International Journal of Research
International Journal of Research
Available at https://edupediapublications.org/journals
p-ISSN: 2348-6848
e-ISSN: 2348-795X
Volume 03 Issue 17
November 2016

Face Recognition under the Mixed Effects of Non-Uniform Blur, Lighting, and Pose

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Abstract: This is the first attempt to systematically address face recognition under (i) non-uniform motion blur and (ii) the combined effects of blur, illumination and pose. In this paper, we propose a methodology for face recognition in the presence of space-varying motion blur comprising of kernels. We model the blurred face as a convex combination of geometrically transformed instances of the focused gallery face, and show that the set of all images obtained by non-uniformly blurring a given image forms a convex set. We first propose a non-uniform blur-robust algorithm by blurring the gallery image's with its corresponding TSF function and extract LBP features and finally returns the identity of the probe image by comparing the LBP features of the probe image with those of the transformed gallery images and find the closest match. Then we propose the motion blur and illumination-robust algorithm by blurring and re-illuminating the gallery image's with its corresponding optimal TSF function and illumination coefficients and extract LBP features and finally returns the identity of the probe image. Finally we propose the motion, blur, illumination and pose-robust algorithm by estimating and synthesizing the new pose of the blurred probe image and then blurring and re-illuminating the gallery image's with its corresponding optimal TSF function and illumination coefficients and extract LBP features and finally finds the closest match of the given input probe image.

Index Terms—Face recognition, non-uniform blur, sparsity, illumination, pose.

I. INTRODUCTION

It is well-known that the accuracy of face recognition systems deteriorates quite rapidly in unconstrained settings. This can be attributed to degradations arising from blur, changes in illumination, pose, and expression, partial occlusions etc. Motion blur, in particular, deserves special attention owing to the ubiquity of mobile phones and hand-held imaging devices. Dealing with camera shake is a very relevant problem because, while tripods hinder mobility, reducing the exposure time affects image quality. Moreover, in-built sensors such as gyros and accelerometers have their own limitations in sensing the camera motion. In an uncontrolled environment, illumination and pose could also vary, further compounding the problem.

The focus of this paper is on developing a system that can recognize faces across non-uniform (i.e., space-variant) blur, and varying illumination and pose. Traditionally, blurring due to camera shake has been modeled as a convolution with a single blur kernel, and the blur is assumed to be uniform across the image. However, it is space-variant blur that is encountered frequently in hand-held cameras. While techniques have been proposed that address the restoration of non-uniform blur by local space-invariance approximation, recent methods for image restoration have modeled the motion-blurred image as an average of projectively transformed images.

Face recognition systems that work with focused images have difficulty when presented with blurred data. Approaches to face recognition from blurred images can be broadly classified into four categories. Deblurring-based in which the probe image is first deblurred and then used for recognition. However, deblurring artifacts are a major source of error especially for moderate to heavy blurs. Joint deblurring and recognition, the flip-side of which is computational complexity.

Deriving blur-invariant features for recognition. But these are effective only for mild blurs. The direct recognition approach of and in which reblurred versions from the gallery are compared with the blurred probe image. It is important to note that all of the above approaches assume a simplistic space-invariant blur model. For handling illumination, there have mainly been two directions of pursuit based on the 9D subspace model for face and extracting and matching illumination insensitive facial features combine the strengths of the above two methods and propose an integrated framework that includes an initial illumination normalization step for face recognition under difficult lighting conditions. A subspace learning approach using image gradient orientations for illumination and occlusion-robust face recognition has been proposed. Practical face recognition algorithms must also possess the ability to recognize faces across reasonable variations in pose. Methods for face recognition across pose can broadly be classified into 2D and 3D techniques. A good survey article on this issue can be found Although the problem of blur, illumination and pose are individually quite challenging and merit research in their own right, a few attempts have been made in the literature.

II. RELATED WORK

W. Zhao, R. Chellappa, P. J. Phillips, and A. Rosenfeld

As one of the most successful applications of image analysis and understanding, face recognition has recently received significant attention, especially during the past several years. At least two reasons account for this trend: the first is the wide range of commercial and law enforcement applications, and the second is the

availability of feasible technologies after 30 years of research. Even though current machine recognition systems have reached a certain level of maturity, their success is limited by the conditions imposed by many real applications. For example, recognition of face images acquired in an outdoor environment with changes in illumination and/or pose remains a largely unsolved problem. In other words, current systems are still far away from the capability of the human perception system.This paper provides an up-to-date critical survey of still- and video-based face recognition research. There are two underlying motivations for us to write this survey paper: the first is to provide an up-to-date review of the existing literature, and the second is to offer some insights into the studies of machine recognition of faces. To provide a comprehensive survey, we not only categorize existing recognition techniques but also present detailed descriptions of representative methods within each category. In addition, relevant topics such as psychophysical studies, system evaluation, and issues of illumination and pose variation are covered.

R. Fergus, B. Singh, A. Hertzmann, S. T. Roweis, and W. T. Freeman

Camera shake during exposure leads to objectionable image blur and ruins many photographs. Conventional blind deconvolution methods typically assume frequency-domain constraints on images, or overly simplified parametric forms for the motion path during camera shake. Real camera motions can follow convoluted paths, and a spatial domain prior can better maintain visually salient image characteristics. We introduce a method to remove the effects of camera shake from seriously blurred images. The method assumes a uniform camera blur over the image and negligible in-plane camera rotation. In order to estimate the blur from the camera shake, the user must specify an image region without saturation effects. We show results for a variety of digital photographs taken from personal photo collections.

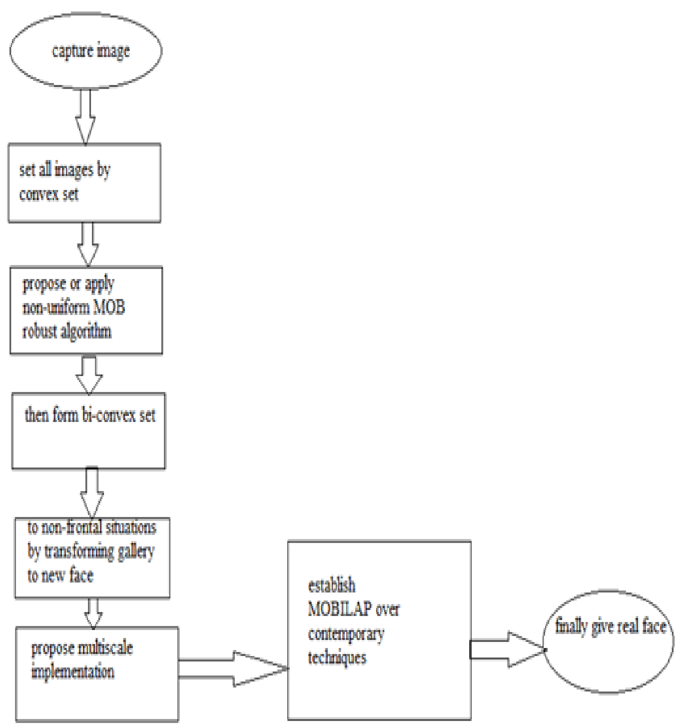
II. EXISTING SYSTEM

Existing methods for performing face recognition in the presence of blur are based on the convolution model and cannot handle non-uniform blurring situations that frequently arise from tilts and rotations in hand-held cameras. The convolution model is sufficient for describing blur due to in-plane camera translations, a major limitation is that it cannot describe several other blurring effects (including out-of-plane motion and in-plane rotation) arising from general camera motion. In order to demonstrate the weakness of the convolution model in handling images blurred due to camera shake, we synthetically blur the focused gallery image to generate a probe, and provide both the gallery image and the blurred probe image as input to two algorithms- the convolution model which assumes space invariant blur, and the non-uniform motion blur model which represents the space-variant blurred image as a weighted average of geometrically warped instances of the gallery.

PROPOSED SYSTEM

In this paper, we propose a methodology for face recognition in the presence of space-varying motion blur comprising of kernels. We model the blurred face as a convex combination of geometrically transformed instances of the focused gallery face, and show that the set of all images obtained by non-uniformly blurring a given image forms a convex set. We first propose a non-uniform blur-robust algorithm by blurring the gallery image's with its corresponding TSF function and extract LBP features and finally returns the identity of the probe image by comparing the LBP features of the probe image with those of the transformed gallery images and find the closest match. Then we propose the motion blur and illumination-robust algorithm by blurring and re-illuminating the gallery image's with its corresponding optimal TSF function and illumination coefficients and extract LBP features and finally returns the identity of the probe image. Finally we propose the motion, blur, illumination and pose-robust algorithm by estimating and synthesizing the new pose of the blurred probe image and then blurring and re-illuminating the gallery image's with its corresponding optimal TSF function and illumination coefficients and extract LBP features and finally finds the closest match of the given input probe image.

SYSTEM ARCHITECTURE:



ADVANTAGES

- This is the first attempt to systematically address face recognition under (i) non-uniform motion blur and (ii) the combined effects of blur, illumination and pose.
- They can handle non-uniform blurring situations
- They can detect the face regions. Therefore, they can achieve satisfactory detection results
- Face regions are detected and extracted correctly.
- The relevant face images present in the gallery/database were retrieved properly.

SIMULATION RESULTS

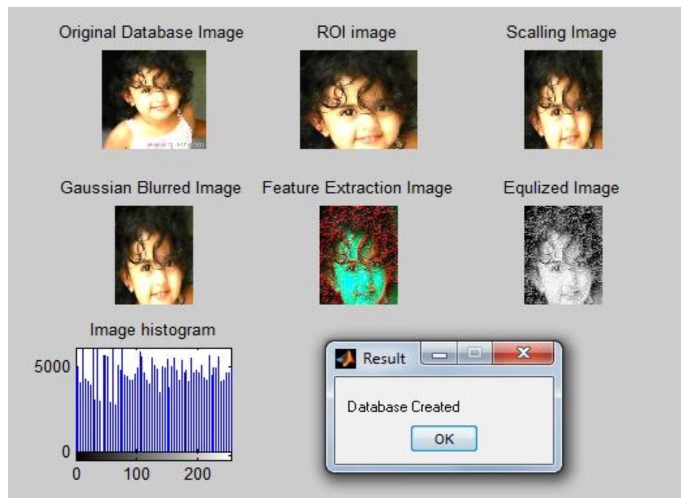


Fig 2:

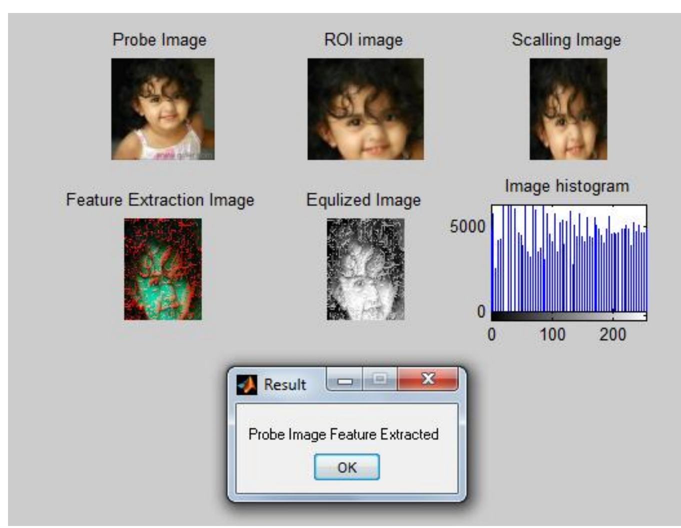


Fig 3:

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Available at https://edupediapublications.org/journals
p-ISSN: 2348-6848
e-ISSN: 2348-795X
Volume 03 Issue 17
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Fig 4:

CONCLUSION

In this study, we propose the motion, blur, illumination and pose-robust algorithm by estimating and synthesizing the new pose of the blurred probe image and then blurring and re-illuminating the gallery image's with its corresponding optimal TSF function and illumination coefficients and extract LBP features and finally finds the closest match of the given input probe image.

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