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Face Landmark Detection

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Abstract: *Based on birthplace or nation of origin, it is possible to distinguish the variations in facial form. This initiative makes an effort to address the issue of categorising people's ethnicity based on their visual traits. The five main ethnic groups that this project can identify are White, Black, Asian, Indian, and Others. To accomplish this, a CNN model is first trained using a set of face photos that include the x- and y-coordinates of important facial landmarks to predict these coordinates in a given image.*

Keywords: *CNN, Deep Learning.*

I. INTRODUCTION

Face examination is one of the most concentrated on research point in the field of PC vision and example acknowledgment for the beyond couple of many years. Despite the fact that a person's face conveys a variety of demographic information, such as their gender, age, and ethnicity, ethnicity remains one of the fundamental and invariant characteristics that, like age and gender, cannot be easily disguised. Therefore, grouping people according to age and gender would not only make the issue more complicated, but it would also produce incorrect results. At security checkpoints, ethnicity classification is therefore a crucial feature of various video surveillance systems. Besides, this characterization proclamation has expected application in picture search question where earlier information on race would limit the pursuit space in the data set, accordingly working on the cycle. In this work, five ethnic classes have been thought of: Asian,Black,White,Indian, and others. because people in the same category are likely to share similar characteristics. In a similar vein, individuals of various ethnic groups will have characteristics that set them apart. We were able to identify and categorize each of these categories in accordance with the value that sets them apart thanks to this concept.

II.PROPOSED SYSTEM

Convolutional Neural Networks (CNNs) with pre-trained models have not been fully investigated in some studies, which may have resulted in less accurate results. This initiative makes an effort to address the issue of categorising people's ethnicity based on their visual traits. The suggested system uses CNN to determine a person's ethnicity based on their facial traits. The five main ethnic groups that this project can identify are White, Black, Asian, Indian, and Others. This is accomplished by teaching a CNN model to anticipate the key face features in a given image.

.III. METHODOLOGY

Deep learning was used for image classification with good results. For this experiment, I used this pre-trained model of his 16-layer architecture. Due to the limited computation available, this model was pre-trained on various sites. This pre-trained model was used to extract features from training and test examples. During training, the input images are passed through a convolutional layer stack with 3*3 sized filters and a Relu activation function. The VGGNet used has 13 layers of convolutions. Pooling is done via a window size of 2*2, step 2 max pool layer. This convolutional layer stack is followed by three fully connected layers.

The first two have 4096 channels and the last has his 3 channels, each representing an ethnic class. The network was compiled using the categorical cross entropy of the loss function (with SoftMax output) and Nesterov momentum was used. The learning rate was set to 2.5e-4 and all but the last fully connected slice were frozen (trained at about 1/10th of the initial learning rate). Once all these parameters are initialized, this network is used for feature extraction. Training and testing were then carried out.

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IV. SYSTEM ARCHITECTURE

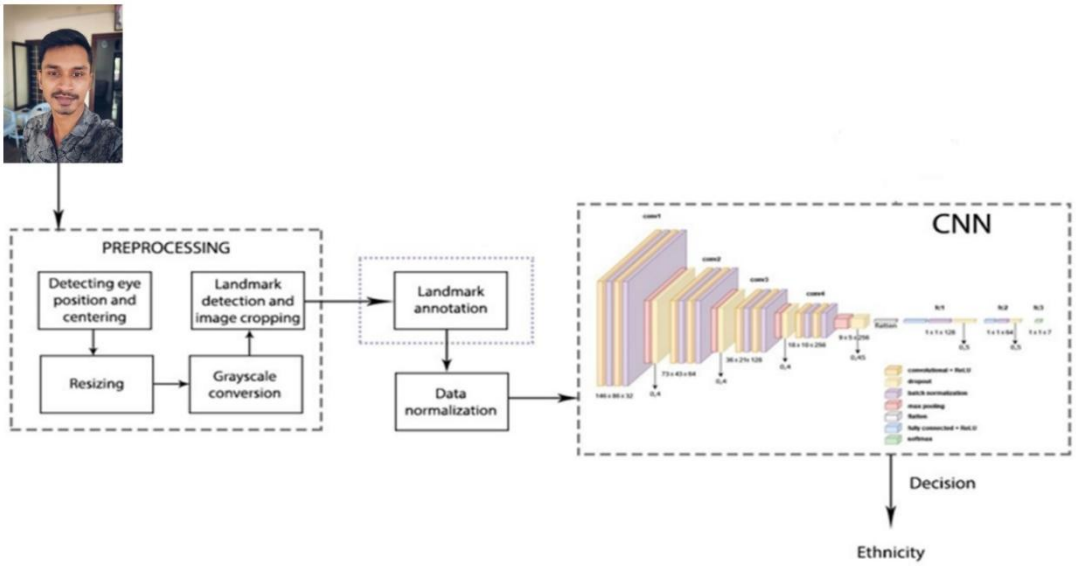

Figure 1: System Architecture

The approach proposed in this project consists of several phases. First, all training images are pre-processed. After pre-processing, the cropped images are used to create a filtered dataset. Here, the landmark ethnicity classification approach proceeds to the landmark annotation step, after which a new dataset containing the annotated landmarks is created. Ethnic classification approaches that do not use plotted landmarks omit this step and normalize and enrich the data. Steps omitted in the approach without marked landmarks are marked with purple dotted lines in Figure 1. The normalized and augmented images are used for training the CNN. Testing is conducted after CNN training and validation. The first part is to input images that will be pre-processed in the same way as the training images. Next, we annotate the landmarks (plotted landmarks approach only), normalize the images, and the trained CNN makes ethnicity predictions. Based on previous research and observations by studying other projects where landmarks are less commonly used in combination with deep neural networks, one of the objectives of this project was to explore whether representations of landmarks could contribute to ethnic classification models.

Data Pre-processing

The complete pre-processing stage consists of five steps.

(1) eye detection and face centering
(2) resizing the image
(3) grayscale conversion
(4) landmark detection
(5) image cropping

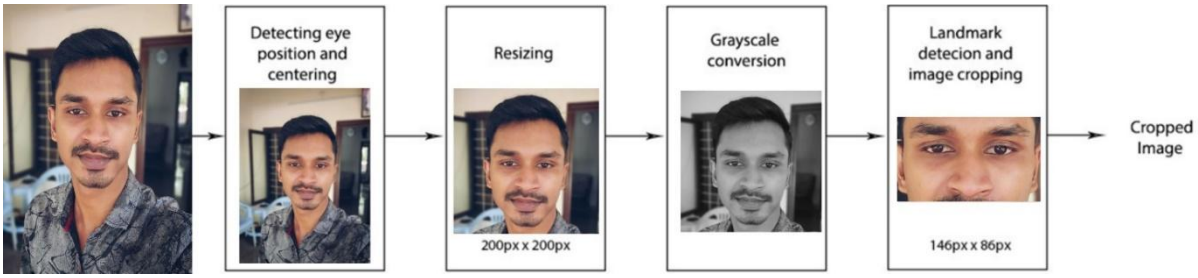

Figure 2: Data Pre-processing

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To facilitate image processing, all images were first centered based on the eye positions detected in the images and scaled down to 200 × 200 pixels. Landmark detector and predictor work only on grayscale images, so all images are first converted to grayscale. For each face detected by the detector, the predictor detects her 68 landmarks. We used histograms of directional gradients (HOG) and linear support vector machines (SVM) to detect landmarks. HOG is created by dividing an image into multiple parts or cells, and a histogram of aligned pixel gradients is computed. The combination of cell histograms represents a histogram of the aligned gradients of the entire image. The SVM applied to the final histogram of the system separates it by viewing the incoming data as vectors and trying to split them into two classes at one level, which is usually very complicated.

The goal of SVM is to compute which of these hyperplanes separates the data with the least error. The system learns classification by computing such hyperplanes for each image in a given dataset. Based on this method, the face and all regions of interest on the face are recognized. As this study focuses on ethnic classification based on the central part of the face, all images used for training and validation were cropped to include only specific parts of the face. The result is a rather unusual 146 x 86-pixel image format, which has proven satisfactory for the images of the selected dataset. These images are two-thirds smaller, reducing memory usage and computational complexity. The entire network consists of 4 VGG blocks, a smoothing layer, a fully connected ANN with batch normalization and dropout, and a SoftMax layer.

Each VGG block is a sequence of the following elements:

(i) a convolutional layer,
(ii) an activation function (Rectified Linear Unit),
(iii) batch normalization;
(iv) a pooling layer (max pooling) and
(v) dropout layer.

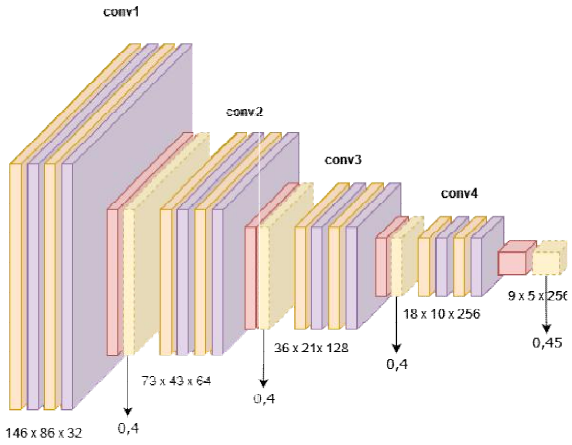

Figure 3: Architecture of CNN

V. CONCLUSION

This project tackles the problem of classifying people into ethnic groups based on facial images. Results of ethnic classification with and without marked landmarks were analyzed and compared. To determine the initial ability of landmarks in ethnic classification, previous studies on the subject that showed sufficient differences in the characteristic traits of individuals between different ethnic classes to distinguish them were reviewed. Therefore, in view of the observed increasing trend of using neural networks to solve this and related problems, neural networks were chosen as the main research impetus for this project. I was.

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The scientific contribution of this project is evident in the development of a new CNN to classify ethnicity into her five races (Caucasian, Black, Asian, Indian, etc.) using only the central part of the face. It has been observed that the facial regions around the nose and eyes contain most of the visual data for successful ethnic classification. The developed CNN was tested against a dataset (UTKFace) and the results were compared with existing systems, showing improved accuracy while reducing pre-processing and training time. Landmarks were applied to a deep neural network (CNN). This did not make a big difference in the results from the CNN network, but only increased the time and resources spent on image pre-processing, training, and testing the CNN.

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