IJARCCE

ISSN (Online) 2278-1021
ISSN (Print) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering
ISO 3297:2007 Certified
Vol. 6, Issue 12, December 2017

# Detection of Good Quality Front Face from Low Resolution Surveillance Camera

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**Abstract** : The face is one of the important remote biometrics and it is used in facial analysis systems, like human-computer interaction, face detection and recognition and so on. Giving poor quality images and low resolution from inexpensive videos sequences they may give error nous and unstable results so we need a proper mechanism to deal with this problem on low resolution front face images. The approach which I have mentioned in this paper exactly deals with .To deal with this approach we need to apply the reconstruction based techniques. This algorithm has mainly two problem one is that it requires a similar images and another its improvement factor limited only two. To resolve the first problem we introduce an approach of three-step, which produces a sequence of faces which consists of similar front faces having maximum possible quality. To resolve the problem of improvement factor limitation we applied super-resolution which is based on learning based algorithm to the result of the reconstruction-based technique to enhance the quality of images. Because of this technique the improvement factor gets improved by four for whole system. Face recognition is a biometric system used to identify or verify a person from a digital image. Face Recognition system is used in security. Face recognition system should be able to automatically detect a face in an image. This involves extracts its features and then recognize it, regardless of lighting, expression, illumination, ageing, transformations (translate, rotate and scale image) and pose, which is a difficult task.

**Keywords**: Face-log generation, Face quality assessment, Super-resolution, surveillance video.

## I. INTRODUCTION

THE FACE is one of the most important remote biometrics and is widely employed in many facial analysis systems, like face recognition, human–computer interaction, and so on. One of the real-world challenges of these systems is that they have problem working with low-resolution (LR) images. This is the reason that for example surveillance applications in public places like airports need human operators to identify suspected people. Therefore, having an automated system working with LR and low-quality face images is desirable. However, low-quality images do not have enough high-resolution (HR) details for facial analysis systems and using them directly in these systems is not reliable. Thus, there is a need for a mechanism for bridging this gap between LR images and facial analysis systems. Super-resolution (SR) is one of such mechanisms for obtaining an HR image from one or more LR input images. SR algorithms are broadly classified into two classes: reconstruction-based SR (RBSR, known as classical multi frame SR) and learning-based SR (LBSR, known as hallucination, or example based SR). RBSR algorithms usually work with more than one LR input image. These LR inputs must have intra-image sub pixel misalignments. The algorithm uses these misalignments to reconstruct the missing HR details of the inputs. These misalignments are considered in a registration step before starting the reconstruction process. The first RBSR system was a frequency domain algorithm proposed by Tsai and Huang.They used the shifting property of Fourier transform and the spectral aliasing to reconstruct the HR details of the output. Spatial domain solutions for RBSR were later developed. These methods have better considerations for noise and blur than the frequency domain approaches. Several methods have been proposed for spatial domain RBSR. These methods have better considerations for noise and blur than the frequency domain approaches. Several methods have been proposed for spatial domain RBSR. These methods mainly differ in three points: the used registration algorithm, the used method for obtaining the final response of the system and the regularization method. The registration algorithm in the first spatial domain RBSR system by Irani and Peleg can handle 2-D shifts and in-plane rotations of the LR input images. Their registration method has been widely used in SR systems. However, the main limitation of that registration algorithm is the fact that it can only handle very slight motions between the inputs. It means that this algorithm cannot be directly used in real world scenarios where there are big differences between the first and the last appearance of the moving objects. For obtaining the final response of the system, Irani *et al.* used an iterative back projection based method similar to what is used in computer aided tomography.

## II. RELATED WORK

To detect a face is the first stage of any face recognition process. A lot of works has been done on this area. Since we are dealing with the video sequences coming from the surveillance camera there are chances of various orientation of

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human poses so to detect proper face from these variations is a research and quite tough task. Generally this process consists of three steps at first frame based detection is done .for this lots of traditional methods are applied which are applicable for still images like statistical modeling, neural network based method, SVM based methods. Ignoring the temporal information provided by video sequence is main drawback of this approach. Secondly, integrating detection and tracking, this indicates that identifying the face is the first step and then identify the person on the basis of it the whole process. Super resolution is the process of giving low resolution images and from that obtain the high quality images .Based on reasonable assumptions or prior knowledge about the observation model that converts the images having high resolution image to the images of low resolution ones. Super resolution algorithm is classified into two categories which are Reconstruction based super resolution (RBSR) and (LBSR) Learning based super resolution. Super resolution algorithm which based on reconstruction techniques works with more than one Low resolution input image. These LR inputs must have intra-image sub-pixel misalignments.

## III. PROPOSED ALGORITHM AND PROPOSED SYSTEM

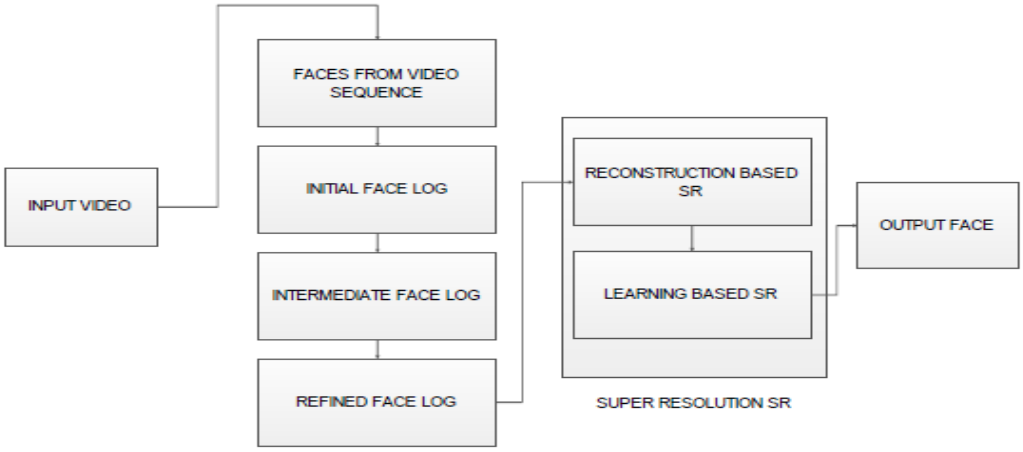


Figure 1. System Architecture

Description of the Proposed Algorithm*:* Fig 1 describes about the block diagram of our proposed system architecture. Proposed approach is consists of following modules.

A) Face Log Generation
B) Super resolution algorithm
C) RBSR Algorithm
D) Final extracted image

A. *Face-Log(s):* Face-logs are considered as a concise and/or complete representation of a video sequence. The content of face-logs depends on the application. For example if the face-logs are used for indexing video sequences, they may only contain the best face image of the sequence. If they are used for summarizing a video sequence, they should be complete. It Means that they should contain the best side-view images (if any) as well as the best frontal image. If face-logs are used for SR, as in this paper, in addition to the best frontal (and side-views) face(s) they need to have many more images that are closely similar to the best images. The proposed system in this paper uses one to three face logs. The most important one is a face-log containing frontal and semi-frontal face images. The other two face-logs are associated with two side-view face images of the subject. For constructing these three face-logs, we first use a head-pose estimation method that is developed for LR images. Based on the value of this feature, we classify face images of the input video sequence into three face-logs containing frontal, left side-view, and right side-view face images. These face logs are denoted as initial face-logs. Each of these initial face logs goes into the same computations, separately. Thus, we describe the rest of this paper only for the frontal face-log.

B. *Face Identification:* To detect the face we are using Viola and Jones idea of employing Haar-like features of the integral images of the input which are taken from video sequence to detect face images.

C. *Facial Feature Estimation:* To extract the facial features in LR images is quite difficult task. For that we need to use some methods to operate correctly on facial features extraction scheme, for this we are taking four parameters into considerations that parameters are brightness, sharpness, resolution and head pose estimation.

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*1) Head-Pose Evaluation :* Since people move freely around the surveillance camera we cannot predict about the proper face detection from that video sequence we need a mechanism to detect the proper faces from rotated pose so it's important to estimate the head pose .For this number of mechanism are given we are using Widrow –Hoff learning technique. Aauto associative memories are used for estimating the head-pose, one auto associative memory for each pose. From the series of LR input images a closely related score image is been selected as a head pose of that input image. Each angle varies between −90° and +90°, with a step of 15° for pan, and 30 and 15 for tilt. In this paper, we only use pan information

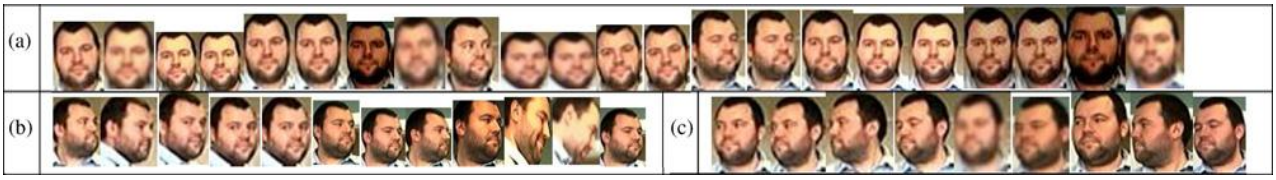


Fig 2: Three different initial face-logs created for the video sequence based on the value of the head-pose.
a) Initial frontal face-log. (b) InitialLeft side-view face-log. (c) Initial right side-view face-log.

*2) Sharpness:* since we are dealing with the surveillance camera video sequence so images obtained from it are not clear so we need to operate on blur images so that we can clearly identify the person and properly detect the face hence sharpness is one of the important parameter in facial extraction technique.

$$Sh_{x_i} = avg(abs(X_i - lowpass(X_i))) \qquad (1)$$

Above formula clearly finds the sharpness where *Xi* is the *i*th face image in the given video sequence, *ShXi* is its sharpness, the mean function is given by avg , the absolute function is given by abs , and *lowpass* is a simple 3 × 3 mean filter.

*3) Brightness:* Changes in lighting conditions are very common in surveillance camera in such cases brightness can easily get changes which will affect on the quality of faces in video sequence so we need to apply the brightness technique on faces so that we will get clear images. We have defined the brightness as the mean of the illumination component of the face in *YCbCr* colour space.

*4) Resolution:* For covering as much of the scene as possible, surveillance cameras are usually set up with wide fields of view. Therefore, there is a large distance between the camera and objects. This causes the faces to appear very small. However, due to the motion of the object the size of the faces is likely to change. To involve this feature in the quality Assessment we assign the highest quality score of resolution to the biggest face. Accordingly, the quality score decreases for the smaller faces.

*D. Face Quality Evaluation:* since we are dealing with video sequence there is a series of faces of different persons hence we need to identify exact face of same person for that we need to assign image score to each image and closely related images are collected from that video sequence. For that we are using following equation

$$Q_{1X_i} = \frac{P_{\min}}{P_{X_i}} \qquad (2)$$

Where *Xi* is the *i*th face image in the given video sequence (*i* is Changing from one to the size of the initial face-log, *m*1), *PXi*
Is its head-pose value, and *Q*1*Xi* is its first quality score. Minimum value of the head-pose feature in the face-log is determined by *P*min. For normalizing the other three features, we have used

$$Q_{jx_i} = \frac{F_{X_i}}{F_{\max}} \qquad (3)$$

Where X i is the *i*th face image in the given video sequence (*I* is changing from one to the size of the initial face-log, m 1), PXi is its head-pose value, and Q 1Xi is its first quality score. Pmin is the minimum value of the head-pose feature in the face-log.

*Reconstruction Base Super Resolution :* In order to construct the higher quality images from the low resolution faces detected from the video sequences in surveillance camera we need to apply reconstruction technique. By warping Based on the imaging model each LR image has been created, blurring and down-sampling the HR image. It means that each *Xi*, *i* = {1, 2 . . . *m*3} where LR images in the refined face-log have been obtained by

$$X_i = DB_iW_iH + n_i$$

Where *D*, *Bi*, and *Wi* are the down-sampling is given by D, blurring is given by Bi, and warping matrix is given by Wi, *H* is the HR image and *ni* is the introduced noise in the imaging process to produce the *i*th LR image from the HR image *H*.

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*Learning Base Super Resolution***:** In order to prepare the training data for any network we have first obtained the face areas of HR images and converted to gray scale. Then, an LR image is created for each of these HR images by down-sampling the images by a multiple of two. Then, all of these LR/HR pairs which are obtained from the above procedures which are applied in order to get high quality images are fed to the network as the training samples and the network learns the relationship between them.

## IV. SIMULATION RESULTS

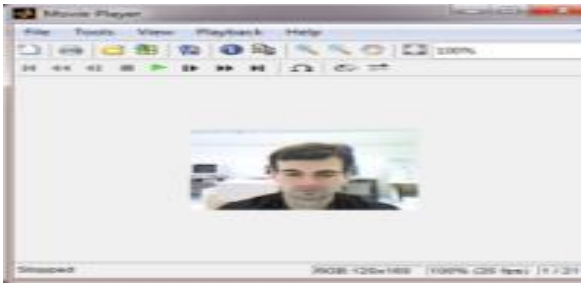
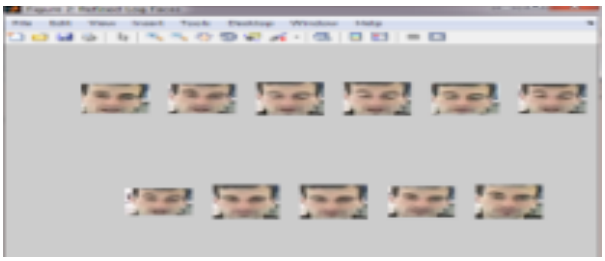


Fig 1: Input the video

Fig describes about the inputting the video to generate face log.

Fig 2: Face Log Generation

**Fig** 2. This figure describes about the face log generation and face rotation depending on head pose estimation



**F**ig 3: Refined Face Log

Fig 3.Describes about the refined face log generation technique and morphological operation and applying facial features extraction techniques

Fig 4: RBSR image

Fig 4 Describes about the RBSR that is reconstruction based super resolution algorithm

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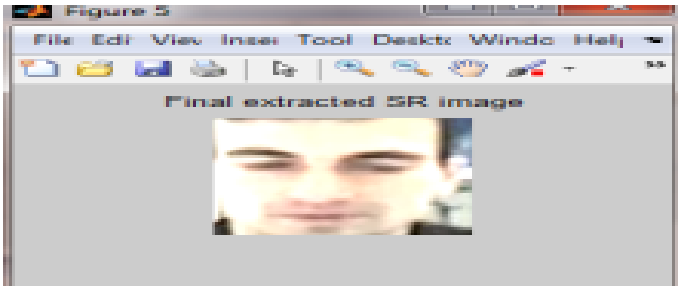


Fig 5: Final Extracted Image

Fig 5.Describes about the final extracted image after RBSR and LBSR technique

## IV. Conclusion and Future Work

This approach is best solution to obtain the good quality of front face from low resolution surveillance cameras .Since we not getting the clear and high resolution front faces from the video sequences in surveillance camera for that we need a proper approach this is the best approach to deal with this problem.

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