Deep Convolutional neural network for Fingerprint Recognition

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1. Introduction

Fingerprints are ridge and valley patterns presented on the surface of human fingertips. Fingerprints recognition techniques are applied in many areas such as authentication, suspects identification and privacy protection. Typically, to query a fingerprint, the system needs to search and match thousands of fingerprints that are stored in the database. This is a time-consuming process due to huge amount of computation. To mitigate this problem, we can first classify a fingerprint into a basic type and then perform fingerprint match within fingerprints of that type.

Most of fingerprint classification problems adopts Galton Henry classification scheme.[2]. Thus, in this project, we are going to propose a fingerprint recognition system that classify a fingerprint into the following 5 categories: A=Arch, L=Left Loop, R=Right Loop, T=Tented Arch, W=Whorl.
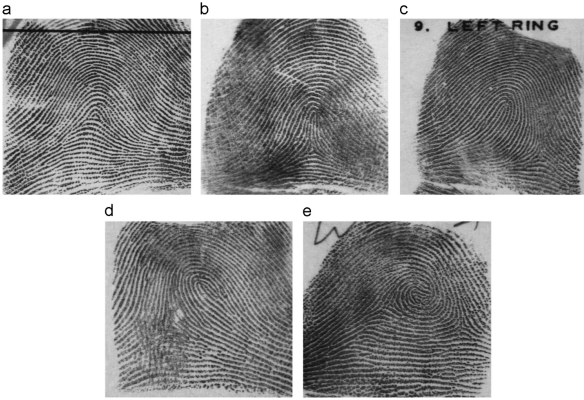

Figure 1. Examples of fingerprint classes: (a) Arch (b) Tented Arch (c) Left Loop (d) Right Loop (e) Whorl [1]

2. Motivation

The challenge of classifying fingerprint includes: 1) the quality of some fingerprints images are poor; 2) the inter-class dissimilarity is small and the intra-class similarity is small; 3) some fingerprints can be classified into multiple classes and there exists some ambiguity in the label.

To solve these problems, many researchers propose to use handcrafted features instead of raw fingerprint images for classification and many methods have been proposed. Kai Cao *et al.*[1] propose to a novel method to extract fingerprint orientation feature and use a hierarchical classifier for classification. Ruxin Wang *et al.* [4] also use fingerprint orientation as feature. By adopting stacked autoencoder

3. Plan

3.1. Deep Learning

In this project, we plan to develop and implement a novel deep learning algorithm for fingerprint claasifications. Specifically, we will implement some state-of-the-art convolutional neural network (CNN) architecture as baselines, such as GoogLeNet [3]. Our goal is to propose a novel approach to classify fingerprints. The innovation of our approach is two-fold:

1) devise some novel CNN architecture that aims at classifying fingerprints, rather than just use some existing CNN

4. Dataset

References

[1] K. Cao, L. Pang, J. Liang, and J. Tian. Fingerprint classification by a hierarchical classifier. *Pattern Recognition*, 46(12):3186–3197, 2013.

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[4] R. Wang, C. Han, Y. Wu, and T. Guo. Fingerprint classification based on depth neural network. *arXiv preprint arXiv:1409.5188*, 2014.