Available online at www.sciencedirect.com

ScienceDirect

Procedia Computer Science 45 (2015) 361 – 369

Procedia Computer Science

International Conference on Advanced Computing Technologies and Applications (ICACTA-2015)

A Review of Various Approaches To Face Hallucination

Ms. Prachi Autee[a], Mr. Samyak Mehta[a], Ms. Sampada Desai[a] , Prof. Vinaya Sawant[b], Prof. Anuja Nagare[b]

[a]*D.J Sanghvi College Of Engineering, Mumbai University,Mumbai, India.*
[b]*D.J Sanghvi College Of Engineering, Mumbai University,Mumbai, India.*

Abstract:

In this paper, we study the various approaches and methodologies used for face hallucination. Face hallucination was first presented as high-resolution image from a low-resolution image. The numerous applications of this method include in the field of image enhancement, face recognition surveillance and security. It is useful in surveillance and security system to enhance the a low-resolution face which possesses facial details matching that of a potential high-resolution image, helping in further analysis. In this paper we have analysed various approaches for enhancing low-resolution images namely, Face Hallucination (FH) with Sparse Representation, FH using Eigentransformation, FH via Locality Constraint Representation, learning-based FH in DCT (Discrete Cosine Transform) domain.

Peer-review under responsibility of scientific committee of International Conference on Advanced Computing Technologies and Applications (ICACTA-2015).

Keywords: Face Hallucination; Eigentransformation; Super-resolution; Locality Constrained Representation; Principal Component Analysis; Discrete Cosine Transform

* Corresponding author. Tel.: 9920518278; 9930300617; 8097423854.
E-mail address: auteeprachi5@gmail.com; samyak_28@hotmail.com; samdes7@gmail.com;vinaya.sawant@djsce.ac.in;anuja.nagare@djsce.ac.in

Peer-review under responsibility of scientific committee of International Conference on Advanced Computing Technologies and Applications (ICACTA-2015).
doi:10.1016/j.procs.2015.03.162

1. Introduction

Very often the distance between surveillance cameras and the scene is very large. Such cameras are usually set up in wide field of views. Most of the times, the faces captured are indiscernible due to various factors such as small size, low-resolution, improper illumination, blurriness etc. In such a scenario, recognizing the faces of interests becomes a challenging task. As face recognition plays a very important role in security control, surveillance monitoring, authentication and biometrics, devising methods to improve the resolution of the facial images becomes mandatory. Face hallucination or face super resolution as proposed by Baker and Kanade[1] serves this purpose.Fig. 1 illustrates the general idea of FH.

Fig.1. (a) Low Resolution Input Face; (b) Resultant Hallucinated Face; (c) Original Face.

Experiments have proved that the face images after hallucination can be used easily by humans for recognition as well as it becomes easier to recognize the face automatically as they add more high frequency details thereby highlighting the difference in the face. Our aim is to survey the various algorithms used for hallucinating faces. Following are the three constraints, which must be met by any FH algorithm:

- Sanity constraint: The hallucinated image should be close to the original image when it is being smoothed and down sampled.
- Global constraint: The result should have all common features of a human face, *e.g.* mouth, eyes and nose, symmetry and many other features. The facial features must be coherent always.
- Local constraint: The results must have specific features of the image, while retaining the local characteristics.

The first constraint can be easily met whereas the other two constraints are relatively difficult to formulate. If the algorithm fails to meet the above-specified constraints, then the resulting image could be noisy or discordant with the ordinary facial features.

There have been numerous algorithms for hallucinating faces. Some of these algorithms are:

- Face hallucination with sparse representation[2], which improves on the example-based super-resolution method and improves the computational speed for hallucinating face images detected from a surveillance video.
- Hallucinating face by Eigentransformation[9] which extracts high frequency facial feature from the face images of low resolution by using Principal Component Analysis (PCA) and is robust to noise.
- Noise Robust Face Hallucination via Locality-Constrained Representation[16], which focuses on reducing noise while hallucinating the image using patch-based approach to obtain optimal representation of one image patch.
- Learning- based Face hallucination in DCT domain [13] helps to enhance the local facial features of a low-resolution image by means of an AC (Alternative Current) coefficient. While the AC coefficient enhances the local facial features, DC (Direct Current) coefficient along with clustering of the training set is used to enhance the global facial features.

In this paper, we have stated the end results after analysing the merits, demerits and experimental results of the above stated algorithms.

2. Face Hallucination With Sparse Representation For Video Surveillance

2.1. Overview

In this paper[2], a novel FH algorithm for enhancement of face images extracted from security video surveillance has been proposed. It is built upon the work on face hallucination and super-resolution published by Liu et al[3] and Yang et al[4]. This algorithm uses Sparse Representation and the Approximate Nearest Neighbors (ANN) method to enhance both global face shape (whole face) and local high frequency information (facial features). For a stack of