Age and Gender Detection using Python

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ABSTRACT

In this paper, the author has worked on a technique for age and gender classification using python algorithm. Human identification and classification are being utilized in various field for a very long time. Fields like Government ID Cards, Verification procedures etc. We have already developed techniques like retina scan, iris scans, fingerprint and other sophisticated systems such as DNA fingerprinting to identify the individuals. Although these already built methods works efficiently, the hardware, software and human proficiency requirement are way too demanding for several simpler task which may or may not require a professional efficiency. Technique reported in this paper is simple and easy for human classification which can be performed using only a webcam and a decent computer system.

Keywords: Age Estimation, Gender Detection, Python Deep Learning, Convolutional Neural Network, Webcam

1. INTRODUCTION

Human Classification is an age-old procedure and being done in various fields and technology such as biometrics, forensics sciences, Image processing, Identification system, etc. With the development of Artificial Intelligence and techniques such as Neural Network and Deep Learning, it has become increasingly easier to classify human. These new technologies help identification, classification of Individuals without the need of another professional or Individual records. Also Being immensely fast, these technologies can classify millions of individuals way faster than a professional.

Human Facial Image Processing provides many clues and cues applicable to industries such as security, entertainment, etc [1]. Human Face can provide immense amount of information like their emotional state, slightest agreement or disagreement, irony or anger, etc. This is the reason why faces have been long research topic in psychology [2]. This data (or in our case digital data) is very valuable as they help recognition, selection or identification of individual according to the requirement.

Age and Gender Detection can alone provide a lot of information to places such as recruitment team of organizations, Verification of ID cards, example: Voter ID cards which millions of individual uses to cast their vote at the time of election, etc. Human Facial Image processing eases the task of finding ineligible or counterfeit individuals.

2. RESEARCH METHODOLOGY

Basic requirement for this project includes: Python 2.7-3.6, Open CV2, PyCharm Community Edition, Webcam (at least 2.0MP). An adequately equipped windows machine to run the project is required.

The Project uses Python Deep Learning to identify the gender and age of given face data accurately. Deep Learning belongs to the family of machine Learning. Deep Learning mimics the functionality of human cognitive thinking and acts as an Artificial Intelligence system. It can recognise objects, faces, speeches, characters from unstructured data sets.

The Algorithm designed is divided into four main parts: Input, Face Detection, Face Processing (Age and Gender classification) and output.
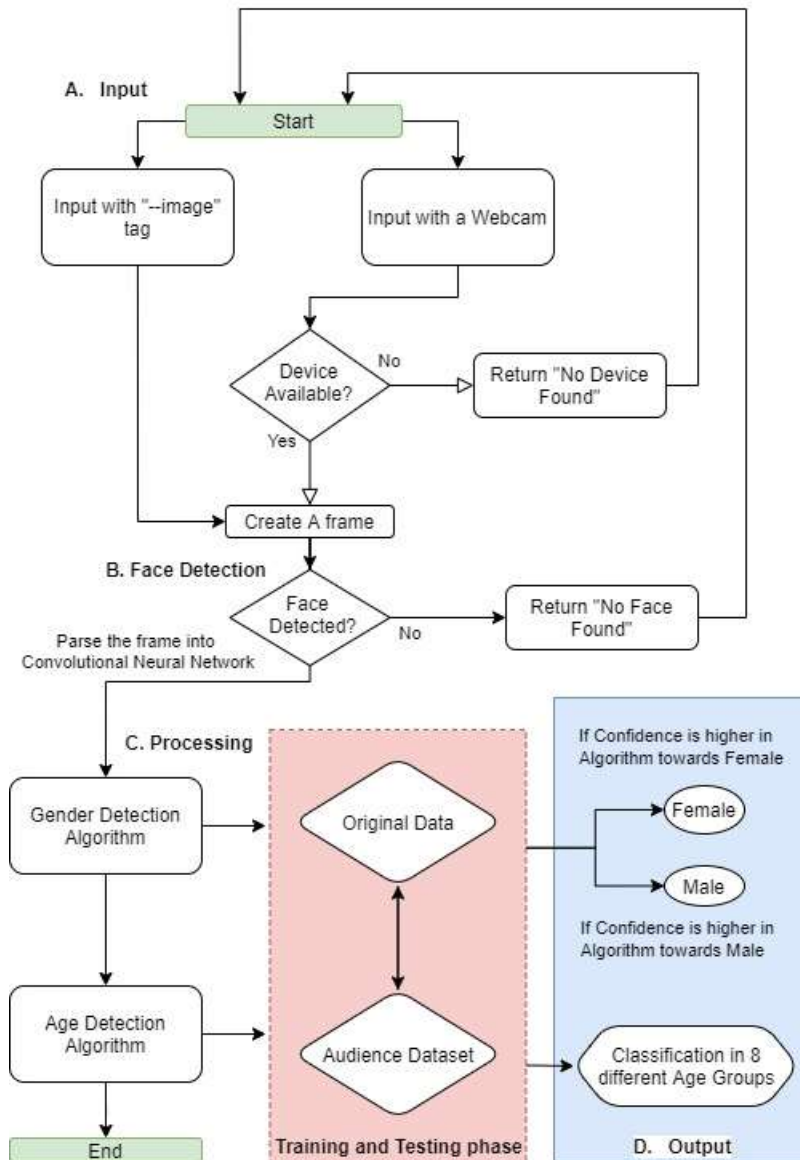
Fig. 1 Flowchart of the Algorithm.

2.1 Input

Main Focus of this design is to make the whole process easier and faster. In order to get the input fast there are two options to feed the data into the algorithm. First, User can use the system webcam or any other webcam camera device to directly take the live data. This is not only fast but user can get real-time output while using the webcam device. Second User can use "—image <name>.jpg" tag while initiating the algorithm. This method reads the jpeg file, process it and gives back the output. One key advantage of this method is user can process multiple files at once.

2.2 Face Detection

Face detection has a long research history. Yang et al [3] compared some prominent face detection algorithms in year 2002, But they did not use any prominent algorithms such as Haar Classifiers in their studies. Haar Classifier is one of the most prominent and accurate object detection approach described by P. Viola and M. Jones [4]. For any Face recognition system or facial image processing system to work properly face detection needs to be implemented properly. A thorough survey can be found in [5] There are several natural (lighting, pose angle, face marks) as well as digital (noise, glitches) variation imposed while detecting a face in a frame. Difficulties of human face recognition lie in the following two properties of human face as a pattern: (1) number of patterns, that is, faces to be classified is tremendous, maybe infinite; and (2) almost all patterns are very similar[5]. We have used audience dataset of all the different type of variations to fix this issue and increase the efficiency of the algorithm. The audience set will also act as benchmark for Gender Detection and Age Classification in out neural network. All the photos have been collected from Creative Common (CC) distribution license.

2.3 Face Processing

This process allows us to extract data from the detected face in previous step. Once the face has been detected data can be extracted. here we are only testing and benchmarking the gender and age of the faces but face can provide enough information to study emotion, ethnicity, heritage, biasness such as agreement/disagreement, mood, abnormality. These things are highly useful in various industries. Face is the most natural body part utilized for biometrics application [5].

Once the face has been detected in the frame. We can start its processing using Convolutional Neural Network or CNN. It is a type Deep Neural Network which is mostly used for Image processing and NLP. The CNN will carry out the testing training phase and will give different prediction. For Gender the prediction can be either of two: Male and Female. Age estimation is a multi-class problem in which the years are classified into classes. People with different ages have different facials, so it is difficult to gather the information accurately [6]. To make the process faster we have created age groups. The Age prediction can be either of these 8 groups: $(0 - 2)$, $(4 - 6)$, $(8 - 12)$, $(15 - 20)$, $(25 - 32)$, $(38 - 43)$, $(48 - 53)$ and $(60 - 100)$.

The Architecture here uses three convolutional layers each with different nodes and kernel sizes, specifically:

- 96 nodes with kernel size of 7
- 256 nodes with kernel size of 5
- 384 nodes with kernel size of 3

2.4 Output

It is the last part of the workflow. Here the Output is saved in .jpeg format if the input had image sourced in it. If the webcam is used the output will be overlaid in the video output from the webcam.

If the face is not detected in input frame the "No Face is detected" will be shown as an output. And no .jpeg output will be stored.

Fig.2 Output from The Project.

3. PROCEDURE

Since the technique is implemented, we can start testing it for its accuracy. The general procedure to be followed is

- Input the data.
- Create a frame.
- Detect the face.
- Classify the Gender.
- Classify the Age Group.
- Attach the result in the image.
- Output the image in specified location.

4. TEST RUN

To verify the efficiency of the technique we collected some of human face along with their mentioned ages when the photo was captured and fed them to the program. The performance can be judged using the chart below:
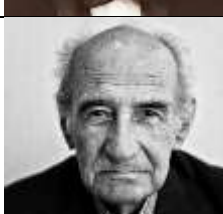
Input	Actual Age and Gender	Output		Result
	Gender: Male Age: 38 year	Gender: Male	Age Group: (34-48)	Both Age and Gender are correct.
	Gender: Female Age: 32 years	Gender: Female	Age Group: (22-34)	Both Age and Gender are correct.
	Gender: Female Age: 3 years	Gender: Female	Age Group: (4-6)	Gender is correct whereas original age doesn't lie in the predicted agr group.
	Gender: Male Age: 28 years	Gender: Male	Age Group: (22-34)	Both Age and Gender are correct.
	Gender: Male Age: 88 years	Gender: Male	Age Group: (60-100)	Both Age and Gender are correct.
	No human face in this frame	Gender: Female	Age Group: (8-12)	Detects a human face like object as a legit human face.

Fig 3. Test run using different sources.

The final result showed promising output with almost perfect result. The only place it faced problem was when human face like non-human object was provided as an input and since the no data for the non-human object was stored in training datasets it gave the inaccurate results.

5. KEY FEATURES

Main aim of this technique is to provide faster and cost-effective method of age and gender classification of human. Key Features of this model are:

- There is no need of high precision hardware or software. It can process the image directly through the camera device such as webcam. Although a better device will provide more efficient result.
- This technique is easy to use, it does not require a professional level knowledge. A normal computer knowledge is enough.
- It can process and store hundreds of faces along with the corresponding result without any lag or delay.

6. USE CASES

Several uses cases for this project includes the following:
- Identification of the target audience in marketing organisation.
- In Recruitment procedure, to verify legitimacy of the applicants.
- Verification of authentic person applying for government IDs.
- Classification of human resources in bulk.

7. CONCLUSION

"Human Age and gender classification" are two of the many important information gathering resource from and individual. Human faces provide enough data which may be used for many purposes. In order to reach the correct audience human age and gender classification is very essential. Here we tried to do the same process but with general equipment. The efficiency of the algorithm depends on several factor but the main motif of this project is being easy and faster while also being as accurate as possible.

Work is being done to the improve the efficiency of the algorithm. Some future improvements include discarding the face like non-human objects, more datasets for people belonging to different ethnic groups and more granular control over the workflow of the algorithm.

8. REFERENCES

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