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GENDER AND AGE PREDICTION USING DEEP LEARNING

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Abstract: *Automated age and gender classification is increasingly relevant for various applications. This paper proposes an approach using multiple convolutional neural networks (CNNs). The method involves face detection, background removal, face alignment, multiple CNNs, and a voting system. The CNN model uses three CNNs with different structures and depths, trained on the AGFW dataset. A voting system combines their predictions for the final result..*

Keywords: *Age and Gender Classification, Convolutional Neural Networks, Facial Images, Face Detection, Face Alignment, Voting Systems..*

1. INTRODUCTION

Biometrics, is the science of analyzing the physical or behavioral characteristics of each individual that enable the authentication of their identity in a reliable manner, it offers significant advantages conventional identification methods, such as passwords and cards, are not transferable, exclusive to each person and are not lost or stolen, particularly because of biometric features. The range of biometric solutions relies on user approval, security, cost and time for implementation...etc. Recently, face recognition has been one of the most interesting tasks in pattern recognition, many applications use this technique because the human face is considered a very rich source of information. In particular, gender and age are facial features that can be very useful for a multitude of applications, for example an automatic gender and age prediction system is used to profile customers who are interested for a product or for target advertising.The areas of age and gender classification have been studied for decades. Until detailing the methods used in this article, we will first provide a summary of the facial recognition experiments carried out by scholars, which can be grouped into tree classes of interest. Over the last decade, the rate of image uploads to the Internet has grown at a nearly exponential rate. This newfound wealth of data has empowered computer scientists to tackle problems in computer vision that were previously either irrelevant or intractable. Consequently, we have witnessed the dawn of highly accurate and efficient facial detection frameworks that leverage convolutional neural networks under the hood.

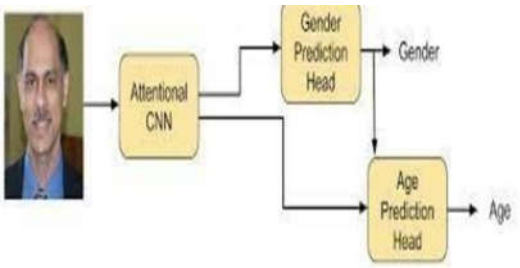
One of the most critical barriers that face any system to age estimation or age-classification is the absence of a consistent pattern of facial aging. This is due to the nature of human faces, and the stages of aging may differ from one human to another.

2. METHODOLOGY

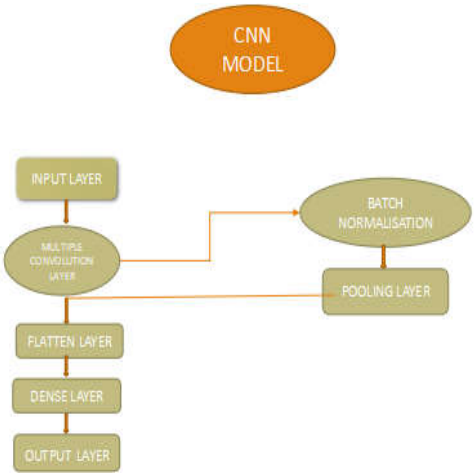
Age and Gender Detection, Deep Expectation (DEX) – is used for age estimation which can be seen in image classification and object detection fueled by deep learning. From the deep learning concept we learn four key ideas that we apply to our solution: the deeper the open cv(by sheer increase of parameters / model complexity) the better is the capacity to model highly non-linear transformations - with some optimal depth on current architectures.The larger and more diverse the datasets used for training, the better the network learns to generalize and the more effective it becomes to over-fitting;The alignment of the object in the input image impacts the overall performance.When the training data is small that is when we must finetune a

network pre- trained for comparable inputs and goals which would benefit us from the transferred knowledge.

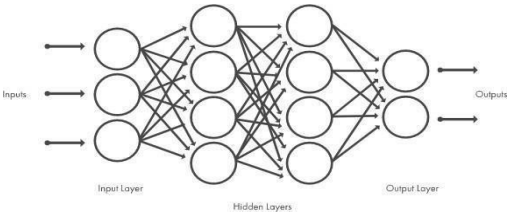
Block Diagram



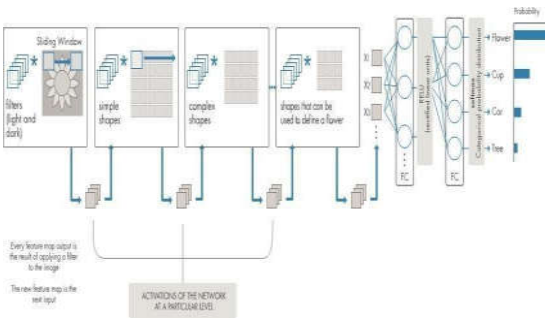
Flow Chart



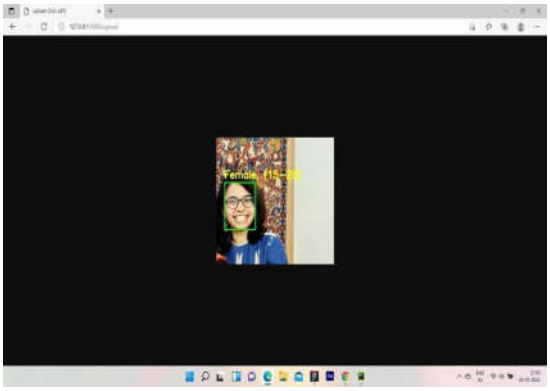
DEEP LEARNING WORKING DIAGRAM:

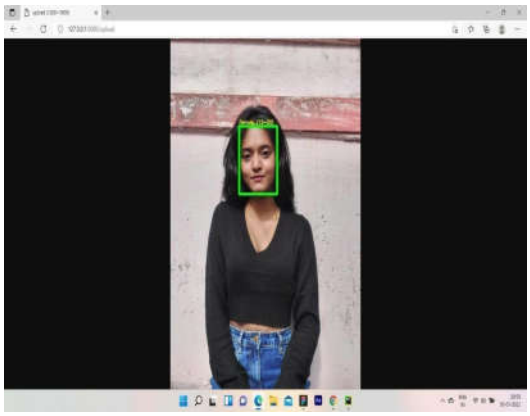


DEEP LEARNING WORKING DIAGRAM



3. EXPERIMENTAL RESULTS AND DISCUSSION





Gender and Age Prediction

3.1. Dataset collection:Collecting data heavy use of collections of images called datasets. A dataset in computer vision is a curated set of digital photographs that developers use to test, train and evaluate the performance of their algorithms.Data can be gathered by different means like scraping from the web, gathering from third-party sources or you could even buy datasets from re- sellers etc. Auto encoders work best for image data. Support file type filters Support Bing.com filter filters.Download using multithreading and custom thread pool size.Support purely obtaining the image URLs

3.2. Data Cleaning: Data cleaning is the process of fixing or removing incorrect, corrupted, incorrectly formatted, duplicate, or incomplete data within a dataset. When combining multiple data sources, there are many opportunities for data to be duplicated or mislabeled. It involves identifying data errors and then changing, updating or removing data to correct them.

3.3. Feature Extraction: Feature extraction is a part of the dimensionality reduction process, in which, an initial set of the raw data is divided and reduced to more manageable groups.So when you want to process it will be easier. The most important characteristic of these large data sets is that they have a large number of variables.These variables require a lot of computing resources to process. So Feature extraction helps to get the best feature from those big data sets by selecting and combining variables into features, thus, effectively reducing the amount of data. These features are easy to process, but still able to describe the actual data set with accuracy and originality.Image Processing –Image processing is one of the best and most interesting domain. In this domain basically you will start playing with your images in order to understand them.

3.4. Model training: Plan and simplify. In the beginning we must think about how does the computer sees the images. Collect. For all the tasks try to get the most variable and diverse training dataset. Sort and upload. You have your images ready and it's time to sort them. Load and normalize the CIFAR10 training and test datasets using torchvision.Define a Convolutional Neural Network.Define a loss function. Train the network on the training data. Test the network on the test data.

3.5 Testing Model: In this module we test the trained deep learning model using the test dataset.A type of test that makes detailed pictures of areas inside the body. Imaging tests use different forms of energy, such as x-rays (high-energy radiation), ultrasound (high-energy sound waves), radio waves, and radioactive substances. They may be used to help diagnose disease, plan treatment, or find out how well treatment is working.Examples of imaging tests are computed tomography (CT), mammography, ultrasonography, magnetic resonance imaging (MRI), and nuclear medicine tests. Also called imaging procedure.

3.6 Performance Evaluation: In this module, we evaluate the performance of trained deep learning model using performance evaluation criteria such as F1 score, accuracy and classification error.To evaluate object detection models like R-CNN and YOLO, the mean average precision (mAP) is used. The mAP compares the ground-truth bounding box to the detected box and returns a score. The higher the score, the more accurate the model is in its detections.Model evaluation is the process of using different evaluation metrics to understand a machine learning model's performance, as well as its strengths and weaknesses. Model evaluation is important to assess the efficacy of a model during initial research phases, and it also plays a role in model monitoring.

3.7 Detection: Object detection is a process of finding all the possible instances of real- world objects, such as human faces, flowers, cars, etc. in images or videos, in real-time with utmost accuracy.The object detection technique uses derived features and learning algorithms to recognize all the occurrences of an object category. Then we divide the image into various regions.We will then consider each region as a separate image.Pass all these regions (images) to the CNN and classify them into various classes.

3.8 Steps for CNN:

Step 1: Choose a Dataset
Step 2: Prepare Dataset for Training
Step 3: Create Training Data
Step 4: Shuffle the Dataset
Step 5: Assigning Labels and Features
Step 6: Normalizing X and converting labels to categorical data
Step 7: Split X and Y for use in CNN

3.9 Open cv: OpenCV (Open Source Computer Vision Library) is an open source computer vision and machine learning software library. Open CV was built to provide a common infrastructure for computer vision applications and to accelerate the use of machine perception in the commercial products. OpenCV (Open Source Computer Vision Library) is a library of

programming functions mainly aimed at real-time computer vision. Originally developed by Intel, it was later supported by Willow Garage then It see (which was later acquired by Intel). OpenCV is a great tool for image processing and performing computer vision tasks. It is an open-source library that can be used to perform tasks like face detection, objection tracking, landmark detection, and much more. .Some of these functions are really common and are used in almost every computer vision task.

3.10 Output: In the Output phase, we apply the same feature extraction process to the new images and we pass the features to the trained machine learning algorithm to predict the label.

4. Conclusion

The task of recognizing age and gender, nonetheless, is an innately troublesome issue, more so than numerous other PC vision undertakings.The fundamental justification for this trouble hole lies in the information needed to prepare these kinds of frameworks.Python obtained images and the Model did not do well much in the accuracy rate, further, improvement is required in the model algorithm. The Gender and Age Detection project successfully demonstrates how computer vision and machine learning techniques can be used to predict demographic attributes from facial images. Using pre-trained deep learning models such as convolutional neural networks (CNNs), we were able to achieve accurate predictions for both gender and approximate age group of individuals.The results show that while gender prediction tends to be more reliable, age estimation remains a more complex task due to individual variations in appearance and facial aging patterns. Despite these challenges, the model performs well within acceptable error margins, especially when trained on diverse datasets.This project highlights the potential of AI in applications like personalized marketing, security systems, and demographic analysis. However, it also emphasizes the importance of ethical considerations, such as privacy, data bias, and consent, when deploying such technologies in real-world scenarios. Future improvements could include enhancing dataset diversity, incorporating more robust models, and optimizing performance for real-time deployment on edge devices.

5. Future Enhancement

Gender Detection:Use a CNN to classify detected faces into male/female categories. Combine age and gender prediction in one model (multi-output).

Emotion Recognition:Detect facial expressions such as happy, sad, angry, etc. Adds a human behavior analysis dimension to your project.

Real-time Detection: Implement using OpenCV + TensorFlow/PyTorch.

Run age and face detection live through webcam/video feed.

Face Mask Detection:Identify whether the person is wearing a mask or not. Useful for health compliance or security purposes.

Age Group Classification:Instead of exact age, classify into groups (e.g., child, teenager, adult, senior). More practical in real-world applications.

Dataset Augmentation: Use image augmentation to improve model robustness. Helps with accuracy under various lighting/angle conditions.

Face Alignment: Pre-process face images to normalize pose and orientation. Increases accuracy of age prediction.

Face Recognition: Match faces to known identities from a database.

Combine it with age detection for security or personalization.

Privacy-Aware Features:Implement face blurring for unidentified users. Show responsible AI practices.

Deployment Options:Deploy using a Flask/Streamlit web app or Android app. Add GUI for uploading image/video and displaying results.

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