Face Detection, Extraction and Swapping on Mobile Devices

Prof. Balkhande Balasaheb W.[1], Prince Satapathi[2], Muktesh Shinde[3], Ravi Yadav[4]
Department of Computer Engineering
[1,2,3,4] Bharati Vidyapeeth College of Engineering, Navi Mumbai

Abstract- *At one in each of the foremost roaring application of images analysis and understanding, face recognition has recently received vital attention. It brings along the promise of assorted biometric systems, that conceive to tie identity to at least one by one distinctive choices of the body, and thus the tons of acquainted with usefulness of visual investigation systems. The Face Swap rule uses Viola-Jones face detection, Active type Model fitting, and Laplacian Pyramids among various ways to search out faces in a very image and swap them whereas maintaining a natural and realistic look.*

Keywords- Face Recognition Technology (FRT), Principal Component Analysis (PCA), Linear Discriminant Analysis (LDA), Elastic Bunch Graph Matching (EBGM).

I. INTRODUCTION

The machine model not alone contribute to theoretical insights but place along to many wise applications like automatic crowd investigating, access management, quite human pc interface (HCI), content based totally image management, criminal identification therefore on. many industrial systems for still face recognition square measure presently available. Recently, necessary analysis efforts unit of measurement targeted on video-based face modelling/tracking, recognition and system integration. New databases unit of measuring created and evaluations of recognition techniques exploitation these databases unit of measuring appointed.

II. FACE RECOGNITION ALGORITHMS

PRINCIPAL COMPONENT ANALYSIS (PCA)

It is a applied math approach used for reducing the quantity of variables in face recognition. It involves the extracting the foremost relevant info (feature) contained within the pictures (face). during this method, each image within the coaching set may be pictured as a linear combination of weighted eigenvectors referred to as as "Eigenfaces" . These chemist vectors square measure obtained from variance matrix of a coaching image set referred to as basis operate.

The weights square measure seen once selecting a bunch of most relevant Eigenfaces. Recognition is performed by ventricose a current image (test image) onto the set spanned by the eigenfaces therefore classification is finished by distance live ways that like geometrician distance.

INDEPENDENT COMPONENT ANALYSIS (ICA)

Independent component Analysis (ICA) might be a strategy for locating underlying factors or parts from variable (multidimensional) mathematics info.

What distinguishes ICA from alternative ways is that, it's for part that area unit each statistically freelance and non guassian. The ICA is analogous to blind supply separation drawback that boils all the way down to finding a linear illustration within which the elements area unit statically freelance. The comparison of face recognition victimisation PCA and ICA on FERET info with completely different classifiers were mentioned and located that the ICA had better recognition rate as compared with PCA with statistically freelance basis pictures and conjointly with statistically freelance coefficients.

LINEAR DISCRIMINANT ANALYSIS (LDA)

Linear Discriminant Analysis (LDA) finds the vectors among the underlying space that best discriminate among classes. For all samples of all categories the between-class scatter matrix SB and therefore the within-class scatter matrix southwest area unit outlined. The goal is to maximize SB while minimizing southwest, in different words, maximize the ratiodet|SB|/det|SW|. This magnitude relation is maximized once the column vectors of the projection matrix area unit the eigenvectors of (SW^-1 × SB). LDA may be a powerful face recognition technique that overcomes the limitation of Principal component analysis technique by applying the linear discriminant criterion. This criterion tries to maximize the magnitude relation of the determinant of the between-class scatter matrix of the projected samples to the determinant of the among category scatter matrix of the projected samples. Linear discriminant cluster photos of the

same class and separates photos of assorted classes of the pictures.

ELASTIC BUNCH GRAPH MATCHING (EBGM)

All human faces share a similar topological structure. Faces are depicted as graphs, with nodes positioned at fiducial points. (Exes, nose...) and edges labelled with 2-D distance vectors. every node contains a group of 40complex Dennis Gabor ripple coefficients at totally different scales and orientations (phase, amplitude). They are known as "jets". Recognition is predicated on labelled graphs. A labelled graph may be a set of nodes connected by edges, nodes are labelled with jets, and edges are labelled with distances.

III. METHODOLOGY

ANDROID APPLICATION

The Face Swap robot application incorporates a long, however simple information flow. when an image is infatuated the camera on the robot phone the phone uploads the image to a server and waits whereas the server processes the image.

FACE AND EYE DETECTION

The input is born-again to grey-scale before being sent as input to the face detector at the side of trained face and eye classifiers. Since there's no interface to pick that faces to settle on within the image, the face detection rule should mechanically choose faces that have the potential to be simply swapped. If fewer than 2 faces are detected then the server outputs a slip-up. If specifically 2 faces are detected then those faces are outputted (the output is just a bounding box roughly round the head) at the side of any eyes that were found on the faces. However, if there are associate degree far more than faces to settle on from then further precautions are taken to create certain that the chosen faces are legitimate faces. 1st eye detection, conjointly mistreatment Viola-Jones and Haar-like options, is run on every face. If a minimum of 2 faces have a minimum of one eye detected then it's assumed that these aren't spurious faces and are in reality inanimate objects. so the faces with the foremost eyes are outputted.

If one or none of the faces have eyes that area unit detected then more testing is finished to form certain that none of the faces area unit spurious. At now the image is low pass filtered by a sq. kernel of ones (normalized by the world of the kernel) whose aspect length is one fourth the length of the detected face. This low pass filtering is finished supported the idea that spurious faces area unit because of random background signal with low magnitude and can not be detected once more when low pass filtering. Face detection is then run once more and faces that area unit found in each the first image and also the low pass filtered image area unit written to the output. If fewer than 2 faces were found in each pictures then all of the opposite faces area unit output still.

FACE OUTLINING

Next the Active form Model (ASM) is suited the faces within the image. The ASM was trained with sixty labelled coaching pictures. Thirty of those were male faces and thirty were feminine, representing a various array of ethnic backgrounds. All coaching is completed beforehand therefore the ASM fitting rule solely has to specialise in the faces found throughout Viola-Jones truth detection. The face detection computer code found a minimum of 2 faces and by default the most important 2 faces are chosen to be passed into the ASM rule. The initial location of the model overlaid on every face image is just the centre of the image, and therefore the faces are scaled to the dimensions of the trained model (the model itself was trained on 256x256 picture element images). The ASM fitting rule then runs for fifteen iterations on every face; 5 iterations at 2:1 sub-sampling to assist the rule converge a lot of quickly, then 10 iterations at the complete size of the model The rule search searches fifteen pixels (equivalent to thirty pixels within the original image) on either aspect of this define throughout every iteration on the sub-sampled image, then searches ten pixels on either aspect of the define throughout every iteration on the complete image. once the ASM rule has finished it outputs a binary mask of every face.

FACE TRANSFORMATION AND CENTERING

The masks within the ASM output square measure accustomed figure the centre of mass of every face by computing the centre of mass of the disguised region. Then the rotation of every mask is computed victimization the locations of the eyes detected by the Viola-Jones classifier. this is often done victimization the arc-tangent of the slope from one eye to the opposite. Finally, the common intensity values square measure computed for every RGB color and for every face, and also the intensity values for every channel and every face square measure scaled to match the recent values for the opposite face. once these 3 steps square measure done the faces square measure able to be disguised out, rotated, and affected to the center of mass of the opposite face.

SMOOTHING USING LAPLACIAN PYRAMIDS

The last stage of the rule uses Laplacian Pyramids to swap the faces exploitation the antecedently calculated

rotation angle and centre of mass inputs whereas smoothing round the mask boundaries wherever the every face was swapped in. Four pyramid levels square measure used (four was through empirical observation determined to be the most effective range of levels) the extent one pyramid is that the size of the image itself, and every consecutive level is Gaussian filtered then sub-sampled with a 2:1 magnitude relation. The output pyramids square measure made by masking every level severally then collapsing the degree into one base pyramid. Then we have a tendency to blur the sting of the pyramid image into the total image employing an easy low pass filter (a normalized column or row of ones relying upon that edge is being blurred). This final image is then sent back to the phone to be displayed.

IV. CONCLUSION

The face detection, extraction and swapping algorithms were totally studied taking variety of take a look at pictures and ranging the conditions and variables. All the work mentioned on top of concerned real time knowledge. The most vital application for face detection remains as a pre-processor in face recognition systems. For offline process, face detection technology has reached a degree wherever the detection of one face in a picture with honest resolution (typical for a face recognition system) is about to being a resolved drawback. However, correct detection of countenance like the corners of the eyes and mouth is harder, and this is often still a tough drawback to resolve. Face detection has conjointly found its thanks to CBIR systems like net search engines and digital video compartmentalization.

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