

WQD 7004 - PROGRAMMING FOR DATA SCIENCE

SEMESTER II - SESSION 2018 / 2019

GROUP PROJECT TOPIC

TRAINING A CONVOLUTIONAL NEURAL NETWORK TO DO FACIAL RECOGNITION USING BIG DATA

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# Introduction

## Facial Recognition

Facial recognition system is a technology used to identify or verify a person from a digital image of the person. The application of facial recognition system is immense. It has been used in various systems such as access control in security systems, commercial identification and marketing tool, video surveillance, indexing of images, and various social media platforms related functionalities.

On November 2017, Apple Inc. released iPhone X with a facial recognition system called Face ID installed. Face ID allows user to unlock the phone by looking at the front camera of the phone. (<https://www.theverge.com/2017/9/12/16288806/apple-iphone-x-price-release-date-features-announced>)

On December 2016, Amazon launched a chain of convenience store named Amazon Go in the United States. The store concept uses facial recognition and various technologies to automate the purchase, checkout and payment steps associated with a retail transaction. Customers can purchase products without checking out at a cashier or self-checkout station. (<https://www.theverge.com/2016/12/5/13842592/amazon-go-new-cashier-less-convenience-store>)

Add 1 more application on security

There are many more applications of facial recognition on improving business product, consumer experience and even advancing a nation’s interest.

## Challenge

The challenge of doing facial recognition on digital image is the difficulty of extracting facial features from pixels value. The recognition problem is made difficult by the variability of a face in the image. This includes variability in head rotation and tilt, light intensity and angle, facial expression, aging and other factors**. (Woody Bledsoe, 1966)**

Traditional methods:

https://www.researchgate.net/publication/271584966\_Face\_Recognition\_Challenges\_Achievements\_and\_Future\_Directions

Neural Network advantage

# Objective

The objective of this project is to predict the identity, gender, and age group of a person from a given digital image of the person using convolutional neural network (CNN) model. This can be achieved by training three separate CNN models using large number of images data to predict the age group, gender, and identity of a person.

The first CNN model will be trained on the Labelled Faces in the Wild (LFW) dataset. (lfw source) The dataset contains 13,233 images of 5,749 people detected and centered by the Viola Jones face detector and collected from the web. Each image is labelled. This allows a model to extract important facial features to correctly identify the person in the image.

The second CNN model will be trained on the UTKFace dataset (https://susanqq.github.io/UTKFace/) to predict the gender of a person inside an image. This dataset is a large-scale face dataset containing 23,708 images, with each image labelled by age, gender and ethnicity.

The third CNN model will be trained on the same UTKFace dataset to predict the age group of a person inside an image. The labelled age for each image will be categorized into 10 age groups, namely age of 1 to 3, 4 to 6, 7 to 12, 13 to 18, 19 to 25, 26 to 35, 36 to 45, 46 to 60, 61 to 75, and 75 and above.

Finally, all these 3 CNN models will be used to classify data unseen by the model during training. There will also be an attempt to use existing model to classify the identity of a person using images of classes or identities not known to the model via feature extractions on CNN layer and clustering technique, without re-training the model.

# Scenario and Methodology

4) Methodology - R scripts (gtx1070, i5)...(Package version etc.)

a) crop face using opencv (reticulate and python)

b) pre-processing, filtering etc

flow image from directory (ram constraint)

image augmentation

mobilenetv2 (source: why use - efficient:)

rmsprop

## 1. Identity Prediction

## 2. Gender Prediction

## 3. Identity Prediction

## 4. Identity Prediction

# Results

Accuracy on test set.

Accuracy on unseen data.

Unseen data - prediction on image (show image and show actual and prediction)

Visualization: TSNE features embedding

Training loss curve

# Conclusion

accuracy might be low for identity, but could be improved by having more images of the unseen individual

Could be improved with re-id training (source: https://arxiv.org/abs/1611.05666)