A Survey on Facial Age Estimation Techniques

Vishnu Prasad Verma[1*], Dipti Verma[2]

[1,2]Dep. of computer science and Engineering, Vishwavidyalaya Engineering college, Lakhanpur Ambikapur(CG), India

Corresponding Author: vishnuprasadverma86@gmail.com, Tel.: +91-8959576336

Abstract— Age Estimation is predicting a person's age and is a very important attribute used for identity authentication. One of the major factors affecting the age estimation result is the identification of features of a person's face accurately. Age Estimation has several real-world applications, equivalent to security management, biometrics, client relationship management, recreation, and cosmetology. The foremost ordinarily used age estimation technique is regression based mostly as a result of it takes into consideration the interrelationship among the age values for face pictures. The current work is an overview of techniques employed previously for age estimation.

Keywords— Age Estimation, Forensics, Age based retrieval, Security, Surveillance, Label based learning, Label Distribution based learning.

I. INTRODUCTION

Person together with age, gender, expression, and so on. Facial age estimation has gained wide recognition in current years. They encompass electronic merchandising machines, forensic artwork, enjoyment, cosmetology, and so forth. even supposing the field of age estimation has grown lots, it's miles nonetheless challenging to estimate age because the manner of aging is stricken by elements like the exchange in form and length of the face, residing style, consuming habits, environment, and so on. Moreover, the presence of various types of scars due to surgery and other due to another medium can negatively have an effect on the accuracy of facial age estimation systems. Non-frontal head poses additionally have an effect on the accuracy of the output of the age detection process. Some of the popular actual international packages of facial age estimation techniques are:

A. Forensics
In forensics age estimation can be helpful for identifying the current age of a person based on previous age records which can be helpful for solving crimes committed many years back. As a simple exercise in forensics, modifications in the face because of age progression are projected in pixel by computerized structures or with the aid of expert artists to include age results. Automated structures age estimation can be used as serving hand for forensic artists to create face picture.

B. Age based retrieval for face photograph
Indexing within the database of face photographs may be executed on the premise of age. It's very useful when retrieval of photos is primarily based on age including discovering how many young adults prefer laptops over computers.

C. Security Based Services and Surveillance
The face is the most effortlessly biometric trait that can be utilized in safety structures to identify a user. Face popularity is being widely used to comfortable the personal structures/rooms from unauthorized customers. Time is the best barrier which hinders the high-quality security provided by means of face recognition structures due to the fact the face of consumer adjustments as it ages. This will be removed by combining facial age estimation with face recognition this is age-invariant face reputation structures. Now an afternoon's surveillance tracking is one of the most difficult jobs as explosive records are now easily on hand. Underage humans and minors may be warned from getting into wine shops and bars or from buying tobacco by using a tracking digital camera and the age estimation machine. Children can also be refused from getting access to grownup websites or watch restrained films by using the identical.
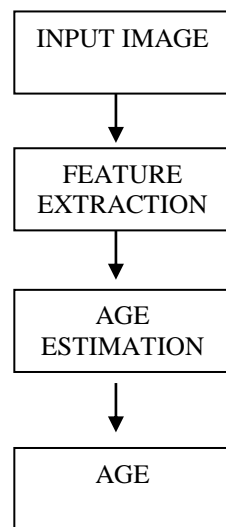
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Figure 1: Face age estimation process

II.   ISSUES IN FACIAL AGE ESTIMATION

Age estimation shares many troubles encountered in different typical face picture interpretation obligations inclusive of face detection, face recognition, expression and gender popularity. Facial look deformations resulting from one-of-a-kind expressions, inter-individual variant, lights version, face orientation and the presence of occlusions have a terrible impact on the overall performance on computerized age estimation. Foremost demanding situations are as mentioned below.

A. In positive instances differences in look among adjoining age corporations are negligible, inflicting difficulties in the procedure of age estimation. This hassle is escalated when managing mature subjects.

B. The rate of getting older and kind of age-related consequences vary for different walks of people. As an example, the wrinkles can be consistent between people of similar ages . As a result of the range of getting the old version, the use of the identical age estimation strategy for all subjects may not produce adequate performance. Numerous elements like race and genetic developments sought to affect the aging process. For that reason one of a kind age estimation processes may be required for different organizations of topics.

C. External elements have an impact on the fee and the getting older pattern adopted by means of a character affecting in that way the method of age estimation. Usual factors that have an effect on getting old styles consist of fitness situations, the way of life, psychology and deliberate attempts to intrude with the growing older process thru using anti-aging products or beauty surgical procedures.

D. The appropriate dataset is needed for accurate estimation of the age of the face. Appropriate datasets ought to include multiple pictures displaying the identical situation at exceptional a long time masking a huge age range. Due to the fact growing older is a type of facial variant that can't be controlled at once via humans, the gathering of such datasets calls for the use of pictures captured inside the past. Currently, publicly available morph database consists of only a few samples according to the subject while the FG-NET database includes pictures displaying considerable no n - getting the older related variant.

III.   LITREATURE SURVEY

A novel mastering scheme to take advantage of those weakly labeled records thru the deep convolutional neural networks (CNN) is proven. For each photo pair, Kullback-Leibler divergence applied for calculating the distribution of age difference data. Age is predicted when the entropy loss and the cross-entropy loss are applied on each image to make the distribution show off a single top value [1].

Some challenges in age estimation are the feel and shape variations are excessive for long periods like 20 y to 50 y, it's far hard to describe these versions. A number of the non-facial functions considered for age estimation are hair coloration, boldness, brow, and hair-fashion. Amassing equal individual's face photograph with special a long time is hard and not available publicly [2].

With the development of growing older, human faces indicate awesome modifications which include face size getting larger, face skin will become darker and wrinkly. The main aim of age estimation is to compute a person's exact age or age-organization primarily based on face attributes derived from a facial photograph [3].

A comparison is executed some of the techniques used within the age estimation based on face photographs. the maximum commonly used database is FG-net. The maximum generally used age estimation technique is regression based totally as it takes into consideration the interrelationship of some of the age values [4].

In another technique, the neural network that is Feed Forward based is used for using a combination of PCA and ICA algorithm for feature extraction and then recognition of faces [5].

One of the foremost problems in facial age estimation is that the studying algorithms cannot anticipate sufficient and entire schooling statistics. fortuitously, the faces at close a long time appearance pretty comparable on the grounds that growing old is a slow and clean system. Inspired by this statement, in place of considering each face image for instance with one

label (age), this paper regards every face image for example related to a label distribution. The label distribution covers a sure wide variety of sophistication labels, representing the diploma that every label describes the example. Through this manner, one face image can contribute to no longer most effective the mastering of its chronological age, however also the getting to know of its adjoining a while. IIS-Ltd and CPNN like algorithms are proposed to learn from such label distributions [6].

. Table1: Comparison between the related works.

S. No	Pre-processing	Features
1	. For each photo pair, Kullback-Leibler divergence is hired to embed the age difference data. The entropy loss and the cross entropy loss applied on every image to attain a single top value	to take advantage of those weakly labelled records thru the deep convolutional neural networks (CNNS) is proven
2	A number of the non-facial functions considered for age estimation is hair coloration, boldness, brow and hair-fashion is considered for facial age estimation.	It handles the challenge of the feel and shape variations are excessive for long periods like 20 y to 50 y.
3	With the development of growing older, human faces indicates awesome modifications which include face size getting larger, face skin will become darker and wrinkly.	The main aim of age estimation is to compute a person's exact age or age-organization primarily based on face attributes derived from a facial photograph
4	According to the paper the maximum generally used age estimation technique is regression based totally as it takes under consideration the interrelationship some of the age values.	A comparison is executed some of the techniques used within the age estimation based on face photographs. The maximum commonly used database is fg-net.
5	Uses neural network that is Feed Forward based for using a combination of PCA and ICA algorithm for feature extraction and then recognition of faces.	Neural networks if trained properly can be used to predict the age of person in more accurate manner.
6	One of the foremost problems in facial age estimation is that the studying algorithms cannot	. Inspired through this statement, in place of considering each face image for instance with

anticipate sufficient and entire schooling statistics. fortuitously, the faces at close a long time appearance pretty comparable on the grounds that growing old is a slow and clean system. | one label (age), this paper regards every face image for example related to a label distribution.

IV. LABEL BASED DISTRIBUTION LEARNING

A gaining knowledge of manner is basically constructing a mapping from the instances to the labels. Inside the existing gaining knowledge of paradigms, there are especially instances of label prototypes:

- A single label is assigned to this instance
- Multiple labels are assigned to this instance.

Single-label based knowledge accumulation assumes that all the instances inside the training set are labeled within the first manner. Multi-label based knowledge accumulation allows the schooling instances to be categorized within the second way. Accordingly, Multi-label can cope with the ambiguous case where one instance belongs to multiple classes (labels). Normally talking, present-day Multi-label algorithms were developed with two strategies. The first method is requirement transformation, where the fundamental concept is to convert the Multi-Label based problems into one or extra Single Label based tasks. For example, the Multi-Label based problem might be transformed into binary type problems, a label ranking problem, or an ensemble learning problem. The second approach is the algorithm model, wherein the primary concept is to extend particular Single Label based algorithms to address multi-label records.

Label distribution based learning is a popular studying framework, which assigns to an instance a distribution over a collection of labels in preference to a single label or multiple labels. Label distribution tends to learn the relative significance of every label concerned in the description of an example, i.e., a distribution over the set of labels. This type of mastering method is suitable for plenty of real-world issues, that have label ambiguity. An example of the instance is facial age estimation. Even human beings can't predict the ideal age from a single facial photo. They'll say that the individual is probably in one age group and less probably to be in another. Subsequently, it's more natural to assign a distribution of age labels to every facial photo rather than using a single age label. Many Label distribution methods anticipate the label distribution can be represented by way of the maximum entropy model and learn it by means of optimizing a power characteristic based on the version. Some different Label Distribution techniques expand the existing studying algorithms, e.g., through boosting and support vector regression, to cope with label distributions, which

keep away from making this assumption, however, have barriers in representation learning, e.g., they do not examine deep functions in an end-to-end way.

IV. CONCLUSION AND FUTURE SCOPE

Developing techniques for efficient estimation of age has gained a lot of momentum in recent years. Human age estimation on the basis of face images has wide potential practical applications for example in demographic data collection for supermarkets or other public areas. Most of the problems associated with the face like facial features detection on frontal and non-frontal pose on the large volume of facial databases have been resolved in previous works. The methods for efficient age estimation can be either classification based or regression-based. Age labeled image databases can be used for both methods. The current paper focuses on conducting a survey on face age estimation techniques for both classification and regression-based. Future work aims to develop a technique which can be a hybrid of both of the above-discussed methods. The future work will integrate the facial component features along with labeled distribution method in order to improve the age estimation accuracy.
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Authors Profile

Vishnu Prasad Verma received his BE degree from Vishwavidyalaya Engineering College, Lakhanpur, Surguja University, Ambikapur, Chhattisgarh in year 2016. He is currently persuing M.Tech from Vishwavidyalaya Engineering College, Lakhanpur, Surguja University, Ambikapur. His research interest includes Image Processing.

Dipti Verma working as Assistant Professor in Department of Computer Science and Engineering, Vishwavidyalaya Engineering College, Lakhanpur, Surguja University, Ambikapur. She has 10 years of teaching experience.