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Improvement in Face Hallucination using cuckoo algorithm

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----------ABSTRACT----------
To Study about the Face Hallucination technique and to create high-resolution face images. After that Apply Artificial intelligence based cuckoo search technique to get high hallucination parameters. Cuckoo work on the colored image and performing face hallucination. PSNR, EPI, MOS, Correlation, MSE and SSIM parameters are used finally. In this paper Artificial intelligence based cuckoo search technique is used to get high hallucination parameters. Cuckoo based algorithm is one of the recent optimization algorithms, in the league of nature based algorithm. This technique is represent as a local linear filtering worked by incorporating four constraint functions at patch level. The first two constraints check if the training images are similar to the face image. And the final step defined in the HR face image. The proposal of applying the cuckoo algorithm for optimization in the process of face recognition is presented in this paper.

KEYWORD: - *Face hallucination, local linear filtering, super resolution, Peak signal noise ratio (PSNR), Echo Planar Imaging (EPI), Mean Opinion Score (MOS), Correlation, Mean Square Error (MSE) and Structural Similarity (SSIM)*

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I. INTRODUCTION

Digital image processing is applied in computer algorithms to use image processing on digital images. As other category of DSP, DIP has many advantages over analog image processing. It allows very large range of algorithms to be applied to the input data. Since images are defined over two dimensions digital image processing may be modeled in the form of multidimensional systems.

This paper is organized as follows. The first section gives detail about Face Hallucination, background of face hallucination, Significance Cuckoo search (CS) with a working design of Cuckoo Search with literature survey. Conclusion is defined in the second section and Research Design in the third section.

Face Hallucination:-Face hallucination is super-resolution of face images or clarifying the details of a face from a low-resolution image. The technique of sparse coding can be used. The various basis decomposition methods can be used such as non negative matrix factorization (NMF) and Principal Component Analysis (PCA) other applications, the face hallucination has become an area of research.

In many cases the face images captured by live cameras are often of low resolutions due to the environment or equipment limitations. Thus, how to recover human faces automatically has become an important problem for the further works such as face analysis and recognition. Face hallucination is super-resolution of face images. The technique of sparse coding can be used.

(a) Low-res input (b) Hallucinated by our system (c) Original high-res

Figure 1 Example of face hallucination

Note that the detailed facial features like eyes, eyebrows, nose, mouth and teeth of the hallucinated face (b) are different from the ground truth (c), but perceptually we see it as a valid face image. The processing from (a) to (b) is entirely automatic.

Super-resolution techniques in computer vision infer the missing high-resolution image from the low-resolution input. Low-resolution is equivalent to low-frequency and high-resolution consists of high, middle and low frequency bands. There are in general two classes of super-resolution techniques: reconstruction-based (from input images alone) and learning-based (from other images). Of particular interest is face hallucination, or learning high-resolution face images from low-resolution ones. Face hallucination is a term coined by Baker and Kanade [1], which implies the high-frequency part of face image, must be purely fabricated. Hallucinating faces is particularly challenging because people are so familiar with faces.

A face hallucination algorithm should meet the following three constraints:

(a) Data constraint-It act as an input image

(b) Global constraint-This show the feature of a human face, *e.g.* mouth and nose, etc.

(c) Local constraint-Defines the face image, with photorealistic and local features.

Background and Significance Cuckoo search (CS):- It is an optimization algorithm compiled by Xin-she Yang and Suash Deb in year 2009. [4]. It was followed by the obligate brood parasitism of some cuckoo species by laying their eggs in the nests of other host birds. Tapera have evolved in such a way that female parasitic cuckoos are often very specialized in the mimicry in colors and evaluation of the eggs of a few chosen host species [17].

This evolutionary algorithm was developed by Yang and Deb in 2009 has undergone a substantial development, as this method was very different from other met heuristic optimization algorithm. The authors in [5] basically stressed on the fact that the existence of all living things was based on the rule of "survival of the fittest" which is a Darwin's famous theory. CA is based on the cuckoo's bird behavior of their destructive reproduction strategy. Firstly, different possible solutions/nests of problem are created (cuckoo's will lay eggs in host bird nests). These Solutions are then tested based on their performance. Among all achievable solutions/nests, a part of good solutions are selected, and others are eliminated (best nests with high quality of eggs will be carried to next generation). This process of production of new generations and its evolution is continual unless there is convergence of generation [4]. The CA essentially works with three important components: selection of the best by keeping the best nests or solutions; Levy's flight search pattern for replacing the host eggs with respect to the quality of the new solutions or Cuckoo eggs produced; and discovery of some cuckoo eggs by the host birds and replacing those eggs according to the quality of the local random walks. It seems that it can outperform other met heuristic algorithms in application.

1. CS is based on three idealized rules:

Each cuckoo lays one egg at a time, and dumps its egg in a randomly chosen nest;

The best nests with high quality of eggs will carry over to the next generation;

The number of available hosts' nests is fixed, and the egg laid by a cuckoo is discovered by the host bird with a probability $p_a \in (0,1)$. Discovering operates on some set of worst nests, and discovered solutions dumped from farther calculations.

An important advantage of this algorithm is its simplicity. In fact, comparing with other population- or agent-based meta heuristic algorithms such as particle swarm optimization and harmony search, there is essentially only a single parameter p_a in CS (apart from the population size n). Therefore, it is very easy to implement.

Working of Cuckoo Search:-

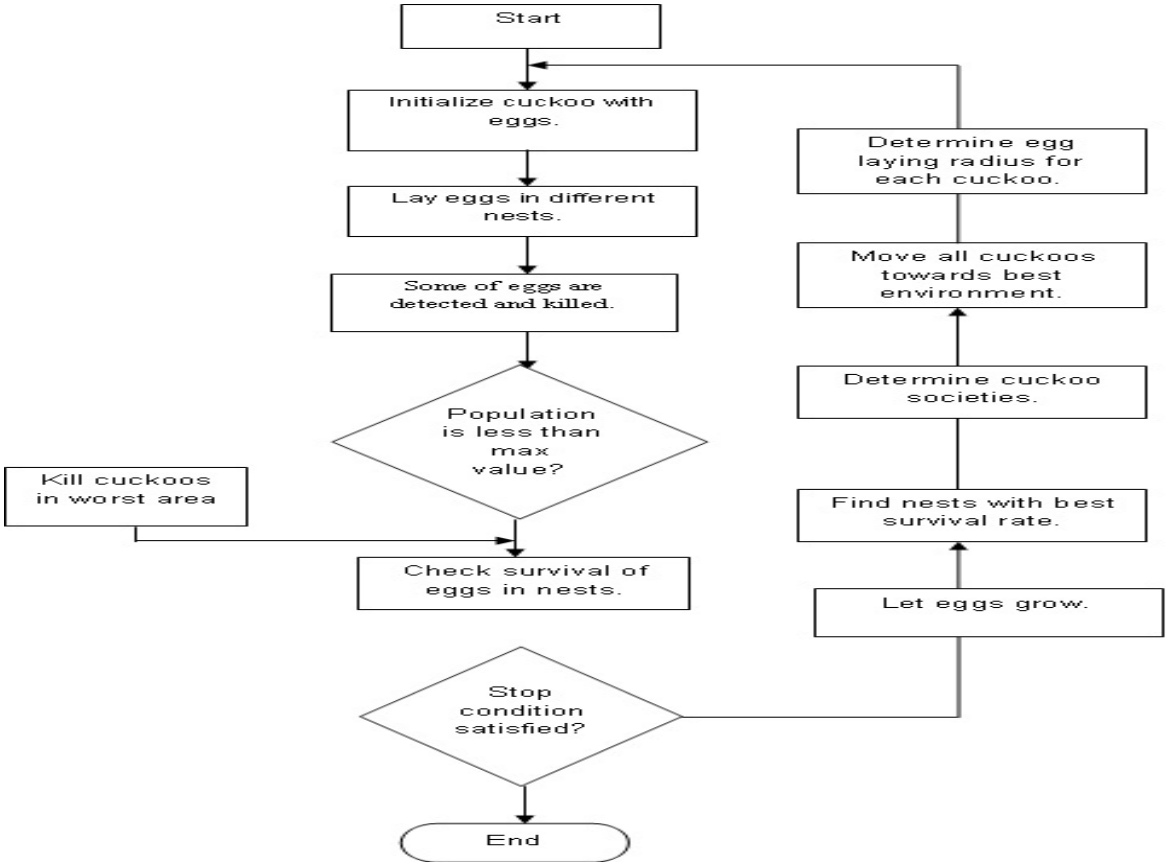

Fig 2:- Working of cuckoo system.

Literature survey: - [11] Ce et al. in this paper define face hallucination or synthesizing a high-resolution face image from an input low-resolution image, with the help of a very large collection of other high-resolution face images. At the first step, they define a global linear model to learn the relationship between the high-resolution face images and their smoothed and down-sampled lower resolution ones. At the second step, they define relationship between an original high-resolution image and the reconstructed high-resolution image. By combination both global and local models, they can produce photorealistic face images. The important approach is demonstrated by extensive experiments generating high-quality hallucinated face images from low-resolution input with no manual alignment.

Jianchao et al. in the paper [12] addresses the problem of hallucinating a high resolution face given a low resolution input face. The problem is defined through sparse coding. This subspace is effective for super-resolving the incoming low resolution face under reconstruction constraints. To future enhance the facial information, we produce a local patch method based on sparse representation with respect to coupled over complete patch dictionaries,

Yan et al. in the paper [13] described that Due to the numerous important applications of face images, and identity verification. This paper created a survey of technique of high quality face hallucination by looking at backgrounds and practical results.

Abdu et al. in the paper [14] described that the faces often appear very small in surveillance imagery because of the wide fields of view that are typically used and the relatively large distance between the cameras and the scene. In various applications (like face recognition, face detection etc), the resolution enhancement techniques are therefore generally essential. The Super resolution is the process of determining and adding missing high frequency information in the image to improve the resolution. It's highly useful in various areas of recognition, identification, compression, etc. As Face hallucination is a subset of super resolution. This work is basically intended to enhance the visual quality and resolution of a facial image. Its main focus is on the Eigen transform based face super-resolution techniques in transform domain. An Advantage- Eigen transformation based technique does not require iterative optimization techniques and hence it is comparatively faster. As Eigen transform is performed in wavelet transform and discrete cosines transform domains and the results are presented. Results establish the fact that the Eigen transform is efficient in transform domain also and thus it can be directly applied with slight modifications on the compressed images.

II. CONCLUSION

In Earlier base paper they presented a new face hallucination method based on similarity constraints to produce a high-resolution (HR) face image from an input low-resolution face image. This method is modeled as a local linear filtering process by incorporating four constraint functions at patch level. First two constraints focus on checking if the training images are similar to the input face image. Third is defined in the HR face image which imposes the smoothness constraint between neighboring hallucinated patches. Final constraint computes the spatial distance to reduce the effect of patches that are far from the hallucinating patch. The Experimental evaluation on a number of face images demonstrates the good performance of the proposed method on the face hallucination task. It has been already explained that the Face hallucination is super-resolution of face images, or clarifying the details of a face from a low-resolution image. The technique of sparse coding can be used. Our first problem is to study the Face hallucination method based on similarity constraints to produce a high-resolution (HR) face image from an input low-resolution (LR) face image then we will apply Artificial intelligence based cuckoo search technique and expecting the high hallucination parameter. By using cuckoo search technique we will get more accuracy and the parameters like PSNR, EPI, MOS, Correlation, MSE and SSIM will be improved. We will work on the colored image and try to achieve the optimized results.

III. RESEARCH DESIGN

In the base paper they presented a new face hallucination method based on similarity constraints to produce a high-resolution (HR) face image from an input low-resolution (LR) face image. This method is modeled as a local linear filtering process, by incorporating four constraint functions at patch level. First two constraints focus on checking if the training images are similar to the input face image. Third is defined in the HR face image, which imposes the smoothness constraint between neighboring hallucinated patches. Final constraint computes the spatial distance to reduce the effect of patches that are far from the hallucinating patch. The Experimental evaluation on a number of face images demonstrates the good performance of the proposed method on the face hallucination task. Because of the importance of face images in facial recognition systems and other applications, the face hallucination has become an area of research. Our first problem is to study the Face hallucination method based on similarity constraints to produce a high-resolution (HR) face image from an input low-resolution (LR) face image then we will apply Artificial intelligence based cuckoo search technique and expecting the high hallucination parameter. Artificial intelligence based Cuckoo search technique will optimize the input image.

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