**Intermediate Project Report**

**1. Introduction and problem description**

Face recognition and detection has played an important role in today’s society, especially for government’s surveillance and social media’s platforms. What seemed like a dream 50 years ago now become possible thanks to the explosion of technology development, especially to the wise and creative minds who never stop inventing and developing amazing products that bring tremendous changes to human. Face detection and recognition is just the big scope, and more things has derived after that such as age and gender classification based on images. And even deeper, classification based on videos. These applications evoked my interests and inspired me to develop this project’s idea. From the project’s proposal, I narrowed down to have only gender classification since I want to dig deeper in the project with the small scope to focus. I choose gender for the topic because it is one of the vital information in modern’s society. From the basic task such as filling out applications for schools to the government’s level such as crime investigation. For the method, I decide to use convolutional neural network since right now, it is one of the best techniques for image classification.

**2. Description of the data used in the project**

For the dataset, I have gone through many sources to look for the good and well-processed images, since the good data would help the model train better. From other sources, not many images have labels and CVS files for metadata, and if they have, the amount of images is quite small, which is what I do not want because a large dataset would help the model learn better due to its diversity. I came upon UTKface dataset from Kaggle, which is 23,708 images with annotations of age, gender, and ethnicity. However, they do not have CVS files, instead, they have annotations embedded in the image’s name. The images are already cropped and aligned. Male and female are all in one folder.

**3. What have I done so far**

I have done research and studied deeper about convolutional neural network and face detection. There are many tutorials, sources, and blogs on the Internet that give me useful knowledge for the project. Right now, I am at the data processed phase. Since the images are not divided into female and male beforehand, I wrote Python code to access image’s name for annotation to shuffle then divide them according to gender as well as train and test set. The original dataset has 23,708 images, I cut it down to about 12,500 images total and split 80% for training, 20% for testing. So the train set has about 10,000 images and test set has about 2500 images. Since I deal with image as input, I have to use cv2 to read the image and transfer it to array for the processing. However, I found another way that still works. Because I have my images in appropriate categories, male and female, I can use flow\_from\_directory buil-in fuction from Keras library to generate the image as input. I only have to rescale it by dividing by 255, then do data augmentation, and finally transfer input into the model. It is finally successful. I choose VGG16 as pretrained model for my project. Nevertheless, another problem arise. That is, it is extremely slow when the model is training. I run 20 epochs and it take me a whole night to finish. I do research and figure out that GPU is better for machine learning programs. Therefore, I switch to Google Colab since they have a free GPU. I have to download my data to Google Drive then connect Google Drive to Google Colab, and finally unzip the data. To get to this end, before that I have try many ways to upload images to Google Colab, but it took a very long time. I finally find this method and upload the images quickly. The script runs nicely on Google Colab and produces results in much faster time compared to my TOSHIBA Laptop’s CPU.

**3. What remains to be done**

Overall, the process is long and produce undesired output sometimes, but I have fun and gain more knowledge as well as experiences. The things remain to be done is that I need to tweak and tune parameters for better results. I also have to plot graphs of accuracy and loss. In addition, after training the model, I need to give it new test images it has never seen before with no labels to test its performance in reality. The test images can be as small as 10 images, but the goal is to test the model’s ability to perform in the real world, where no label were given.