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REAL TIME AGE AND GENDER CLASSIFIER

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***Abstract*-Gender is still a prominent element of our personalities. It also plays an important role in our social lives. Artificial intelligence age forecasts have applications in a variety of disciplines, including smart human-machine interface development, health, cosmetics, and electronic commerce, among others. The ability to estimate people's sex and age from their face photographs is a current and active research topic. The researchers proposed a number of solutions to the problem, but the criteria and actual results are still insufficient. This paper proposes a statistical pattern recognition strategy to solve this challenge. In the proposed method, a Deep Learning technique called Convolutional Neural Network (ConvNet / CNN) is employed to extract features. CNN takes input images and assigns a value to distinct characteristics / elements of the image (learnable weights and biases) and can distinguish between them. Other classification techniques require far more pre-processing than ConvNet. While the filters are created by hand using simple methods, ConvNets can be trained to learn these filters and features. Face photos of individuals were trained with convolutional neural networks in this study, and age and sex were accurately predicted with a high rate of success. There are around 20,000 photos with age and gender. Poses, facial expressions, lighting, occlusion, and resolution are all represented in the photos.**

***Keywords*- Convolutional Neural Networks (CNN), Visual geometry group (VGG), Residual Neural Network (ResNet), and Rectified linear activation function (ReLu), OpenCV, Transfer Learning, HAAR Cascade**

I. INTRODUCTION

Face recognition research has expanded as a result of the wide range of applications, including user identification, targeted advertising, video monitoring, and human-robot interaction. With the advancement of technology, apps that integrate advanced fields of pattern recognition and image processing are being utilised to determine age and gender. When you attend for an interview or a health check-up in today's environment, your age plays a significant influence. Many government, business, and advertising-related entities use age information to identify criminals, hire qualified staff, and target audiences for product promotion. However, determining a person's age is not easy, and there are limitations that prevent us from seeing the correct age among the photographs. It's critical to find the right dataset for training the model. The calculation and time required to prepare the model are high due to the large amount of real-time data. It's been a difficult effort after adopting numerous machine learning approaches, but the accuracy has much improved. By mapping the face according to the age found, age estimation plays a significant part in applications such as biometric evaluation, virtual makeup, and virtual try-on applications for jewellery and eye-wear. Lens kart is an example of an app that allows customers to try on lenses. Face recognition and face tracking are subfields of age estimation that, when combined, can forecast an individual's health. This approach is used by many health-care applications to keep track of their health by monitoring their regular activities. This facial detection algorithm is used in China to identify service drivers and jaywalkers. We utilise a variety of machine learning methods to determine age and gender. CNN (convolutional neural network) is one of the most widely used approaches for determining age and gender. We will use OpenCV and CNN to predict the age and gender of any given person in this implementation. We employ a variety of machine learning and deep learning techniques to determine age and gender. The CNN (convolutional neural network) is one of the most widely used approaches for determining age and gender. We employ Open CV and CNN, as well as additional CNN architectures like ResNet and VGG, to estimate the age and gender of each given person's image in this work. The recent proliferation of social media and social platforms has resulted in an increase in the number of applications available. The automatic classification of age and gender has become increasingly important as the number of requests for applications has grown. The performance of current approaches on real-world photographs is significantly inadequate, as reported for the related problem of facial identification. Many industries, such as Multimedia Retrieval and Human-Machine Interaction, rely heavily on age detection. The vocabulary used to address people frequently varies by age group. Gender identification is one of the most important steps in creating gender-specific acoustic modules for speech recognition and other applications. Salutations and linguistic grammar rules differ according to gender. There are many steps that must be followed, such as the issue's removal. In a facial recognition approach, the articulations on the faces hold a lot of

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information. When one person meets another, a slew of ideas is exchanged. The evolution of ideas aids in the determination of particular limits. Age classification is a multi-class issue in which the years are divided into categories. It's difficult to put together the photographs because people of various ages have different face features. Procedures for determining the age and gender of multiple faces are followed by a variety of ways. The convolution network extracts features from the neural network. The image is processed into one of the age classes based on the prepared models. The highlights are taken care of a little bit more and sent off to the preparing frameworks.

II. PROBLEM DEFINITION

In today's world, more targeted advertising based on a person's attributes is becoming more common, and a person's age and gender can have a significant impact on the advertisements that are targeted. The goal is to determine a person's age and gender based on his or her appearance. The project uses a real-time image acquired by the camera to determine the age and gender of the person. The goal is to compare and contrast alternative CNN architectures (RESNET and VGG16).The age and gender classifier can be used in a variety of fields, such as digital marketing, to target individuals on social media by classifying their age and gender based on their profile images. This implementation can also be used by surveillance authorities in security surveillance for purposes such as identity verification and bulk surveillance. Underage persons will be denied access to some programmes and entertainment on over the top (OTT) platforms unless their age is verified. Since the growth of social platforms and social media, automatic age and gender classification has been relevant to a growing number of applications. Nonetheless, present approaches' performance on real-world photographs is still woefully inadequate, especially when compared to the massive improvements recently reported for the related task of facial identification.

III. PROJECT DESCRIPTION

Picture processing is the process of improving image photos generated from camera sources and images captured in everyday life. The image is processed using a variety of procedures and computations based on the study. The creation of digitally created images necessitates meticulous planning and research. There are two main processes in image processing, followed by easy steps. Picture upgrades are the enhancements to an image with the purpose of producing additional high-quality images that can be used by other programmes. The other process is the most widely used method for extracting data from a photograph. Segmentation is the splitting of an image into distinct pieces. The position of the information in the photographs is extremely useful information. For the purposes of discovery, the image's information will be modified and adjusted. To avoid disastrous consequences, we're employing Machine Learning algorithms to provide a more accurate diagnosis. The method we employed in this assignment was "Transfer Learning." Transfer learning provides a number of advantages, the most important of which are reduced training time, improved neural network performance (in most contexts), and the absence of a massive quantities of data.

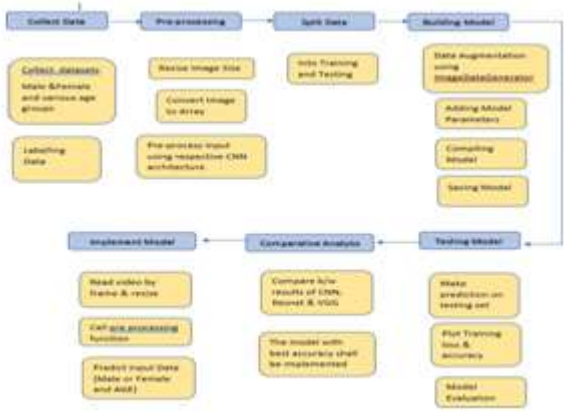

Figure 1 – Proposed Design

As a result, it’s appropriate for this situation. Our project makes use of Machine Learning models such as CNN (Convolutional neural network) and various CNN architectures such as ResNet and VGG. For prediction, Keras, Scikit-image, Scikit-learn, and Matplotlib are utilised, as well as Matplotlib for visualisation of the testing and training data. The main goal of this paper is to figure out which algorithm is optimal for detecting Age and Gender. Although the accuracy and reliability of the aforementioned methods should be evaluated first. The experimental data is compared and analysed in this section, with the precision of Algorithms taken into account.

IV. SEQUENTIAL

As the name implies, we'll be building our own model layer by layer and step by step. Multiple convolutional layers and pooling layers make up the sequential CNN model that we implemented. For wireless spectrum monitoring applications, a unique and efficient end-to-end learning model for automatic modulation categorization is proposed, which automatically learns from time domain in-phase and quadrature data without requiring the production of hand-crafted expert features. Sequential convolutional neural networks are developed to take advantage of the parallel computing capability of convolutional neural networks and the temporal sensitivity of convolutional neural networks, based on the empiricism of convolutional layers with pooling serving as the role of front-end feature distillation and dimensionality reduction.

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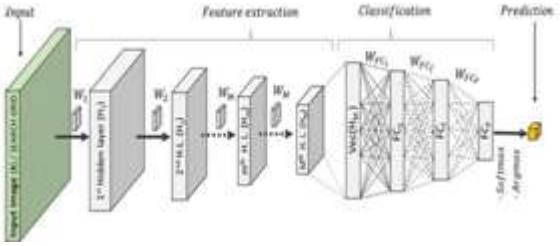

Figure 2 – Sequential CNN Model [9]

V. RESNET

An artificial neural network called a residual neural network (ResNet) is a type of artificial neural network (ANN). Skip connections, or shortcuts, are used by residual neural networks to jump past some layers. ResNet in its most basic form. Double- or triple-layer skips with nonlinearities (ReLU) and batch normalisation are used to create models.

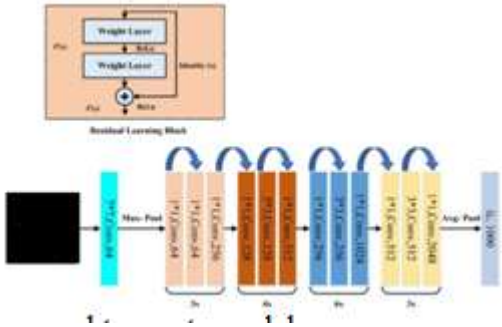

Figure 3 – RESNET Model [8]

VI. VGG

VGG stands for Visual Geometry Group, and it is a multilayer deep Convolutional Neural Network (CNN) architecture. The term "deep" refers to the number of layers, with VGG-16 or VGG-19 having 16 or 19 convolutional layers respectively.

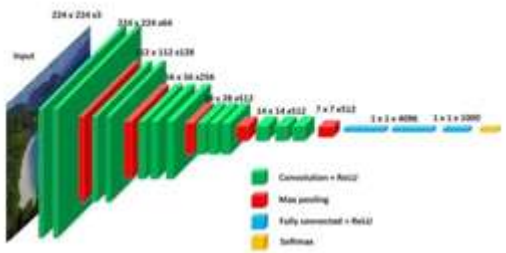

Figure 4 – VGG Model [17]

The VGG architecture serves as the foundation for cutting-edge object recognition models. The VGGNet, which was created as a deep neural network, outperforms baselines on a variety of tasks and datasets in addition to Image Net. VGGNets are built on convolutional neural networks' most important properties (CNN).

VII. EXPERIMENTATION

Almost every effort or real-life circumstance will face some sort of difficulty or setback. To address these difficulties and go forward with the quest for a solution, necessary steps must be taken. Only a few issues arose during the course of our assignment. We use CNN (Convolutional Neural Network) to classify age and gender in our project. In the first phase of our implementation, we'll build our own model utilising sequential in CNN, which allows us to build models layer by layer in a step-by-step manner. Later, we'll use VGG Architecture, and ResNet Architecture to implement the identification. At the conclusion of the paper, we deliver a comparison analysis that includes a full study and visual representation of the various CNN architectures employed in our paper. We sought to make the dataset more suited for the models by experimenting with various pre-processing strategies, which would lead to an increase in the accuracy and efficiency of the models' performance. We now know which pre-processing strategies help and which do not aid in improving the model's performance after extensive testing. We decided to employ Haar Cascades, an Object Detection Algorithm used to identify faces in an image or a real time video. After that, it's utilised to detect faces and other images. It found the appropriate threshold for each feature extracted to classify the faces as positive or negative. Clearly, there were several mistakes and misclassifications. We experimented with numerous parameters in the machine learning models in this paper to see if we could improve the models' accuracy. We adjusted parameters such as the learning rate and the number of epochs used to train the machine as a learning and transfer learning models. We've added and removed thick layers, dropout layers from the deep learning and transfer learning model descriptions. We have also experimented with various activation functions, optimizers, and loss functions for all deep learning and transfer learning models. To get at the result for the comparison analysis, we used a variety of trial and error methodologies. In comparison to previous models, the sequential architecture model was able to achieve a little higher accuracy.

VIII. TESTING AND RESULTS

The main intent of this project is to find the accuracy of the various models while determining the age and gender of the person. We were able to obtain the real time working model of CNN.

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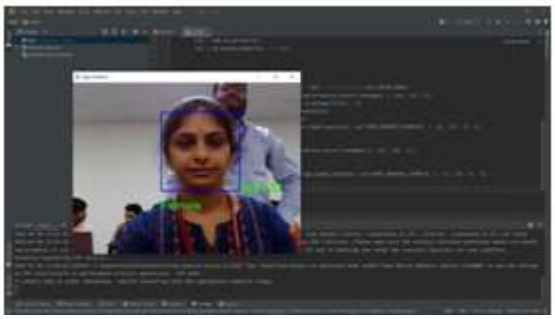

Figure 5 – Real Time Model

The performance metrics were used to determine the accuracy and precision of the CNN model.

	precision	recall	f1-score	support
0	0.91	0.91	0.91	2468
1	0.90	0.90	0.90	2273
accuracy			0.90	4741
macro avg	0.90	0.90	0.90	4741
weighted avg	0.90	0.90	0.90	4741

Figure 6–Accuracy and Precision

The Confusion matrix for CNN gender is displayed below and shows how often the model classified each label correctly and which labels were most often confused for that label,

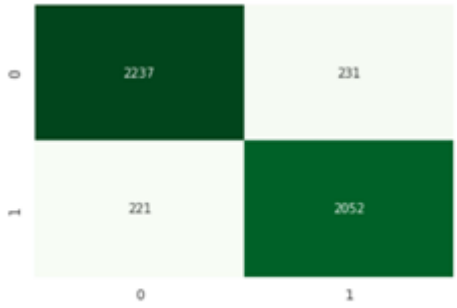

Figure 7 – CNN Gender Confusion Matrix

We also obtained a comparative analysis of all the models to test between the various accuracies.

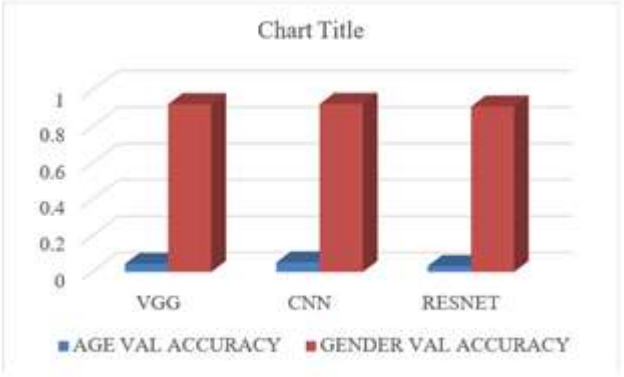

Figure 8 – Comparative analysis of Models

We have also obtained a table comparing the validation accuracies of the various models used.

	AGEValAccuracy	GenderValAccuracy
VGG	0.0442	0.9234
CNN	0.0527	0.9248
RESNET	0.0325	0.9107

Table 1 – Validation Accuracies of Models Used

As compared to alternative CNN designs, Sequential CNN achieved the highest Age and Gender Validation accuracies, as seen in the table above. We proposed a comprehensive framework for real-time and accurate age and gender classification, as well as a full comparison of different CNN models in this paper. Overall, we suggest using machine learning to build a full framework for real-time and accurate age and gender classification. A model is developed and deployed that has an accuracy of greater than 80% for gender and a suitable accuracy for age. This project also includes a graphical representation of a comparison examination of several CNN models, which aids in effective analysis.

IX. CONCLUSION

This paper aims on performing a comparative analysis on various CNN architectures and a real time model for the

architecture that had the best accuracy. This model has various applications in the field of over the top platforms (OTT), facial recognition and many more. We have used machine learning to improve accuracy and we have successfully deployed a model.

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