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An Enhanced Approach for Detecting Human Age and Gender Using CNN (Convolutional Neural Network) Classifier

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I. INTRODUCTION

A. Introduction

In terms of expressing personality and sentiments, the face is crucial in social gender and ageuality. Humans are capable of recognising the many aspects of machines. As a result, automated face recognition systems are critical for facial recognition, head position assessment, and human-computer interaction. Face detection is a computer technique for locating and sizing a human face in a digital picture. Recognizing gender and age has now become a fundamental step in many human-machine interactions. It can be applied to marketing, security, and all other fields where identifying gender and age makes it better for tackling the further aspects of the given task. Gender and age prediction is the gateway tool for any application which takes advantage of it to improve their functionality by doing targeted interaction with the gender and age of its preference.

B. Deep Learning

It employs multilayer neural networks to examine in-depth learning data as a subset of machine learning.Like the human brain, the neural codes in these neural networks are hierarchically interconnected. Deep underground exercises are mechanical exercises in artificial intelligence, which contains indirect or unknown neural formation or deep neural networks. Deep educational structures of neural networks, such as computer vision, biology, pharmaceutical program, pharmaceutical analysis, study of materials and exercises used in some comparison results, continuous neural networks and centralised neural networks.

1) *Neural Network:* In the modern sense, a neural network is a network or orbit of neurons, or an artificial neural network of neurons or artificial nodes. As a result, a neural network can be either a biological neural network made up of biological neurons or an artificial neural network designed to solve AI problems. These artificial networks may be used to teach predictive modelling, adaptive control, and databases-based applications. As a result of experience, self-learning may occur in networks, resulting in a complicated and apparently unconnected set of data.

C. Python

Python is a general-purpose, sophisticated, descriptive programming language. Its language architecture and object-oriented approach are intended to help programmers produce clear, logical code for both small and big projects.
Python has significant documents, most of which have been submitted by various authors. The markup used for Python documents is retrieved text created from documents and edited using custom commands using a tool called Sphinx for post-processing HTML output.Python documents have long been considered a good free programming language.

D. Face Detection

Face detection is a computer technique that identifies human faces in digital photographs. \Human face recognition is the focus of face recognition algorithms. The matching procedure is halted if the face in the database is changed.
Reliable approach to facial recognition based on genetic algorithm and special phase technique:First, potential areas of the human eye are determined by examining all areas of the valley on a grey surface image. The genetic algorithm is then used to create all areas of the face, including the corners of the eyebrows, iris, nose and mouth.
Each image can be normalised to minimise the effect of light caused by random light and the effect of tiles causing the head to move. At this stage, the symmetry of the face is measured and the presence of different facial features for each facial image is checked.

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II. PROBLEM DEFINITION

A. *Problem Statement*

Several types of research works are being carried out on gender and age classification. Theoretical Definition, Categorization of affective state, and the modalities of gender and age Classification are presented.A convolutional neural network (CNN) technique for real-time gender and age categorization is presented to accomplish this investigation. In this project, the main goal is to detect the gender and age of a person using a convolutional neural network (CNN) and we will teach the model through an image database. This is a time consuming process. This exercise creates a model for determining gender and age and identifying faces. The sample is then saved as a separate file. We introduced this model into a face recognition system to recognize people's faces in real time.

B. *Existing System*

When compared to the more typical detection challenge, gender and age categorization can play a key role in many computer vision applications that are understudied. Most modern solutions to image reconstruction problems use classifiers or offline classifiers based on horizontal features.

One of the oldest techniques doing the task of gender and age recognition makes this a binary classification. Being a binary problem, it doesn't guarantee high accuracy. After detecting a face in a still image, it identifies only one gender and age and sets the other gender and age as default. The model is trained by training data and then it predicts the gender and age of test data. Training the model seems obvious but a technique that tried to challenge it is KNN (K-Nearest Neighbour). This method does not believe in training the data; instead, the input feature data is compared to the data in the training data, and the output is determined accordingly. This approach is unique, however it has a high computational cost and low precision. The use of Support Vector Machine (SVM) for gender and age categorization based on face photographs was a breakthrough in this field, although the accuracy was low.

C. *Proposed System*

The used technique uses CNN as its base for detecting faces. Using a dataset from google images, we have trained our model with 2325 labelled images and tested on 580 images. To implement the neural networks, we are using TensorFlow Framework and Keras Deep Learning Open Source Library. We first teach the models using database images.It takes a long time to do this task. This tutorial will develop a model for gender and age and facial identification, and if necessary, it will update the prior model with package tracking. The details of the sample are then stored in a separate file. This file is used to test our model so that we don't have to retrain it every time we run it. During the test period, the image is sent as input code. The image changes colour to GRAY for better brightness and contrast for better facial recognition. This image was sent to a CNN-based face detector, where we can process the sculpted face. The face is the gateway to another neural network that classifies the face as male or female. CNN's key benefit over its predecessors is that it finds essential traits without the need for human intervention.For example, if you give a few photos of a man and a woman, he will automatically learn the individual characteristics of each class.

III. SYSTEM ANALYSIS AND DESIGN

A. *Hardware Requirements*

The development and deployment of the application require the following general and specific minimum requirements for hardware:

Component	Minimum Requirement
Processor and Speed	64-bit or 32-bit,four-core, 2.5 GHz minimum per core
RAM capacity	8 GB for development and evaluation
Hard Disk	10GB for development and evaluation use, in total capacity of 1TB

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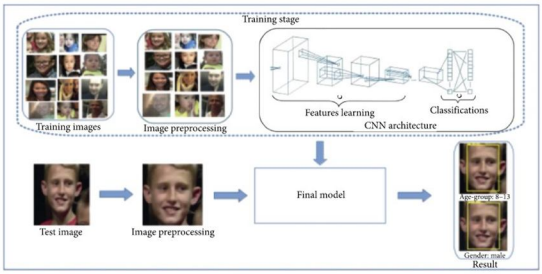
B. Software Requirements

The development and deployment of the application require the following general and specific minimum requirements for software:

Component	Minimum Requirement
Operating System	Windows (64-bit or 32-bit)
IDE	Jupyter Notebook
Programming Language Translators	Python 3.7.6

C. Flow Chart / Object Modelling Diagram

The system can be Performed by following the procedure of below flow chart. The model forms a fundamental procedure for detecting the faces as male/female in image or video frames. In order to obtain this model, we use some technologies like TensorFlow, Keras and OpenCV. The model first requires a dataset which consists of images of male and female. This dataset is required for training of our model. Later by using the Convolutional neural network(CNN) we will generate a trained model. For this trained model we apply for image and video streaming to know whether a person is male or female.



D. System Architecture And Module Description

This section describes how the system detects the person is male and female and how exactly it works. Whenever a particular model is trained the key points for recognizing the human's gender and age and age are made by using the following steps.

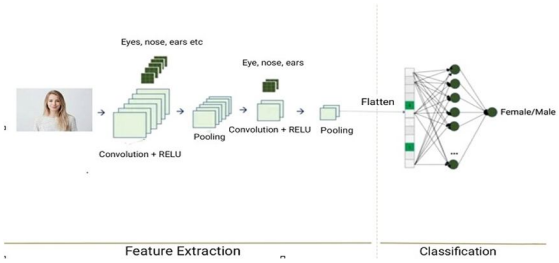
- Choice of a good dataset collection.
- Extracting effective features using cnn.
- Designing a reliable model using Machine learning and deep learning approach and cnn algorithm.

1) System Architecture

This is the network architecture program used in our convolutional neural network (CNN) training algorithm. It has been proposed to use a four-layer CNN for real-time facial gender and age categorization. In comparison to previous approaches, the network's topology decreased the design difficulty by using a smaller number of layers, neurons, instructional parameters, and joints.

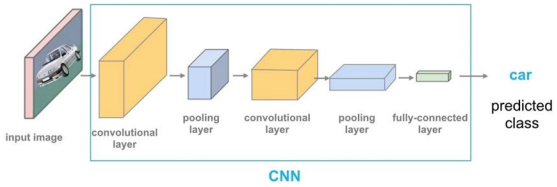
There are two main parts in our proposed CNN architecture

- In the process of feature extraction, a convolutional tool isolates distinct components of a picture for analysis.
- Based on the parameters gathered in the preceding phases, the fully integrated layer utilises the result of the conversion process to forecast the picture class.



Convolutional Layers

Regular layers, composite layers, and full link (FC) layers are the three types of layers that make up CNN. A CNN structure is generated when these layers overlap. There are two crucial parameters of the drop layer and activation functions, which are explained below, in addition to these three layers.



2) Module Description

In order to implement the training model, we use some packages/libraries like TensorFlow, Keras and OpenCV, and Numpy.

- *NUMPY:* NumPy is a library of multidimensional array objects and a collection of routines for executing them. NumPy allows you to conduct logical and mathematical operations on arrays. Python package is the name of the programme. This holds true for Python's number. It consists of a library of multidimensional array objects as well as a collection of array processing functions. NumPy tables in Python give tools for integrating C, C++, and other languages. It may also be used in linear algebra and random number generation. The NumPy table may also be used to store public data in a multidimensional container. NumPy is a Python package that allows you to manipulate arrays. It also contains linear algebra, Fourier transform, and metrics-related functions.
- *Tensorflow:* TensorFlow is a deep learning software package that is open source and free. Traditional machine learning is also supported. Without TensorFlow based on deep learning, it was originally built to calculate huge numbers. It has, however, proven to be quite beneficial in the development of deep learning, thus Google has made it an open source resource. TensorFlow is based on data flow charts, which have nodes and fields. TensorFlow code is considerably easier to run on distributed systems employing graphics processors since the execution method is graphical (graphics processing units).
- *Keras:* Keras is convenient, modular, easy to design and develop to work with Python. API "designed for humans, not machines" and "follows the best methods to reduce cognitive load."Separate modules such as nerve layers, cost functions, optimizers, starter programmes, execution functions, and monitoring methods can be combined to construct new models. The main modules of this project involves two main steps, which are: Training the model with a dataset.

Detection of the image/ frame of live video streaming to know whether a person is male/female.

1) Module -1

After reviewing the dataset, In this module training of the model takes place which includes 3 steps:

- Loading the dataset containing female/male images from disk.
- Training of the model (using Keras/TensorFlow) on this dataset, and
- Serialising the generated model for detecting male/female to disk.

➢ *Loading Our Dataset*

The Dataset for this project has been taken from The google images. This dataset consists of 2,907 images belonging to two classes:

- Female dataset: 1,379 images
- Male dataset: 1,528 images

➢ *Training*

This procedure has trained our model with 80% of (2325) labelled images and tested on 20% of (580) images using convolutional neural network(CNN) as its base for detecting faces of male and female images. Using the dataset collected, To implement the neural networks, we are using TensorFlow Framework and Keras Deep Learning Open Source Library.

➢ *Serialising The Generated Model For Detecting Male/Female*

If a model for recognising gender and age and detecting faces does not already exist, one is constructed during this training section; otherwise, the prior model is upgraded via backtracking. The model information is then stored in a separate file. This file is used to test our model so that we don't have to retrain it every time we test it.

2) Module -2: Detection

The second step is to define a manifold that uses a face detector for perspective scenes to draw frames around each identified face. The location of the face in the photo means determining the integrity of the face in the image, and location refers to the size of the face with a frame around the face. Once we know where the face is in the picture, we can extract the ROI of the face, and from there we use face markers that allow you to see the eyes, nose, mouth, jaw, eyebrows and more.

Using the cvlib package, the given approach uses face detection to compute the bounding box position of the face in the picture.

Cvlib: CVlib is a simple, advanced and easy-to-use library of computer screens for Python. It is designed with an emphasis on easy and quick testing. The ability to move from idea to prototype with minimal delay is important for good research.Guiding principles of cvlib are heavily inspired from Keras (deep learning library).

- Simplicity
- User Friendliness
- Modularity and
- Extensibility

Finding a face in an image is as easy as calling the detector_face () function. This gives the corners of the box a border and the calm associated with all the faces identified.

IV. RESULTS

A. Test Cases

Our database's face input photographs are manually trimmed to only include the most important facial features: eyes, brows, nose, mouth, and beard, as well as glasses if applicable. After that, they're scaled to a resolution of 96x96 pixels. The different test cases can be

1) The faces in the sample below have very little variation in subject lighting. Face emotions (smiling/non-smiling) and facial details (glasses/no glasses) vary between subjects.

2) The individuals are straight ahead and the images are taken on a dark, homogeneous background with a little varied light (allowing some sideways movements). Face emotions (eyes open / closed, smiling / not smiling) and facial details (without glasses / spectacles) affect facial expression.

3) The dataset below contains 1,379 photos of girls and includes some example photographs.

4) The dataset below contains 1,528 photos of males and contains some example photographs.

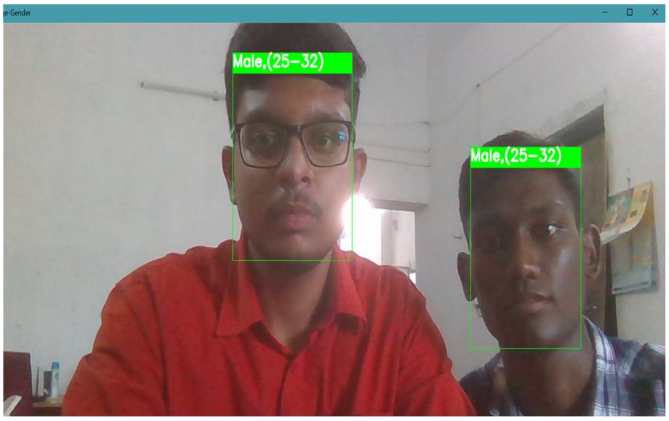
B. Results

1) Module-1: The below image shows the output of training of our model we have trained our model with 80% of (2325) labelled images and tested on 20% of (580) images using convolutional neural network(CNN) Training converges within 100 epochs(refers to one cycle through the full training of dataset).

2) Module-2

- We use face recognition to calculate the location of the face frame in the image using the cvlib library.
- Finding a face in an image is as easy as calling the detector_face () function. This gives the corners of the box a border and the calm associated with all the faces identified.

And the result looks like this at the end.



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V. CONCLUSION

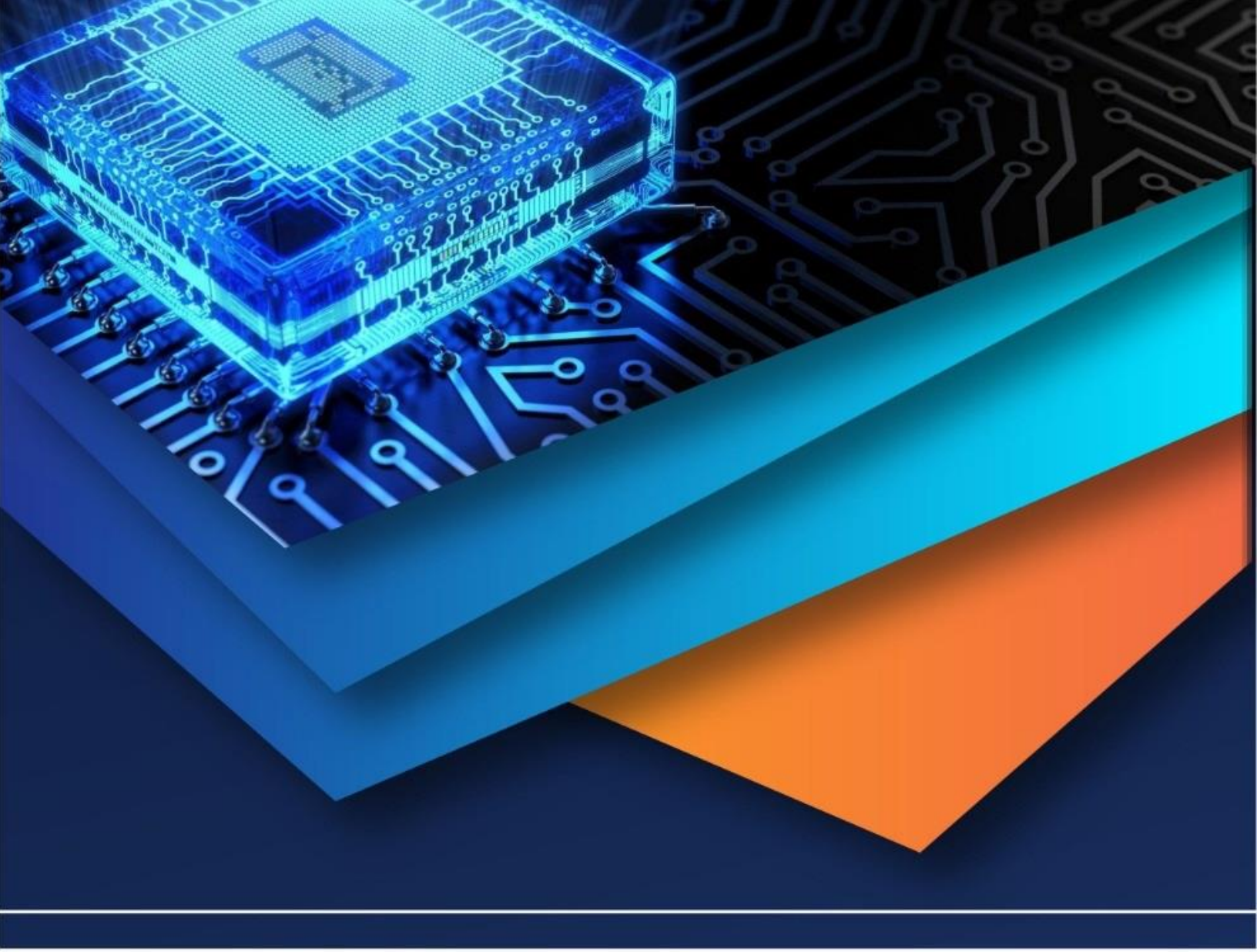
In this Python Mini project, we learned how to determine a person's gender and age via a convulsive neural network (CNN), which receives 99.98% (women) and 99.84% (men) according to our facial databases. CNN's algorithm affects weight based on efficiency, classification speed, and processing speed.

To construct a full gender and age recognition system, the study may be extended to address recognition and task alignment utilising CNN-like structures. This approach is appropriate for real-time processing in contexts with restricted resources that require sophisticated hardware processing. With few resources, we were able to acquire the findings of our technique utilising data sets that were extremely straightforward to prepare and had a 98 percent accuracy.

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