



ROYAL UNIVERSITY OF BHUTAN

ITPRJ303 Project III

Gender Classification from facial image

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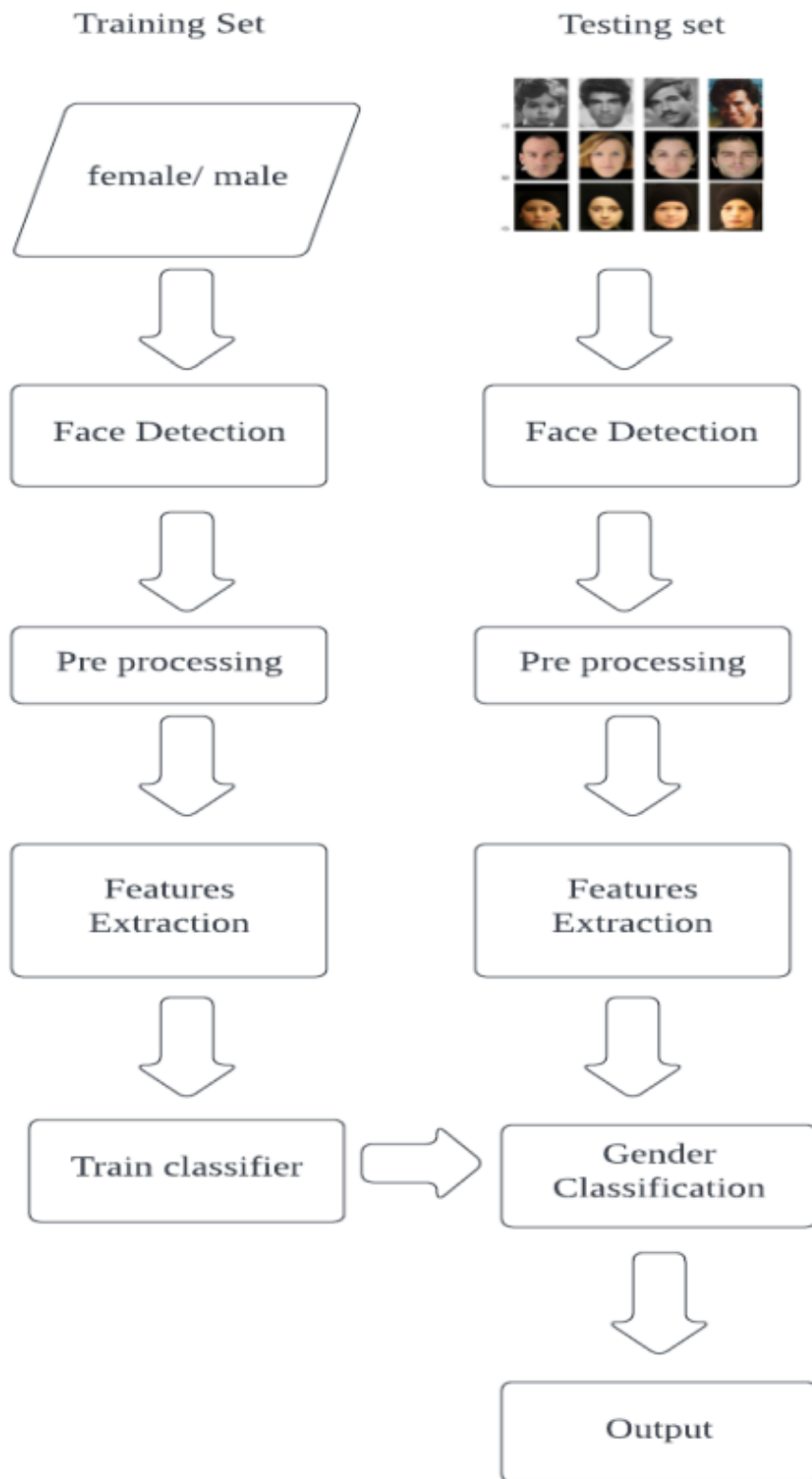
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Gender classification from facial image

1 Introduction

Gender classification system will classify the gender of the person in terms of percentage. The system has many applications including human-computer interaction, biometric surveillance, demographic statistics etc. Most of the time a human has failed to detect the gender from the image. So there is a wide scope for improving the performances of gender classification approaches. This study focuses on increasing gender classification accuracy using deep learning algorithm which includes convolutional Neural Network (CNN). The main objectives of this project is to build a gender classification system and then deploy the system in web application which will be user friendly where the user can upload their facial image and get the result.

2 System Workflow

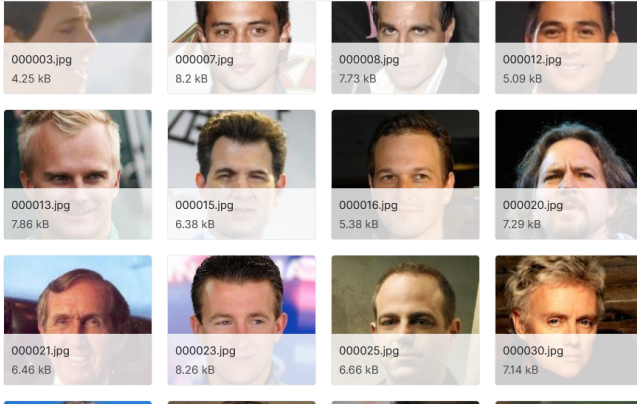


3 Detailed System workflow

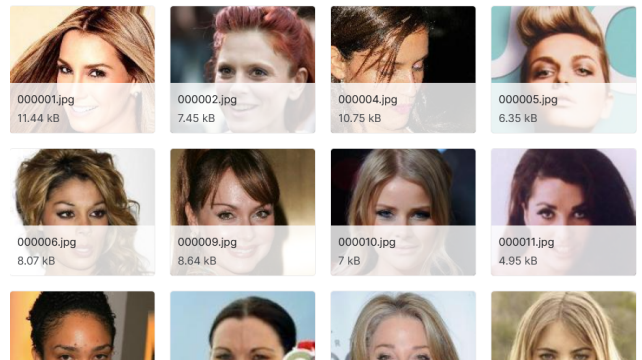
Dataset

For this project, face dataset will downloaded from the website called Kaggle and for further processes, the dataset will be divided in two groups. 70% of the data will be used for training set and rest 30% will be for testing set.

Male (67.2k files)



Female (92.8k files)



Face Detection

Viola and Jones algorithm

Viola-Jones face detection algorithm is one of examples of appearance-based face detection. Viola-Jones face detection is an automatic face detection algorithm that offer reliable feature selection and real-time detection because of its fast feature computation. In the project, the Viola-Jones face detection algorithm will be used to detect and locate faces from input images and training images.



Viola-Jones was designed for frontal faces, so it is able to detect frontal the best

rather than faces looking sideways, upwards or downwards. Before detecting a face, the image is converted into grayscale, since it is easier to work with and there's lesser data to process. The Viola-Jones algorithm first detects the face on the grayscale image and then finds the location on the colored image.

Pre-processing image

Pre-processing is a step where both input and training sets of images will be normalized and its noise will be reduced. Pre-processing will go through several image processing technique mention below in following order.

1. Grayscale

Both input and training images will convert to greyscale images where saturation and hue are eliminated and retain only intensity information. Greyscale images has a scale of 0 to 255, where 0 represents black and 255 represents white. Any value in between 0 and 255 will be grey. The formula to convert RGB to greyscale image are showed below.

$$\text{Greyscale} = 0.2989 \times R \text{ (Red)} + 0.5870 \times G \text{ (Green)} + 0.1140 \times B \text{ (Blue)}$$

2. Histogram Equalization

Histogram equalization were used to enhance contrast of both input and training images. The purpose of using histogram equalization is to fix the images that were taken in poor lighting condition.

3. Image Resize

Principle component analysis (PCA) has a strict restriction that require training samples to have the same dimensions. Different image size will result different dimensions of data size and therefore to make sure both input and training image has the same resolution, all image will be resize to 64×64 pixels.

Feature Extraction

Principle component analysis (PCA) will be applied to facial images to extract facial features of faces. PCA-based face recognition known as eigenface, is one of the most effective techniques to represent faces using statistical method. PCA is a traditional method to represent faces, despite its existence for a long time it is still a decent and widely used technique to recognize faces until now.

Classification Method

The features calculated from features extraction are then used by classification methods to train the classification algorithms.

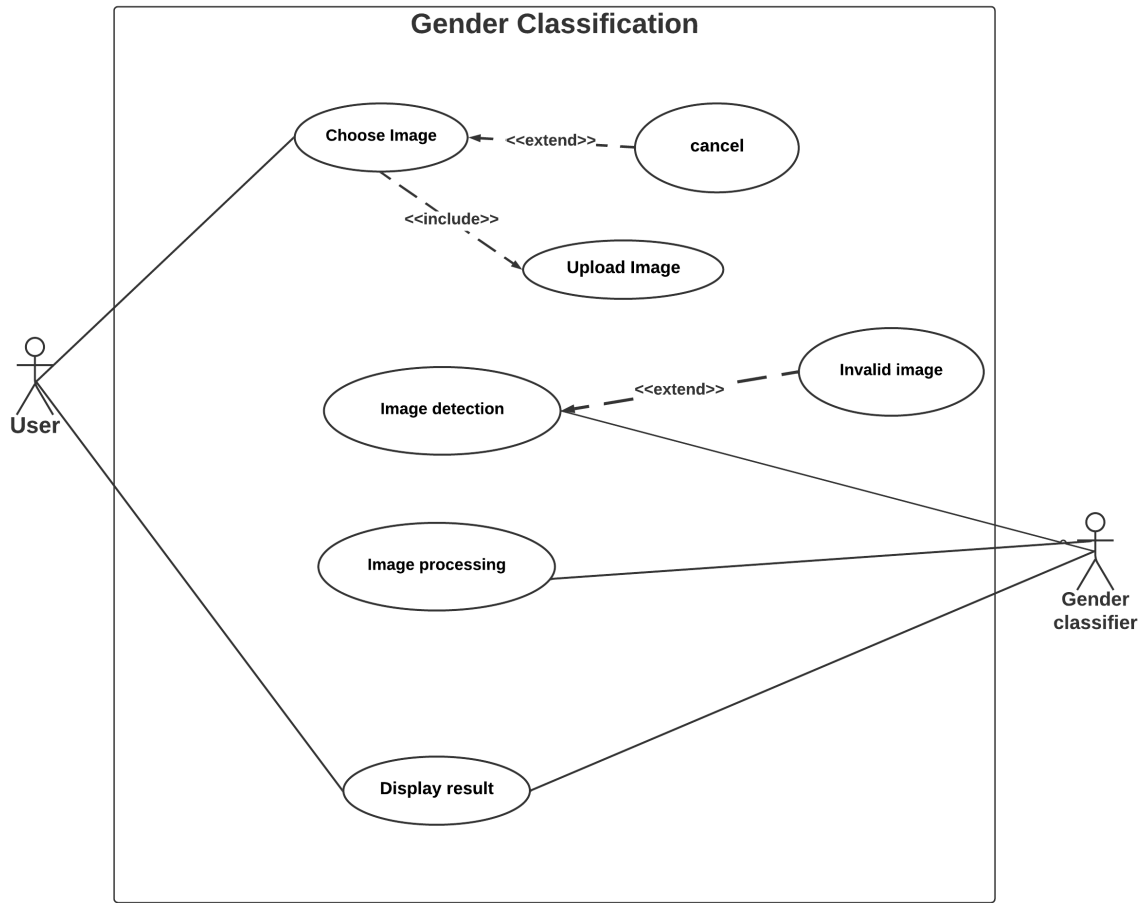
1. Euclidean Distance

Euclidean distance is the most common distance measure metric, it used to find shortest distance between input image and training images in database. In this study, k-nearest neighbors and average distance will use Euclidean distance to measure distance.

2. K-Nearest Neighbors (Matlab fitcknn)

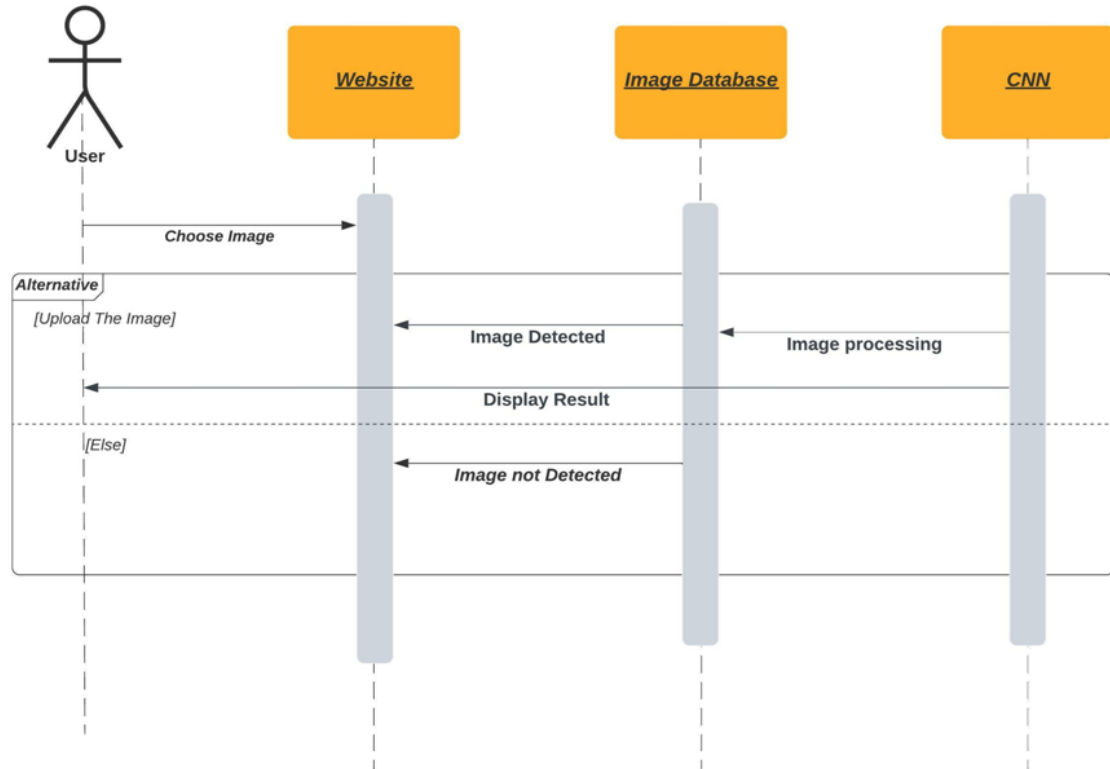
K-nearest neighbors is the simplest and fastest learning algorithm when compared with others classification techniques such as logistic regression, support vector machines (SVM), neural network and etc. In classification phase, all of the training samples are projected into multidimensional feature space, distance between input and training samples are then measure by Euclidean distance, k number of sample with shortest distance are selected, the input sample is then assign to most frequent among the selected samples.

4 Use Case Diagram



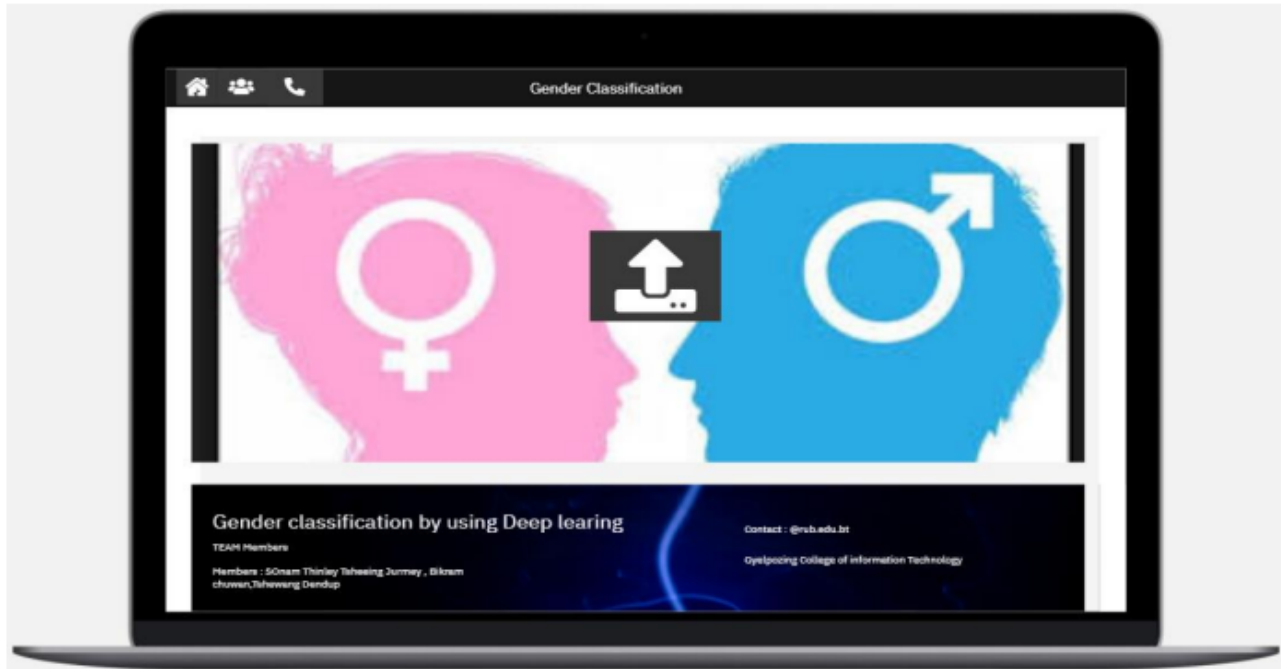
Use case diagram symbolizes the interaction between system and actor. User will choose the image from gallery and upload. Once image being uploaded then detector will detect whether the image has human face or not, if not it send a return message i.e “invalid image”. Once image has been detected then it will proceed to processing of image. Finally it returns the result whether the uploaded image is male or female in percentage.

5 Sequence diagram

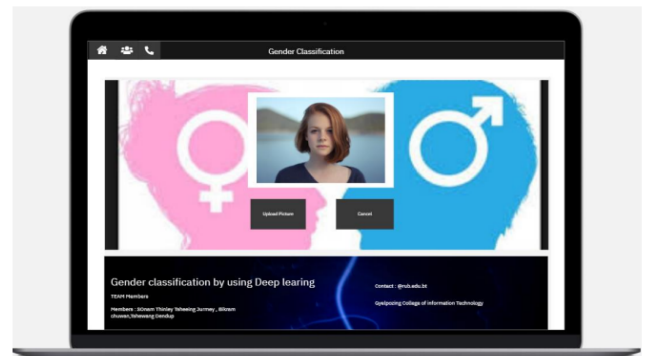
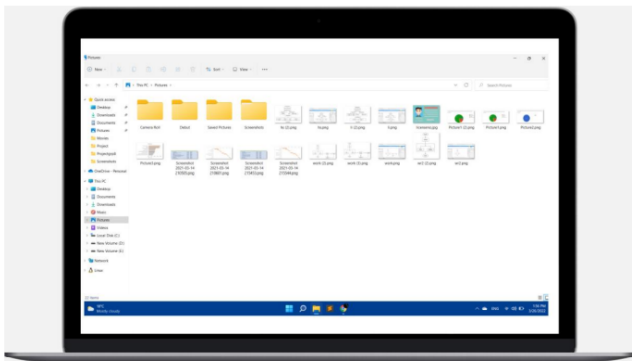


The gender classification's basic operation is depicted in the sequence diagram above. First, the user must pick an image from their computer, following which the user must upload the image. Based on this, the system will determine if the image (human face) is authentic or not. If the image is found to be legitimate, the system will do pre-processing or image processing, and other processes based on the algorithm (CNN), and then proclaim the image's gender. If the picture is not legitimate, the image will not be processed any further.

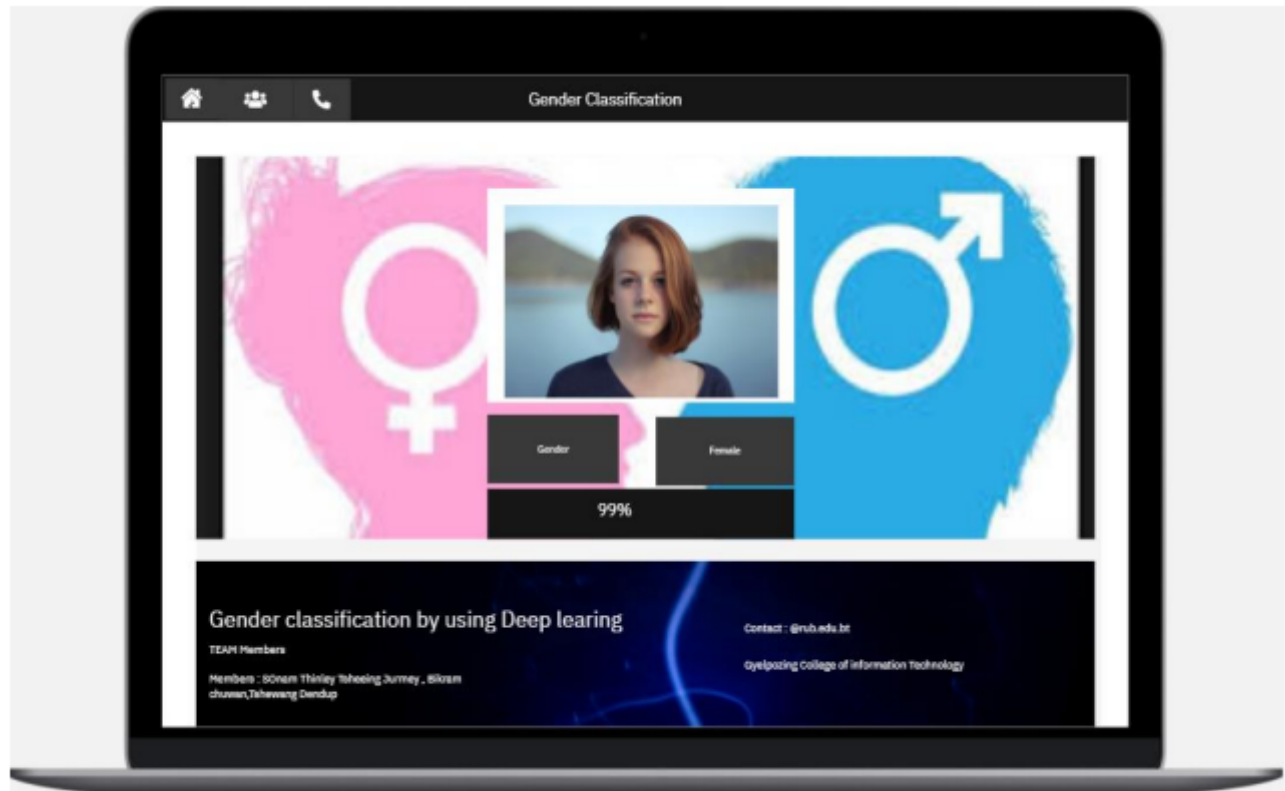
6 Prototype



This is the home page of our gender categorization online application. We may choose a photo from our computer and confirm the gender and accuracy by selecting a male or female image. When we click the Select button, it will take us to our computer where we can select the image. Only one image may upload at a time.



The user must press the upload button to check the gender and accuracy, if not they must press the cancel button. The picture selected from the PC will appear as shown in the prototype, and in order to detect the gender, the user must press the upload button to check the gender and accuracy, if not they must press the cancel button.



This is the ultimate result of our investigation, in which the system can determine gender and the accuracy will be display in percentages, if the percentage is greater than 95%, we will consider it our best instance of detection.