

AGE AND GENDER DETECTION

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Abstract -Today most likely active research areas are pattern recognition and automatic classification. Our main motive is to identify the objects clearly and achieve a result that is much better to understand. Biometrics are the main features of this paper which we all know are generally used in the matter of security. In recent years facial modality and biometrics security have evolved so much. The very kind purpose of this research paper is to calculate the age and determine the gender of the person. With the use of CNN and a structure of 3 basic models, we have created our model.[1]It basically works on IMDB and WIKI datasets, the results of which show the accuracy and the essential measures.

Key Words: face recognition, biometrics, convolution neural network, gender prediction, age estimation, IMDB, WIKI.

I. INTRODUCTION

In today's world Biometrics is one of the concepts which is commonly used to determine the physical and behavioral characteristics of an individual thus, enabling the authentication of their identity. And recently, Biometrics have much more significant features when compared with conventional identification methods which earlier used were as Id-cards & passwords. Even though these identification methods at a certain period of time can either be lost or stolen but biometrics of an individual will remain unique and the same. And, most importantly they are not transferable.

Recently, face recognition is also being used as a part of biometrics and interestingly many applications are nowadays, using pattern recognition techniques to predict the gender and age features as scientifically proven, the human face is considered as a very rich source of information. Many researchers have studied for decades, in the field of age and gender classification. Before we proceed to our research paper, we will first provide a summary of the facial recognition experiments which were earlier carried out by scholars and researchers.

A vast variety of techniques were applied for predicting the gender and facial images. Two common approaches which were used for prediction were: The first one is the local strategies which were used to focus on key points of the face such as eyes, nose, mouth, etc., and hence, they provided much more detailed information. Secondly, the global approaches were used in which only the full surface of the face was used as a source of information and independent of various other parts of the face such as eyes, lips, nose, etc.

However, almost all of the previous researches were based on the carno-facial development method.

During the last few years, the convolutional neural network has dominated over the deep neural network[DNN]. DNN was earlier used to predict the pattern recognition techniques and many face recognition experiments were also carried out on multiple datasets. The results also showed that DNN can effectively extract the facial features however, it was observed that DNN which was existing as a successful method showed poor performances on the small original dataset. DNN has major drawbacks in dealing with a small dataset as a larger dataset requires data labeling and which is much more tedious and time-consuming work. So to overcome this drawback, various observations and considerations were noted and a new approach combining a convolutional neural network with an augmented dataset is developed for the human face and gender recognition in this paper. We will first introduce Convolutional Neural Network in this paper with its basic structure. Then, we will describe the CNN models for training data and classifying gender. And finally, the results are obtained with our conclusion at the end of the paper.

II. CONVOLUTIONAL NEURAL NETWORK

For pattern recognition and machine learning, neural networks are currently very important. Speed and precision have been shown by the neural networks for example,- Convolutional Neural Network which works on the deep feed forwarding network. [8]CNN has two important parts the very first part is the feature extraction, in which the feature performs the task for the formation of number of layers due to which the classification component of the fully connected layers work as a classifier on top of these feature sets, assigning a possibility of what the algorithm predicts the object on the image formed.[9]

CNN has four layers such as convolutional, pooling, ReLU, and Fully-connected (FC) layers by a different set of features on a different map. As a matter of fact, the pooling phases change many times, the number of repeats during which the compact function map outputs are sent to FC layers. In linear operations, the Rectified Linear Units (ReLU) layer is to add non-linearity to a system.[10]

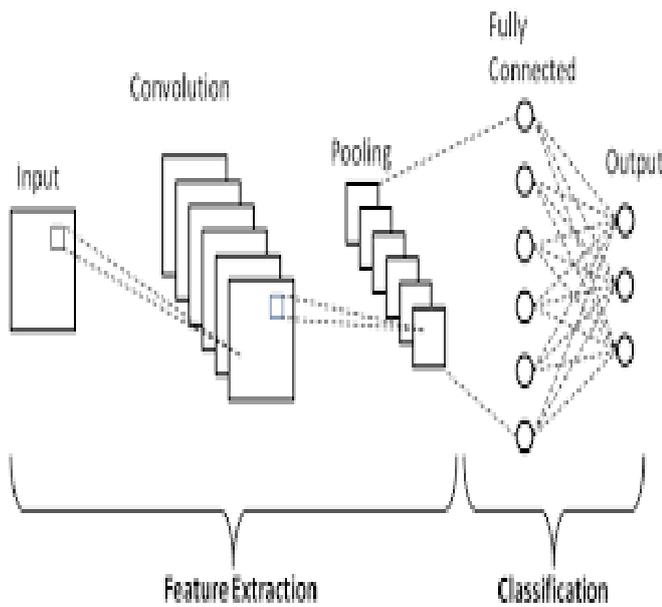


Fig. 1. Convolutional Neural Network Architecture.

III. NETWORK ARCHITECTURE

We have used three CNN [Convolutional Neural Network] models with distinct architecture depths which are mentioned as - CNN 1, CNN 2, and CNN 3 with different pooling layers, and filter sizes. Each of them are used to produce an estimated value of the impact on the CNN depth and size filter when performing gender prediction.[10]

CNN 1	CNN 2	CNN 3
Input image 28x28x1		
Conv 1: 16@3x3	Conv 1: 32@3x3	Conv 1: 32@3x3
MaxPool: 2x2	MaxPool: 2x2	MaxPool: 2x2
Conv 2: 32@3x3	Conv 2: 64@3x3	Conv 2: 32@3x3
MaxPool: 2x2	MaxPool: 2x2	MaxPool: 2x2
-	-	Conv 3: 32@3x3
-	-	MaxPool: 2x2
FC: 512	FC: 512	FC: 512
FC Sigmoid: gender classification		

IV. AGE ESTIMATION

Automatic age estimation is one of the best and most interesting topics, but due to the variation in the aging

process, it is a difficult task to perform. Due to different appearances when we perform the aging process, it differs from person to person. In action to this, we have applied CNN 3 to estimate the age of a person ranges: Young (10-35 years), Middle (35-59 years), and Old (more than 60 years). Table 2 below gives a reference to the architecture of model N°3 used for training on the WIKI and IMDB databases.[11]

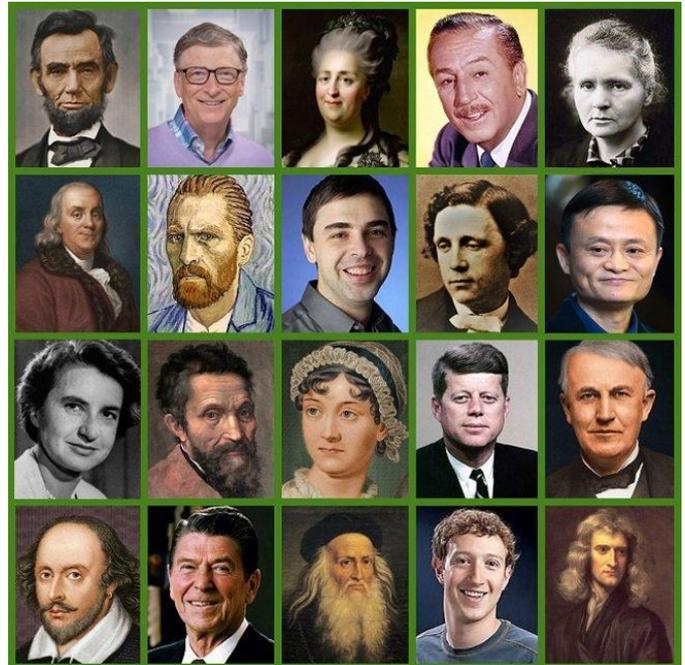


Fig. 2 Some samples in the IMDB and Wiki datasets.

V. DATASETS

In this section, we will present the databases for the age and gender classification. We have used WIKI-IMDB as our primary database [12], which itself consists of a large-scale index related to IMDB and Wikipedia websites. Firstly, the list of the most famous actors who were present on IMDB was taken automatically. Then, the biological (real) age of any of those pictures can be attributed which can be used to represent it by claiming images with single faces and date of birth which are considered to be as right. There are 20,290 IMDB celebrities in all, and it ransacked all profile photos from people's accounts and sorts them according to the IMDB image requirements. Due to inaccurate timestamps, several images are stills from films and because of some databases, many people may assign to error.[12] There are 62,421 personalities in all. However, the accuracy of the allocated age information was not validated.

used as an optimizer to normalize the gradient which will increase the learning rate of our algorithm.[16]

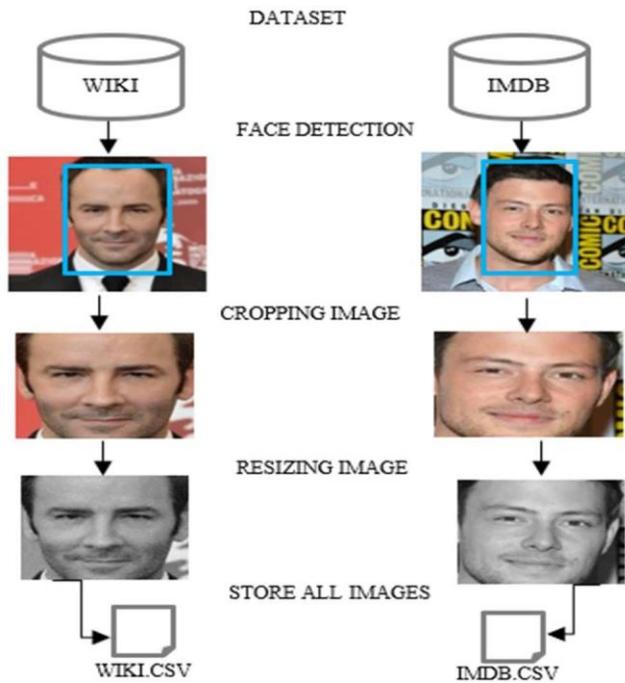


Fig.3 Preprocessing data

VI. PREPROCESSING

There are several methods for preprocessing the steps used in this work, we may use the Haar-Cascade technique. This technique will eliminate the background as well as positive and negative images will be used to train the classifier.[13]

28*28 gray to be the resolution of the next preprocessing sampling. Then, to accelerate the data process, we store all the images resized as a matrix in a CSV format file, which is easy to be loaded in Python.[14]

VII. EXPERIMENTAL WORK AND RESULTS

A. EXPERIMENT AND RESULT FOR GENDER PREDICTION

The efficiency of the model was built using Keras as it is more reliable for developing and managing deep learning models. We are working on around 2600 images of females and males separately around which total of 1500 images are used for training and 1100 for the test. 1700 epochs were trained in the CNN model. After each epoch, the accuracy was calculated and it was assigned equal to the counts of predictions. When the predicted value is relateable to the measured value then, it is expressed as a percentage.[15]

Then the input values are passed through a stack of convolutional and max-pooling layers, and the non-linear activation function (ReLU) is used, to obtain the final output result. We have also implemented the Sigmoid function as shown in table 1, for all models. RMS pro was

CNN Model	Accuracy %	
	IMDB	WIKI
CNN 1	57.90	59.63
CNN 2	64.80	67.55
CNN 3	73.46	77.65

Table 3: Gender classification rates on the WIKI and IMDB dataset, Mean accuracy.

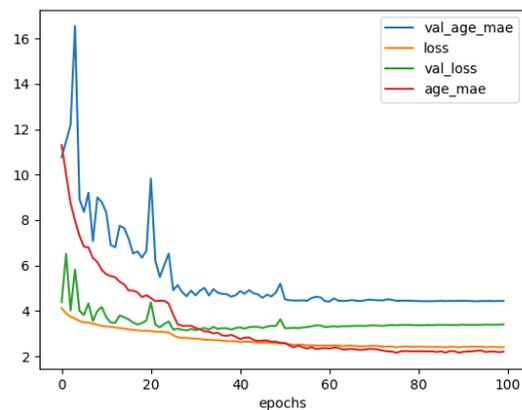


Fig 4: Accuracy of gender classification IMDB dataset.

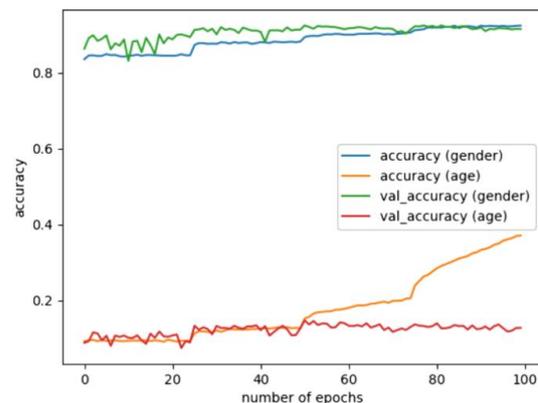


Fig. 5. Accuracy of gender classification WIKI dataset.

B. EXPERIMENT AND RESULT FOR AGE ESTIMATION

CNN has the best accuracy rates, in order to authenticate this model's result. We have trained the CNN network

(model N*3) on the IMDB and WIKI databases for age estimation.[17]

Table 2 describes the architecture of the model for the age estimation and we have used the SoftMax activation function in the output layer (decision layer). This function is also called a logistic function and irrespective of its input value, the function always yields an output value between the range 0 & 1. After the training in the CNN network, we acquire certain results in WIKI and IMDB shown in this Table 3.

Dataset	Accuracy %			
	Young (10-35) years	Middle (35-59) years	Old (+60) years	Mean accuracy
IMDB	78.30	75.60	69.70	74.53
Wiki	79.50	77.85	71.56	76.30

TABLE 3. Age Classification rates on WIKI and IMDB datasets.

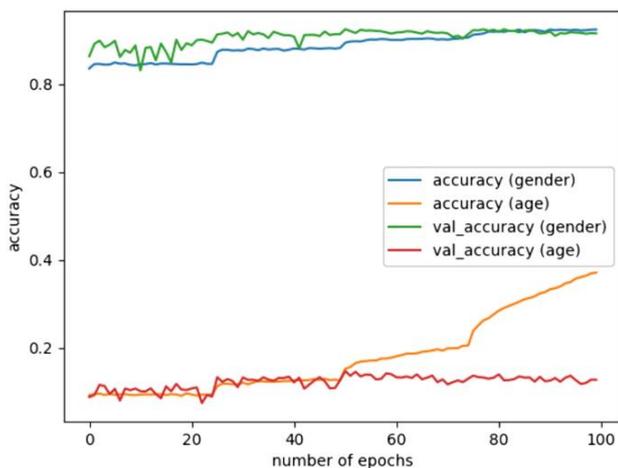


Fig 6. Age estimation accuracy on WIKI dataset.

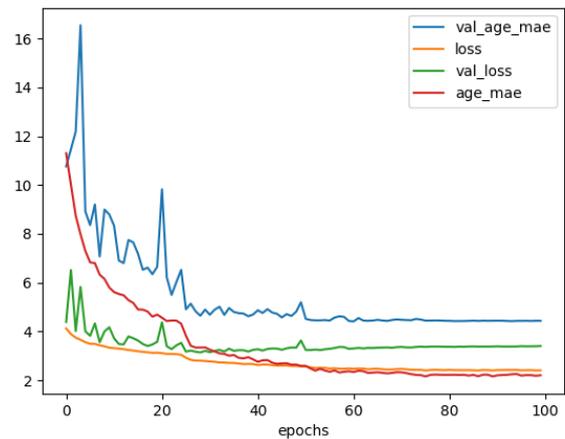


Fig 7: Age estimation accuracy on IMDB database.

VIII. DISCUSSION

In this paper, we aimed to modernize the system for gender prediction and age estimation by using CNN and deep learning techniques. So, we build 3 models of convolutional neural networks which are named as: CNN1, CNN2, and CNN3 & all these models were trained on our IMDB datasets. When these techniques were performed on each model it was observed that the CNN3 presented the best results when compared with CNN2 and CNN1 models. It was due to the depth of the networks as in CNN 3 we have used three convolutional layers but in CNN 2 and CNN 1, we have used only two layers of the convolutional layer with different variety of filter sizes. Almost, 16 filters were implemented at the 1st convolution layer in CNN 1, and 32 filters were applied in the 1st convolution layer in CNN 2. Here we observed that, when the number of filters which were earlier used when increased then the performance of the system also simultaneously, got increased. In other words, we can say that the depth of the networks and the number of filters are directly proportional to creating an efficient convolutional network ranking.[18]

For age estimation, while using CNN 3 model we have classified the age into three parts such as: Young (10-35), Middle (35-59), and Old (more than 60 years). When we trained the CNN3 model for predicting the age we observed that this CNN model can derive perfectly better results as compared to the other two training models.

Thus, with the above discussion we can say that the rate of classification grows more with the number of epochs a model learns. This also makes an impact that with each epoch, the model also learns much more information and that leads them to their growth respectively.

As a result, we have noticed that this CNN model can obtain a perfectly acceptable result, as shown in figures 6 and 7 respectively.

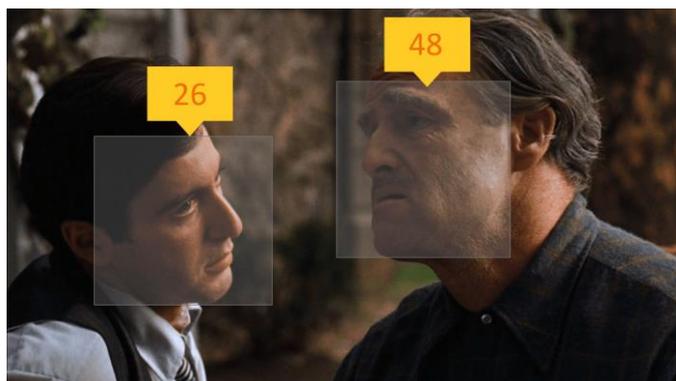


Fig.8. Example of age estimation from IMDB dataset.



Fig.9. Example of gender prediction from WIKI dataset.



Fig.10. Example of age and gender classification from IMDB dataset.

This, CNN model has a very good prediction regarding age and gender detection.

IX. CONCLUSION

In this, we have worked on the implementation of a Deep convolutional network in the human age and gender prediction using CNN. In this whole conclusion age and gender, classification played key segments of research in the future forecast of the biometric system. With this approach,

we can say that the individuals can get their results in an efficient and much more adequate way.

Today, the main social and advertising panels are using intelligent face recognition with gender and age recognition techniques robustly and accurately. Deep learning algorithms are also used for a CNN network which is trained by well-known datasets such as IMDB- WIKI. Then we have implied an efficient and much more precise model for age determination and obtained various results in terms of precision. The different results are shown in the model give us a precise way to compare and get a better result.

The network is reliable and trustworthy but it needs a considerable amount of time to reach its accuracy and gives a better prediction.

Finally, we can conclude that the number of times we form a layer to determine the age and gender of the photo, the accuracy and precision needs the right approach of the facial database hence, showing the variations in the lightning and pose.[19]

X. REFERENCES

- 1)M.K. Benkaddour and A. Bounoua," Feature extraction and classification using deep convolutional neural networks, PCA and SVCfor face recognition " International Information and Engineering Technology Association IETA,2017.
- 2)Jing Wu, W. A. P. Smith, E.Hancock, " Gender classification using shape from shading". ICIAr 2008: Image Analysis and Recognition Processing Systems 3,1990.
- 3)A. Golomb, T.Lawrence, T. Sejnowski, "Neural network identifies sex from human faces", Conference: Advances in Neural Information Processing Systems 3,1990.
- 4)A.Khan, A.Majid, A.Mirza, "Combination and optimization of classifiers in gender classification using genetic programming", International Journal of Knowledge-based and Intelligent Engineering Systems, 2005.
- 5)M.K.Yamaguchi, T.Kato, T. Akamatsu, " Relationship between physical traits and subjective impressions of the face - Age and sex information". IEICE Trans,1993.
- 6)D. M. Burt, D. I. Perrett," Preception of age in adult Caucasian male faces": computer graphic manipulation of shape and color information in Perception.
- 7)K. Ueki, T. Hayashida and T. Kobayashi. "Subspace-based age-group classification using facial images under various lighting conditions". In: Proceedings of Automatic Face and Gesture Recognition, 2006.

- 8)H.Zhou, P. Miller, J. Zhang, "Age classification using Radon transform and entropy-based scaling SVM". Proceedings of the British Machine Vision Conference.
- 9)Y. H. Kwon and N. Lobo, "Age classification from facial images". Computer Vision and Image Understanding,1999.
- 10)J.Schmidhuber, Deep learning in neural networks: An overview. Neural Network.
- 11)Yu Zhu, Yan Li, Guowang Mu, Guodong Guo. "A Study on Apparent Age Estimation". IEEE International Conference on Computer Vision Workshop,2015.
- 12)IMDB-WIKI datasets:
<https://data.vision.ee.ethz.ch/cvl/rrothe/imdb-wiki/>
- 13)E. Eidinger, R. Enbar, T. Hassner "Age and gender estimation of unfiltered faces', IEEE,2014.
- 14)G. Levi, T. Hassner "Age and Gender Classification Using Convolutional Neural networks " IEEE Conference on Computer Vision and Pattern Recognition Workshops,2015.
- 15)K.Zhang, Ce.Gao, L.Guo, M.Sun², X.Yuan², Tony X. Han², Zhenbing Zhao¹, Baogang Li¹, "Age Group and Gender Estimation in the Wild With Deep RoR Architecture". Published in: IEEE.
- 16)Z. Qawaqneh, A. A. Mallouh, and B. D. Barkana, "Deep convolutional neural network for age estimation based on VGG-face model," 2017.
- 17)G. Antipov, M.Baccouche, J. Dugelay, Effective Training of Convolutional Neural Networks for Face-Based Gender and Age Prediction, Pattern Recognition.
- 18)A.Olatunbosun and S. Viriri," Deeply Learned Classifiers for Age and Gender Predictions of Unfiltered Faces", the scientific world journal,2020.
- 19)S.M.Osman, N. Noor, and S.Viriri, Component-Based Gender Identification using a local binary pattern, Computational Collective Intelligence, ICCCI,2019.