

CONVOLUTIONAL NEURAL NETWORK FOR REAL-TIME EMOTION & GENDER CLASSIFICATION

Amit Kumar^{*1}, Sarvesh Gakhar^{*2}, Rishabh Jain^{*3}, Rohan Uppal^{*4}, Amit Pandey^{*5}

^{*1*2*3*4}Department Of Information Technology, Dr Akhilesh Das Gupta Institute Of Technology & Management, New Delhi ,Delhi, India

^{*5}Assistant Professor, Department Of Information Technology, Dr. Akhilesh Das Gupta Institute of Technology and Management, New Delhi, Delhi, India.

Abstract - A person's emotion can be gauged using their emotional and facial expressions. Computers and other electronic devices in our daily lives will become more user-friendly if they can adequately interpret a person's facial expressions and other attributes such as the gender, thereby improving human-machine interfaces.

All computer interfaces such as automated psychological research and treatment, forensic investigations, robotics, polygraphic techniques, home & office security systems implement facial recognition technology.

We aim to predict the emotion and facial expression exhibited by an image using the greyscale picture of a person's face making use of emotional & gender accuracy (fraction of correctly classified images) as our evaluation criterion.

Key Words: Computer Vision, Python, Numpy, Haar feature-Based Cascade Classifier, Mini Exception Model, Batch Normalisation, ReLU, Convolutional Neural Networks

1.INTRODUCTION

The Facial expression is an important indicator of a person's emotion. Computers and other electronic devices can be made more user-friendly if they can adequately interpret a person's facial expressions and other attributes such as the gender, thereby improving human-machine interfaces.

We aim to predict the emotion and facial expression exhibited by an image using the greyscale picture of a person's face. In short, the Input will be the 48 by 48

grayscale image of a face and the Output will be the Gender along with Emotion conveyed by facial expression.

In this project, we will be making use of CNN's building framework. A two-step approach will be used in this process i.e. face detection of image followed by emotion & gender detection on the detected bounded image of the face. The following techniques will be used in face recognition system.

1. Haar feature-based cascade classifiers: Detects front of face in images.

2. Xception CNN Model : Input a 48*48 pixelated bounded image and output probability of emotions displayed.

Software Requirements

- Jupyter Notebook/ Command Prompt/ Terminal
- OpenCV framework
- Keras
- TensorFlow
- Windows/Linux Platform
- Pandas
- Numpy
- Statistics

Hardware Requirements

- 8 GB RAM
- 40 GB disk space will be preferred
- 64-bit Operating system
- Intel(R) Core (TM) i3 or i5 or i7 processor

2. METHODOLOGY

The following techniques are being put in use in our facial and emotion recognition system:-

1. Haar feature-based cascade classifiers : Detects front of face in images.
2. Xception CNN Model : Input a 48*48 pixelated bounded image and output probability of emotions displayed.

In short, the Input will be the 48 by 48 grayscale image of a person's face and the Output will be the Emotion conveyed by facial expression of the person along with the gender of that individual.

To train the model for emotion detection, the data is obtained from Kaggle platform. This data set contains photos and labels of seven categories of facial expressions emotions: Anger, Disgust, Fear, Happy, Sad, Surprise, Neutral. The 'Emotion' tagged labels are:- 4593 images- Angry & 547 images Disgust & 5121 images- Fear & 8989 images- Happy & 6077 images & 4002 images- Surprise & 6198 images- Neutral.

To train the model for gender detection, the gender dataset of IMDB, having 400K+ RGB images segregated into the class "woman" or "man" is used. These are regular jpg images accompanied with a ".mat" file extension which contains various information about the dataset, some of which is :

- gender of the subject
- the age at time of clicking the image
- full path
- face score
- second face score

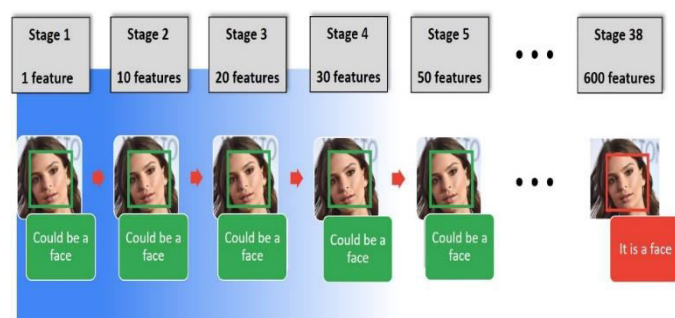


Fig -1: Architecture Of Haar Classifiers

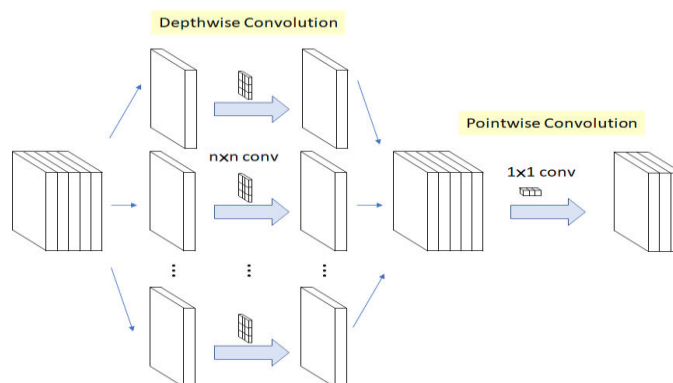


Fig 2: Architecture Of Xception CNN Model

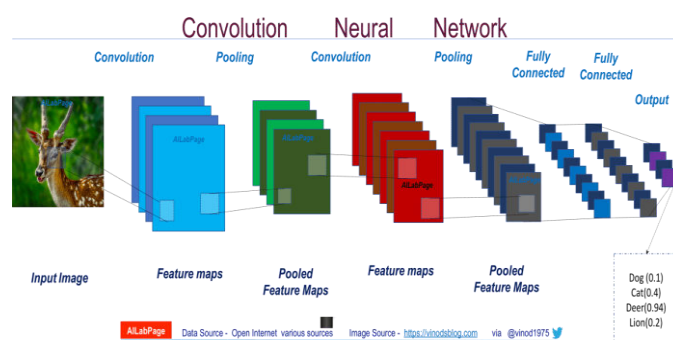


Fig 3: Architecture Convolutional Neural Network

3. CONCLUSIONS

We have developed a mechanism that detects, recognises and predicts the emotion displayed by the subject (person) along with the gender to which he/she belongs to. Using deep learning algorithms (Haar feature based cascade classifier and the Xception CNN Model), we have been able to recognize and predict from the grayscale picture of a person's face :

1. which emotion the facial expression conveys with an accuracy rate of 89 %
2. which gender does the person belong to with an accuracy rate of 78%.

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