

**Deep Learning**

***Classification of Gender on Facial Images Using CNN***

***Team 9***

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# Introduction

Computer Vision and Image processing is one of the most exciting and promising fields in Machine Learning and AI. With advancement in technology, rise in use of smart devices and access to social media has made Facial image processing one of the coveted fields. The applications of facial recognition is wide and varied. From security purposes like unlocking phone or other devices to usefulness in providing secure and dependable security for enterprises, organizations, face monitoring, airports, etc.

Machine Learning uses algorithmic model to train computer to identify the context of visual data. Models are fed enough data that allows computer to differentiate one image from another. In this form of learning computer teaches itself to identify a image instead of someone doing this programmatically.

A CNN helps a machine learning or deep learning model “look” by breaking images down into pixels that are given tags or labels. It uses the labels to perform convolutions (a mathematical operation on two functions to produce a third function) and makes predictions about what it is “seeing.” The neural network runs convolutions and checks the accuracy of its predictions in a series of iterations until the predictions start to come true. It is then recognizing or seeing images in a way similar to humans.

Much like a human making out an image at a distance, a CNN first discerns hard edges and simple shapes, then fills in information as it runs iterations of its predictions. A CNN is used to understand single images.

The biggest benefit of CNN is that CNN performs both feature extraction and classification within a single network structure through learning on data samples . Feature selection is also integrated into the training process by learning the weights held responsible for extracting features . The CNN also has the ability to extract topological properties from  
a raw input image with no or minimal preprocessing required . In addition, a certain degree of invariance  
is achieved while preserving the spatial topology of input data . The CNN also provides partial resistance  
and robustness to geometric distortions and transformations, and other 2D shape variations .

# Problem Statement

The objective of our project is to design a model for classification of gender Male vs Female based on Facial images using CNN.

# Challenges

There were different types of challenges in this project.

Our initial challenge was to find the right dataset that was manageable in size.

The second challenge was to install TensorFlow correctly on GPU.This step has lot of process that needs to be done in correct order or it fails.

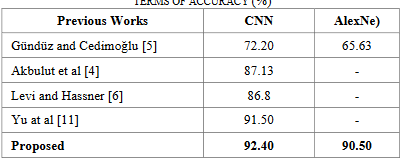
Our last and main challenge was to understand terms and workings of CNN.

None of us had any prior experience with the Model.

So it took some time to figure out choice of activation function, loss function and also how to use a pre-trained model or Transferred learning in other words.

## RELATED WORKS

Lot of research has already been done in Facial Image processing there is close of 100 paper alone in arxiv repository itself.Our work is largely inspired by the three article we read on Gender classification.We noticed in most of the papers the Gender classification used CNN models and Transferred learning from other models .VGG-16, Alex Net and ResNet-50 seems to be popular choice. For Instance we reviewd Sahir[1] study we noticed that they used a smaller data subset of Adience Dataset. They excluded blurred images and child images from the dataset for training. This gave them better results. They used CNN model and Alex Net model for classifying the Gender of images. The overall results obtained for both CNN and AlexNet are  
summarized in Table I. In terms of F1-score, both models produced same results for classification of males and females.For each class, CNN produced better results (92%) compared to AlexNet (90%).This was much higher than other models in past compared to other model. Below is the snippet from their journal.



We were also fascinated by DeepFace Recognition model developed by Meta.This model is quite versatile in facial recognition processing. Apart from identifying the same person in different pictures it can detect emotion and age as well.Abhijit[2]. The Deep Face model was used on UTKDataset to predict the gender and age and the average accuracy was around 82% for both Genders combined.

# Data DESCRIPTION

We are going to use Open Source Kaggle Dataset mentioned in References section[3].The Dataset consist for two folder Training and Validation Dataset. Each Dataset contains separate Male and Female Subsets.

# DEEP Learning process

Our Approach is to classify the Gender into Male and Female category based on Facial Images.

We plan to write our own Basic CNN and also use Transferred Learning method on our dataset using publicly available models such as VGG-16, Deep Face and Alex Net etc. We are still in process of exploring and understanding CNN and these different models and their pros and cons. For the loss function we plan to binary cross-entropy and metrics will be accuracy since this a classification task. Our Optimizer will be Adam.

We are still working on understanding how many convolutional and Dense layer will be needed. The activation function in the papers we read seemed to mostly ReLU and Sigmoid. So we will explore with that.

# Expected Results

We anticipate our proposed model with provide accuracy above 80%.

# Justification for USING Existing code

When it comes to justification for using existing code. There are several state-of-the-art results in image classification that are based on transfer learning solutions (Krizhevsky et al. 2012, Simonyan & Zisserman 2014, He et al. 2016). It is a common practice in the world of image classification.

Since most of the popular Image classification models are trained on large datasets. Using them will not only save our time and be less computationally expensive.

The biggest benefit is we can leverage from previous learning and build on top of that to improve model efficiency.