



AGE AND GENDER CLASSIFICATION USING DEEP LEARNING WITH IMAGES

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ABSTRACT

Real-time age and gender detection from facial photos has received substantial interest in today's era of advanced computer vision and deep learning due to its wide range of applications, ranging from tailored user experiences to security systems. Using Convolutional Neural Networks (CNNs), this study proposes a robust and efficient framework for real-time age and gender recognition. To extract discriminative features from input facial photos, our proposed approach employs cutting-edge CNN architectures that have been pretrained on large-scale facial datasets. The network learns hierarchical representations that are critical for age and gender estimation using a combination of convolutional and pooling layers. Unlike older methods that need human feature engineering, our CNN-based solution learns and adapts to the subtle changes in facial photos. We optimize our model for speed and accuracy, employing approaches such as model quantization and efficient network designs, to assure real-time performance. We also build the system on hardware accelerators, which allows it to be deployed on edge devices and real-time video streams. Furthermore, our system performs in real time on ordinary hardware, making it appropriate for a wide range of applications such as smart surveillance, targeted marketing, and human-computer interaction. In conclusion, our research provides a comprehensive solution for real-time age and gender recognition using CNNs, bridging the gap between cutting-edge accuracy and practical usability. This work advances the field of computer vision by providing robust and efficient demographic estimation from facial photos in real-time circumstances.

Keyword: Age Classification, Gender Reorganization, Convolutional Neural Networks (CNN), Computer Vision.

INTRODUCTION

Human age and gender are crucial biometric characteristics for human identity. Predicting a person's age and gender entails recognizing their face in a photograph, deciding whether they are male or female, and calculating their age. These characteristics are important in our social interactions and have grown in relevance with the rise of social networks and social media. Recognizing face traits in real-time has emerged as an exciting research subject, with recent studies demonstrating that harnessing

aging characteristics learnt from massive volumes of data leads to considerable advances in facial image-based age prediction. In this paper, we describe a deep learning solution for age and gender prediction from a single facial image that is based on a lightweight Convolutional Neural Network (CNN) model. In addition, for face identification, we use Haar cascades, a common feature-based approach that aids in precisely localizing faces in images. We mix three datasets with age and gender labels to provide a large and diverse training dataset for our CNN model. The availability of tools such as OpenCV, as well as advances in deep multi-task learning algorithms, contributes to the creation of accurate and efficient age and gender classification systems. Our model seeks to give real-time age estimation and gender prediction from facial photos by harnessing the capability of CNNs and applying Haar cascades for face detection.

LITERATURE SURVEY

The purpose of this paper is to summarize the In the past few years, there have been several attempts to estimate the individual traits: age and gender from the facial images. A variety of features consisting both of facial shape and textures have been used by the researchers for the estimation of age and gender from facial images. Some of those features are: mean pixel values of channels, energy and entropy of filtered images, Histogram of Oriented Gradients (HOG) etc. Simple features such as density of edges obtained from an image using an edge detector have also been applied. Reference [19] has proposed a 5stage method which calculates distances among the global features and some hybrid ratios. Classification is performed using thresholds for the two genders from the ratios. For the FGNET dataset, the method achieves an accuracy of 95% for the gender recognition task and an accuracy of 79.31% for class wise prediction of ages i.e., groups of 1 to 12 years, 13 to 40 years and 41 to 80 years. Reference [3] has proposed a supervised appearance model (sAM) that improves on active appearance model (AAM) by replacing PCA with partial least-squares regression. The sAM model is used as a feature extractor for age and gender estimation from the facial images. Reference [34] have presented a study investigating the effects of image preprocessing, model initialization and architecture choice on identification of age and gender from facial images. The study has also visualized model's prediction strategies in given preprocessing conditions using the Layer-wise Relevance Propagation (LRP) algorithm. An accuracy of 92.6% is achieved for the gender classification task and 62.8% for the age estimation task on the Adience dataset. Reference [43] has proposed an architecture that makes a gradual refining of the feature through three feature constraint stages. Every stage of the algorithm involves continuous update of the feature center of its corresponding age range, and minimization of the distance between each age feature and feature center of the corresponding age range by means of feature constraint.

3. PROPOSED METHOD

In this project, the proposed system centers on the development of a software cost estimation model using machine learning techniques with effort estimation. The objective is to enhance the accuracy and reliability of cost estimation in software projects, particularly during the early stages of development. The system undertakes a thorough evaluation of various machine learning algorithms, random forest, Decision tree, Support vector machine assessing their efficacy in predicting software costs with precision.

To accomplish this, the project utilizes publicly available datasets, sourced from reputable repositories like the Promise repository. These datasets contain real-world software engineering data, providing a solid foundation for training and testing the machine learning models. The system systematically applies different algorithms, including Random Forest, Decision Tree, Linear Regression among others, to analyze and predict software costs.

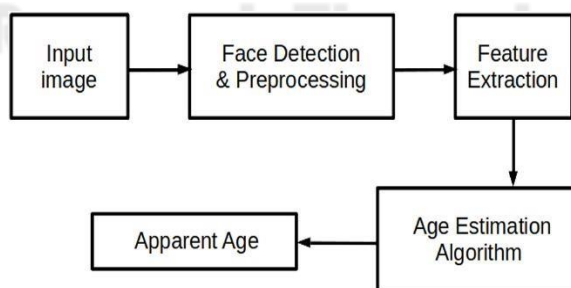


Figure 1: System Architecture

4. MODULES

4.1 RANDOM FOREST

Random Forest is an ensemble learning method that can be used for both classification and regression tasks. It is a type of decision tree algorithm that creates multiple decision trees, also known as "forests", and combines their predictions to make a final decision. The basic idea behind Random Forest is to generate multiple decision trees, each built on a different subset of the data, and then average the predictions of all the trees to make a final prediction. This helps to reduce the overfitting that can occur with single decision trees, and also improves the overall accuracy of the model. Random Forest offers insights into feature importance, shedding light on the variables that wield the greatest influence across the ensemble.

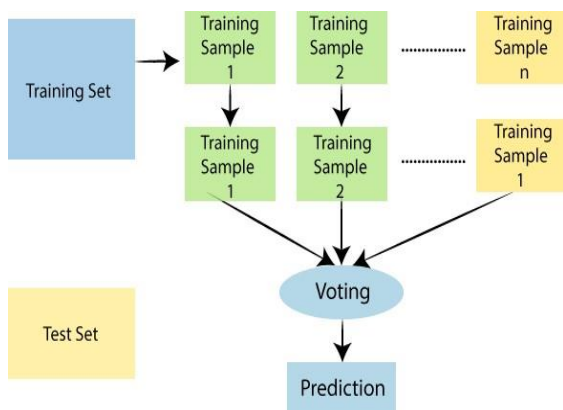


Figure 4.1: Random Forest Algorithm

4.2 SUPPORT VECTOR MACHINE(SVM)

A support vector machine (SVM) handles classification and regression issues. In machine learning, a classifier is a model built to make inferences about a class from additional features. The term "classification" refers to the act of labeling an unlabeled record (data) with a unique value. An SVM variant is an SVR. The regression issues are transformed into classification issues. A linear decision surface (known as a hyperplane) divides two segments of vectors in the SVM training process. These are called as support vectors.

4.3 CNN ALGORITHM

A Convolutional Neural Network (ConvNet/CNN) is a sophisticated Deep Learning technique for image processing and classification. It takes an input image, gives weights and biases to different features or objects in the image, and can discriminate between them. Because of their excellent accuracy, CNNs have grown in favour for picture classification and identification applications. A CNN's architecture is hierarchical, similar to a funnel, in which the network successively takes and integrates characteristics from the input image. It culminates in a fully-connected layer in which all neurons are interconnected and process the final output.

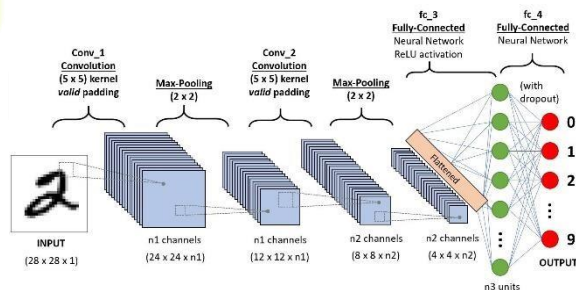


Figure 4.1: CNN Algorithm

4.4 XGBOOST ALGORITHM

Boost (eXtreme Gradient Boosting) is an open-source library for gradient boosting. It is designed to be efficient and scalable, and it has been widely used in machine learning competitions and industry applications.

Boost uses a technique called gradient boosting to improve the performance of decision trees. It builds multiple decision trees and combines their predictions to make a final prediction. In this algorithm, decision trees are created in sequential form. Weights play an important role in Boost. Weights are assigned to all the independent variables which are then fed into the decision tree which predicts results. Weight of variables predicted wrong by the tree is increased and these the variables are then fed to the second decision tree. These individual classifiers/predictors then assemble to give a strong and more precise model.

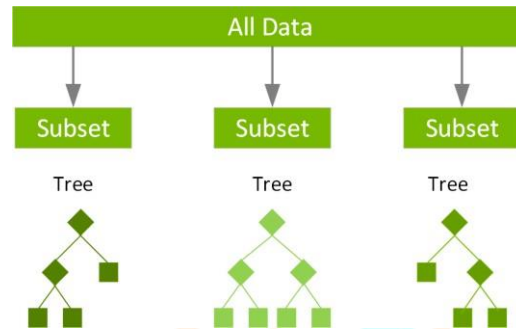


Figure 4.4: Boost Algorithm (Level-Wise tree growth)

RESULT

In this study, machine learning algorithms have been conducted with our proposed dataset. Firstly, the preprocessed dataset has been separated into a training and a testing set. The training set has been used to train the models, and the testing set has been used to test the performance of the models with our dataset. In this experiment, we have used a total of 80% dataset for training, and the rest 20% dataset for testing the models. The parameter values that have been examined for each algorithm as shown in below confusion matrix figures which shows true and false positive rate and figure 5 shows accuracy of different algorithms which shows among all the algorithms Random Forest forest will give more accurate Estimation.

```
1/1 [-----] - 0s 21ms/step
Predicted Gender: Female | Predicted Age: 22
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Figure 1: Age and Gender prediction of age range

20-40

CONCLUSION

Identifying the age and gender of the individuals we come across in our daily lives has an important role in our social lives too. For example, languages used to salute for men and women are very often different, and the words used to address the elders and the young are different too. We human beings are able to evaluate the individual's age and gender just from their facial appearances. properly interpreted and communicated to patients, caregivers, and [healthcare professionals.

A thorough literature review of various Machine Learning and Deep Learning techniques is used to discuss all of the techniques and methods that have already been implemented in this field.

Facial images have become increasingly important in recent decades, owing primarily to their promising real-world applications in a variety of emerging fields. The proposed system is capable of classifying gender as either male or female and predicting age from 0 to 80.

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