IVRL - Images and Visual Representation Lab

Semester projects

Project description and planning

Project Description

Title: GAN-based Finger Vein Image Augmentation for Biometric Authentication

Description: Startup Company “Global ID” has developed a 3D finger vein biometric identification system. To improve and verify the performance of their biometric identification system, they have to get a large number of the finger vein images in person. However it is very cumbersome, time consuming, and labor intensive to collect a large-scale dataset from subjective experiments. To address that, in this project, we will generate a large number of finger vein images from a small number of the real finger vein images using deep generative model. For this purpose, we will study the generative adversarial network (GANs). Furthermore, we will design a GAN-based data augmentation algorithm for synthesizing realistic finger vein images.

Type of Work (e.g., theory, programming): 40% research, 60% development and testing

Prerequisites (e.g., machine learning, C++): Knowledge of image processing and computer vision / Experience with PyTorch for deep learning

Supervisor(s): Hakgu Kim (hakgu.kim@epfl.ch)

Student Information

Name: Samuel Dubuis

E-mail: s.dubuis@epfl.ch

School (e.g., I&C, STI): I&C

Program (Comm. Sys., Comp. Science): Communication Systems

Cycle (B.Sc./M.Sc./EDIC): M.Sc

Semester (1, 2, 3, ...): 3

Project Planning

This form should be completed before the end of the 3rd week and sent to your supervisor(s). The title of the document must be modified by appending your name to its end (replace TEMPLATE by FIRSTLAST name)*. After the submission of the form, which should be first agreed upon with*

your supervisor(s), a modification is still possible, but it should be motivated at the midterm and agreed upon again with your supervisor(s).

Deliverables

Explain in a few sentences the expected concrete outcome of the project (e.g., a C program that removes red eyes, a subjective test on N persons of an algorithm).

- A deep learning program using PyTorch or TensorFlow libraries that augments finger vein images
- A newly generated finger vein image datasets

Timeline

*Explain shortly (in a few sentences) what you plan to achieve for every week of the project in order to reach the final goal described in the previous section. Please be reminded that the students are supposed to spend **30 hours** to prepare the required background **before the beginning of the semester** (e.g., reading papers, reviewing MATLAB/C etc.). The amount of work during the semester should correspond to **18 hours** per week for MS projects (**12** for BS/optional projects). After the end of the semester, **30 extra hours** should be spent to complete report and presentation, which gives a total of 312 hours of work. All details and rules can be found here: https://ic.epfl.ch/semester_project.*

Week	Planned work
1	Semester project kick-off meeting
2	Paper survey on GANs (Generative Adversarial Networks) and finger vein (FV) verification
3	Brainstorming for FV image data augmentation using GAN
Project description and planning is due	
4	A large-scale public FV image database survey and download for training
5	Experimental settings for our FV image data collection
6	Baseline: Spatial Transformer Networks (STN) implementation
7	Baseline: CycleGAN implementation
8	Baseline: STN + CycleGAN
Midterm presentation (tentatively)	
9	STN + CycleGAN + FV region classifier

10	Various transformations 1: illumination / temperature / lightening / etc.
11	Various transformations 2: illumination / temperature / lightening / etc.
12	Fine-tuning the deep network with a newly collected FV image database
13	Experiment: FV image data augmentation based on the proposed method
14	Verification: FV image authentication with the augmented FV image database
Final report due date: https://ic.epfl.ch/semester_project	
Final presentation	