

Face Detection Using Skin Color in Image by Neural Networks

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Abstract—Face detection is the challenging problems in the image processing. The approach relies on skin-based color features derived from two dimensional Discrete Cosine Transfer (DCT) and neural networks, which can be used to identify faces by taking use of skin color from DCT coefficient of Cb and Cr feature vectors. This system contains the skin color which is the important feature of faces for detection, and then the skin face candidate is examined by using the neural networks, which study from the feature of faces to classify whether the original image includes a face or not. The processing is depends on normalization and Discrete Cosine Transfer. The classification based on neural networks approach. The experiment outputs on upright frontal color face images from the internet show an excellent detection rate.

Face detection is an active area of research spanning disciplines such as image processing, pattern recognition and computer vision. Face detection and recognition are preliminary steps to wide of applications such as personal identity, video surveillance etc.

Keywords—face detection, skin color segmentation, compressed domain, neural networks.

I. Introduction

Face detection is computer technology which is used in a variety of applications that identifies human faces in digital images. Face detection refers to the psychological process by which humans locate and attend to faces in a visual scene. Face detection is an active area of research spanning disciplines such as image processing, pattern recognition and computer vision. Face detection and recognition are the preliminary steps to improve the applications such as personal identity, video surveillance. The detection efficiency influences the performance of these systems, there are various approaches of face detection, which divided into four categories (i) knowledge based method (ii) feature based method (iii) template matching method (iv) appearance based method. [1] [2]

In the compressed domain chrominance, shape and DCT information coefficient was merged by Wang and Chang to give high-speed face detection without any decoding of the compressed video image. In the compressed domain chrominance, shape and DCT information coefficient was combined by Wang and Chang to get high-speed face detection without decoding of the compressed video image. [3]

The proposed technique derived from, in their works a direct access content and extraction features in compressed domain instead of pixel domain. The algorithm do the work directly on the DCT coefficient parameters, DCT coefficient as a features based compression reduce spatial redundancy and takes the compact information about the patterns .color information is used as the main detection clues, a skin color model is generated in the level of ycbcr color space .The reason for selecting S Cb and Cr Color space that there is no information related to luminance, classification using only pixel chrominance, skin segmentation may become much robust to lighting variations if pixel luminance is discarded and speed up the calculation in detecting the skin face regions. [4]

II. FACE DETECTION IN IMAGE

There are many techniques for face detection in image which are classified into four categories

- Knowledge based method:
  It depends upon the rules related to human facial features .It is easy to come up with simple rules to elaborate the features of the face and their relationships. For example,
face often appears in an image with two eyes that are similar to each other, a nose, and a mouth, and features relative distance and position represent relationships between features. After detecting features of face, verification is done to reduce wrong detection. This approach is good for frontal image; the difficulty of that is how to translate human knowledge into known rules and to detect faces in different poses.

- **Image Based method:**

  In this type of approach, there is a predefined standard face pattern which is used to match with the segments in the image to evaluate whether they are faces or not. It uses training algorithms to classify parts into face or non-face classes. Image-based techniques depend on multi-resolution window scanning to find faces, so these techniques have more detection rates but slower than the feature-based techniques. Eigen-faces and neural networks are examples of image-based techniques. This approach has advantage of being simple to implement, but it cannot properly deal with variation in scale, pose and shape.

- **Features Based method:**

  This approach depends upon extraction of facial features that are not affected by variations in lighting conditions, pose, and other factors. These methods are divided according to the extracted features. Feature-based techniques based on feature derivation and analysis to get the essential knowledge about faces. Features may be skin color, face shape, or facial features like eyes, nose, etc.... Features based methods are referred for real time systems where the multi-resolution window scanning is used by image based methods are not applicable. Human skin color is an effective feature used to find faces, though different people have different skin colors, several studies have shown that the basic difference based upon their intensities rather than their chrominance. Texture of the human faces have a special texture that can be used to separate them from the different objects. Facial Features method depends on detecting features of the face. Some users uses the edges to detect the features of the face, and then grouping the edges. Some others use the blobs and the streaks instead of edges. For example, the face model contains two dark blobs and three light blobs to represent eyes, cheekbones, and nose.

  The model uses streaks to show the outlines of the faces like, eyebrows, and lips. Multiple Features methods are used for several combined facial features to show or detect faces. First find the face by using features like skin color, size and shape and then verifying these candidates using detailed features such as eye brows, nose, and hair. [1]

- **Template Matching method:**

  Template matching methods is use for the correlation between pattern in the input image and stored standard patterns of a whole face or face features to identify the presence of a face or face features. Predefined templates and deformable templates can be used.

### III. FACE DETECTION ALGORITHMS

Information of the skin color in the color image is a very popular and most useful technique for face detection. The important advantage of this method is simplicity of the skin detection rules which leads to construction of a very rapid classifier. We can use color related information as a special feature to identify a person’s face in an image because human faces have a special color division that varies significantly, although not entirely, from those of the background objects. Previous studies have found that pixels belongs to skin region exhibit similar chrominance components within and across different human faces. In the YCbCr color space, chrominance components are represented by Cb and Cr values. Thus, skin color model can be identified from these values. By taking use of threshold techniques, skin color pixels are evaluated by the presence of a certain set of Cb and Cr values which corresponds to the respective ranges of Rcb and Rcr values of skin color. Otherwise, the pixel is divided as non skin color. The system being designed into three main categories, preprocessing, segmentation, classification using neural networks.

![Fig.1 The proposed system of Face detection](image)

**A. PRE-PROCESSING**

In real, processing of skin color is faster than other facial features, collecting a data set of skin face by cropping or cutting manually the image of skin face and non-skin face to get a dataset of face and non-face. Different people have different skin colors, while the difference lies mostly in the color intensity not in chrominance color itself. Literature survey shows that YCbCr color space is one of the successful color spaces in segmenting skin color accurately. Selecting the suitable color space to the model skin color and a void variation of lighting condition Cb and Cr Color space. Extract DCT coefficient features from Cb and Cr blocks.

**B. SEGMENTATION SKIN COLOR**
Skin color related information is very important features for many researches; however the accurate result of the skin color detection is important for face detection. In this paper we convert the image from RGB to ycbcr where RGB is sensitive to the variance of intensity. Many skin detection methods ignore the luminance component of the color space, to get independent model of the differences in skin appearance that may arise from the difference of human race, and to reduce the space dimension. After collecting the different human faces and analyzing the histogram distribution sample skin color values of the chrominance component to represent the likelihood of the pixel belonging to the skin region. It was found that the chrominance component of the skin color falls in the certain range. X is skin color, if its projection on the Cb and Cr plane is inside predetermined rectangle $Cb \in Rcb$ and $Cr \in Rcr$ i.e., $r1 \ 2 \ C \leq C \leq C \ b1 \ b2 \ C \leq C$ .where $cb \ r \ C \ b1 \ C \ b2 \ C$ and $Rcr \ r1 \ C \ r2 \ C$ , which are found experimentally which is used to eliminate quickly non-skin face color and also to improve the segmentation of skin color regions. [1][5]

C. FEATURE EXTRACTION

Discrete cosine transform is widely used in many application and mainly used in the compressed data domain, and forms the basis well known JPEG image compression format. Jiang el.al introduced a simple less cost and fast algorithms that extract dominant color features directly from DCT rather than in the pixel domain. The derived DCT Coefficient can be used as type of the signature which might be useful for recognition task, such as facial expression recognition. The proposed technique is derived from the system calculates the 2D-DCT for each cropped skin block coming out of the previous stage. This outputs in a matrix of 1 $\times$ 48 coefficients of both Cb and Cr color space components in the processed image block. Which are these values is taken to construct the feature vector. Empirically, the upper left corner of 2D-DCT matrix consists of the most important values, because they corresponds to low-frequency, however the upper most coefficient is called DC and it corresponds to average light intensity of the block. The others are called AC, and those coefficients provides useful information about the texture detail in the blocks. For each block we use the DC’s and the first three zig zag order AC’s as a set of 1 $\times$ 4 vector coefficients.[6][7]

D. CLASSIFICATION

Neural networks are often used for face detection, Rowley, Baluja, Kanade proposed a face detection methods are based on neural networks, that could be discriminate between face and non face on large dataset images. In our system, we use (MLP) multi layer perception back propagation neural networks so that to train data set and classify features that are extracted by taking use of DCT (Discreet Cosine Transfer coefficient ) after divided into blocks of size 8x8 pixels. Training using the vector obtained from 18X27 training data set of 8x 8 pixel block for true oval face may usually guarantees that only pixels the face are used as input to neural networks, however, to produce an output of 0.9 for the skin face and 0.1 for the non-skin face after repeatedly presented input samples and desired targets, compared the result with the desired and measuring the error and adjusting the weights until correct output for every input. The main advantage of choosing Back propagation neural networks the simplicity and capability in supervised pattern matching.[8][9]

IV. CONCLUSIONS

This paper proposes new algorithm for face detection in the compressed domain , extracted DCT coefficient vector features after doing segmentation a face skin candidate using skin color information on both Cb Cr color space, along with the backprobagation neural networks classifier. We have divided the problems into three stages pre-processing, segmentation , and classification with the help of backprobagation neural networks. The system has been tested on a data set of upright frontal color face images from the internet and achieved excellent detection rate.These methods used as a future work, will improve the detection of faces in compressed images to be use for the face image retrieval based on skin color and also we may split the features DC’s and AC’s and feed it as two inputs to the neural networks. However the system proposed can be used as first step to face recognition.

References


