DEEP LEARNING PROJECT FILE

COURSE NO:

CSSE 607

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PROJECT PROPOSAL

BRIEF OVERVIEW OF THE PROPOSED PROJECT:

Gender classification is an important problem that recently gained popularity in the research community, due to its wide range of applications. Research has shown that gender information is encoded in the face shape and texture.

The human face conveys much information, which people have a remarkable ability to extract, identify, and interpret. Recently, there has been an increase in the development of automatic facial analysis techniques with a view to developing machine-based systems that mimic these abilities of the human visual system. Both being demographic attributes of the human face, they play important roles in real-life applications that include **biometrics**, **demographic studies**, **targeted advertisements**, **human-computer interaction systems**, and **access control**. With much progress in automatic face detection and recognition, much research is now focused on automatic demographic identification.

This project aims to facilitate historical research by contributing new tools for image analysis. The algorithm is developed in the programming language Python and uses **Convolution Neural Networks (CNN)** to classify gender.

PROJECT PLAN:

- **What is the problem that we will be investigating? Why is it interesting?**

The face is one of the most important biometric traits. By analyzing the face we get a lot of information such as age, gender, ethnicity, identity, expression, etc. A gender classification system uses the face of a person from a given image to tell the gender (male/female) of the given person. A successful gender classification approach can boost the performance of many other applications including face recognition and smart human-computer interface.

• What are the challenges of this project?

1. Explore and understand the data
2. Visualize the data at hand to gain a better intuition
3. Image ambiguity Cleaning
4. Feature Extraction
5. Scoring & Metrics

• What dataset are you using? How do you plan to collect it?

Data is the essential ingredient before we can develop any meaningful algorithm. Below are a few of the famous repositories where you can easily get thousands of kinds of data sets for free:

- ➔ UC Irvine Machine Learning Repository
- ➔ Kaggle datasets

• What method or algorithm are you proposing? If there are existing implementations, will you use them, and how? How do you plan to improve or modify such implementations?

- ➔ Convolutional neural network (CNN)

To enhance the accuracy we do use **Image augmentation** to build convolutional neural networks that can increase the size of the training set without acquiring new images. The idea is simple; duplicate images with some kind of variation so the model can learn from more examples.
We use two models separately to check the accuracy limit:

1. One without image argumentation which gives around 85% accuracy.
2. Second, we use argumentation which gives around 80% accuracy.

Numpy, Tensorflow, Matplotlib, and pandas libraries import.

• What reading will you examine to provide context and background? If relevant, what papers do you refer to?

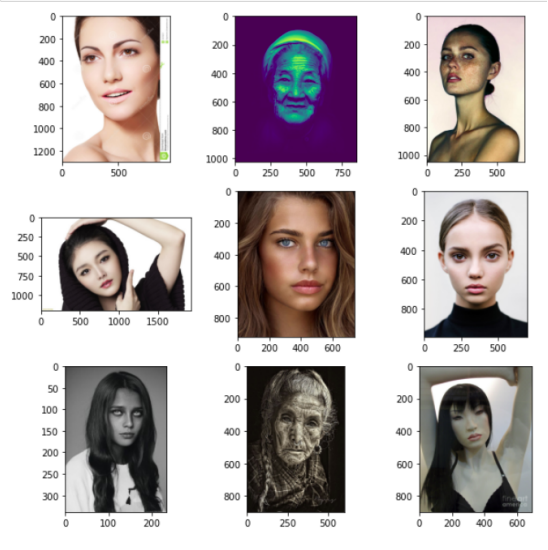
1. Gender Classification Techniques: A Review by Preeti Rai & Pritee Khanna
2. Gender Classification using Facial Embeddings: A Novel Approach by Avinash Swaminathan, Mridul Chaba, Deepak Kumar Sharma, and Yogesh Chaba.
3. Gender Classification by Guodong Guo in *Encyclopedia of Biometrics*
4. Face Gender Classification on Consumer Images in a Multiethnic Environment by Wei Gao, Haizhou Ai in *Advances in Biometrics (2009)*
5. Using an Artificial Neural Network to Improve Image argumentation, by Mohamed Abdulhussain Ali Madan Maki, Suresh Subramanian.

• How will you evaluate your results? Qualitatively, what kind of results do you expect (e.g. plots or figures)? Quantitatively, what kind of analysis will you use to evaluate and/or compare your results (e.g. what performance metrics or statistical tests)?

Precisely we use a confusion matrix to estimate the performance of the gender classification algorithm.

A confusion matrix visualizes and summarizes the performance of a classification algorithm.
We did separate our dataset into 3 different sets training, validation, and test splits, and store them in differnet directories.
Then separately handle the binary genders.
Male and female both will be contained in a different directory.

- The result gives for females:



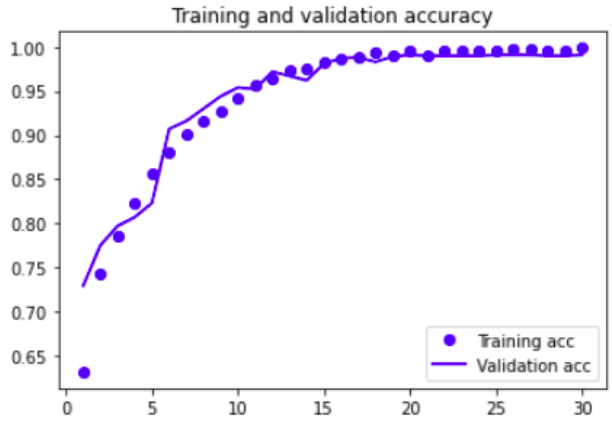
- The result gives for males:

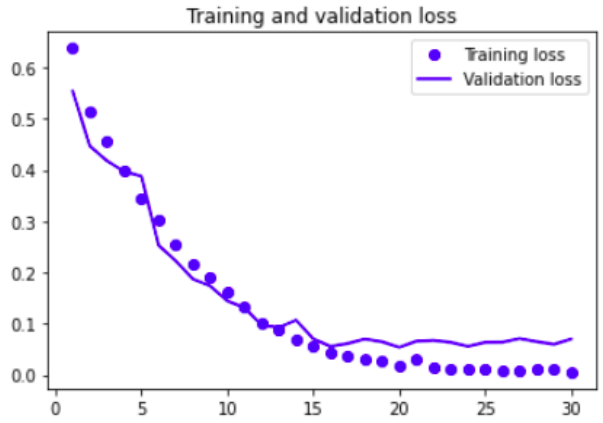
Building the network: the convent will be a stack of alternated Conv2D (with Relu activation) and MaxPooling2D layers. The network is quite large because we're dealing with bigger images and a more complex problem.
Because we're attacking a binary-classification problem, we'll end the network with a single unit (a Dense layer of size 1) and a sigmoid activation. This unit will encode the probability that the network is looking at one class or the other.

Layer (type)	Output Shape	Param #
conv2d (Conv2D)	(None, 148, 148, 32)	896
max_pooling2d (MaxPooling2D)	(None, 74, 74, 32)	0
conv2d_1 (Conv2D)	(None, 72, 72, 64)	18496
max_pooling2d_1 (MaxPooling2D)	(None, 36, 36, 64)	0
conv2d_2 (Conv2D)	(None, 34, 34, 128)	73856
max_pooling2d_2 (MaxPooling2D)	(None, 17, 17, 128)	0
conv2d_3 (Conv2D)	(None, 15, 15, 128)	147584
max_pooling2d_3 (MaxPooling2D)	(None, 7, 7, 128)	0
flatten (Flatten)	(None, 6272)	0
dense (Dense)	(None, 512)	3211776
dense_1 (Dense)	(None, 1)	513

Plotting the loss and accuracy of the model over the training and validation data during training.

```
plt.show()
```





Confusion Matrix

Confusion Matrix is a very good way to understand results like a true positive, false positive, true negative, and so on.