# Initial Plan

Project Title: Generation of Facial Cartoons

Project Number: 146

Author: Wai Yin Leung (C1424864)

Supervisor: Paul L Rosin

Moderator: Yu-Kun Lai

Module Number: CM3203

Module Title: One Semester Individual Project

# Project Description

In the trend of facial enhancements and special effects in many social applications today, there are many cartoon styling tools that allow users to browse through and select their favorites. However, this can take a long time and still not provide to wanted results. To solve this problem, this project tries to develop a program that automatically generate a cartoon stylized version of a frontal face image using a combination of image processing techniques with many sets of training image data.

The aim of this project is to generate cartoon images that make a balance between facial realism and attractiveness that look similar across features with the input images. This project is divided into four main parts. The first part is to identify facial features from input images using OpenFace Software[1]. Then extract individual features including eyebrows, eyes, nose, mouth and facial outline.

Then in the second part, using these features, a library of cartoon styled version of the features will be created which will be used as the features of the output images.

The third part is to perform a line segment extraction on the set of training facial images. This is done by coherent line drawing[2] to detect edges so that processing later on such as feature matching can be simplified. Then each facial image will be resized to a standard for consistency.

Finally, given an input image of a frontal face, the first and third parts are applied and it will be map to the most similar feature. Then according to the actual shape of the features, deformations are done to the cartoon templates to improve realism. In the end, combining these templates and transform them into the correct positions to generate a cartoon stylized face.

Other than facial features stated above, we are also interested in segmentation of hair. With a similar set of processes, this project should be able to produce quality results of hair segmentation in order to generate better final results.

---

[1] **OpenFace: an open source facial behavior analysis toolkit** Tadas Baltrušaitis, Peter Robinson, and Louis-Philippe Morency, in *IEEE Winter Conference on Applications of Computer Vision*, 2016

[2] **Coherent Line Drawing: an open source line drawing standalone program** modified from the paper 'Coherent Line Drawing' by Kang et al, Proc. NPAR 2007

# Project Aims and Objectives

**Aim:** Line segment extraction for facial contents

**Objectives:** Use Coherent Line Drawing program to extract lines on facial features

**Aim:** Feature extraction including eyebrows, eyes, nose, mouth, and facial outline

**Objectives:**

Install and compile OpenFace System

Use OpenFace system to extract features and store them

**Aim:** Create a cartoon stylized features library

**Objectives:**

For each extracted feature, a corresponding cartoon stylized version will be created

- Duplication of features images from related published papers
- Design using online cartoon stylized tool

Both versions will be stored in the library and identified by a numbering system

**Aim:** Given an input image, the best match for each feature should be found between the input features and all the sets in the features library

**Objectives:** Use similarity measure on line segment images to vote for the best matching feature

**Aim:** Deformation of the cartoon template according to the facial feature

**Objectives:** Use different measurements such as sizes and angles to determine deformations

**Aim:** Ensure facial outputs have global consistency and compatibility

**Objectives:** Check that in the output image, it does not consist of two different set of eyes or eyebrows

**Aim:** Implement hair segmentation

**Objectives:** Research through the most reliable and possible methods of hair segmentation

# Work Plan

## Supervisor meetings
Weekly meetings have been scheduled on Thursday at 17:00.

### Week 1
- Project research
- Initial plan
- Schedule first meeting to discuss the initial plan and project approach
- Collect frontal face images (this should be done throughout the first 4 weeks)
- Facial feature extraction

### Week 2
- Continue with project research
- Perform testing using a set of training facial images on OpenFace
- Line segment extraction
- Perform testing using a set of training facial images on Coherent Line Drawing program
- Create cartoon stylized features library

### Week 3
- Continue to create the cartoon stylized features library
- Research and implement algorithm for facial features comparison

### Week 4
- Continue to implement algorithm for facial features comparison

### Week 5
- Continue to implement algorithm for facial features comparison

### Week 6
- Continue to implement algorithm for facial features comparison
- Perform testing using a set of training facial images on features comparison algorithm

### Week 7
- Research and implement algorithm for cartoon template deformation and transformation

### Week 8
- Continue to implement algorithm for cartoon template deformation and transformation
- Perform testing using a set of training facial images on cartoon template deformation and transformation
- Research and implement hair segmentation

### Week 9
- Continue to implement hair segmentation
- Perform testing using a set of training images on hair segmentation
- Add hair cartoon templates to library

### Week 10
- Plan and implement the final algorithm

## Week 11
- Continue implementing the final algorithm
- Perform testing using both training and unknown datasets

## Easter break
- Refinement and improvement to any algorithm
- Perform testing on the improved algorithm
- Report writing

## Week 12
- Final check for the report
- Submit the final report

| Tasks | Weeks | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | Easter | 12 |
| Initial Plan | | | | | | | | | | | | | |
| Collect Frontal Face images | | | | | | | | | | | | | |
| Facial Features Extraction | | | | | | | | | | | | | |
| Line Segment Extraction | | | | | | | | | | | | | |
| Cartoon stylized library | | | | | | | | | | | | | |
| Facial Features Comparison | | | | | | | | | | | | | |
| Template Deformation | | | | | | | | | | | | | |
| Template Transformation | | | | | | | | | | | | | |
| Hair Segmentation | | | | | | | | | | | | | |
| Final Algorithm | | | | | | | | | | | | | |
| Refinement | | | | | | | | | | | | | |
| Report Writing | | | | | | | | | | | | | |