mailto:peter.wild@ait.ac.at)

## Salary

- €1292,5 per month for a maximum of half a year.

## Same or Different?



## Anatomy: Level 2 Characteristics: 500 dpi

- **Minutiae**, or Galtons characteristics, are determined by the termination or the bifurcation of the ridge lines
- Each minutia is denoted by its class, the x- and y-coordinates, and local orientation;

