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Super-Resolution of Single Image

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Abstract— A low–resolution image is converted into a high-resolution image in order to improve the quality of the image is known as Single image super-resolution. The proposed work is established by using an image sharpness algorithm known as the Gradient Profile Sharpness algorithm it is a combination of the triangle as well as Gaussian mixture model. They are used to obtain information about various categories of gradient profiles. The HR image is generated by the summation of the transformed gradient profiles of the input image. The proposed algorithm provides the better quality of the HR image, which is obtained by carrying out tests in terms of the output image and computation time. Work has been carried out to generate better visual quality output image, as compared with the input image.

Keywords- **low–resolution image, gradientfield, Frequency details, HR image.**

I. INTRODUCTION

Super-resolution of single image is generated to obtain high resolution (HR) image by considering the low details of the input image. This process is widely used in real time applications e.g. displaying of image acquiring on moving platform, capturing of image from far distance, in analysis of medical images *etc*. Generally when the low resolution image is down sampled several HR images are produced for the same input image. An image super-resolution process is used to obtain an improved appearance of an input image. In the literature three categories have been used in this field they are Interpolation approach, in this method the appearance of an image is enhanced by considering the neighbouring pixel value so that unknown pixels are inserted, which in turn improves the visual quality of an image.

Learning-based approach algorithm is based on two sets of data namely training and testing sets. The training data consists of both types of images i.e. Low and as well as high resolution images, they are acquired by using single camera with different resolution images. When the low resolution image i.e. Test image is applied to the system based on the training set data, the visual appearance of an image can be improved by using a proper training algorithm.

Compared to above two methods Reconstruction-based approach provides a superior quality of super resolution image by considering several frames of an image, but it is computationally expensive method.

The basic image super-resolution; interpolation-based approaches are bi-linear interpolation method in this process the pixel values are estimated both in horizontal and vertical directions one after other, by considering an average of the four nearest pixel values. bicubic interpolation is carried out by using polynomial technique. The sharpness of an image is improved by considering 16 neighbour pixel values s that overall quality of the super resolution image is high compared to that of bilinear interpolation method.

In Auto-regression model the visual appearance of an image can be improved by calculating conditional probabilities of all previously produced pixels from that the new pixel value can be estimated.

Multi- Surface fitting model is generally used when noise dominates the input image. The high resolution image is obtained by categorising each region of low-resolution image pixels is fixed with one surface and finally the super resolution image is generated by merging the multisampling values on these surfaces. This method preserves the original image details during the enhancement process no prior hypothesis is made.

In sparse representation models the low resolution input image is represented in the dictionary as a several patches by using the coefficients of this patches the Super resolution image is obtained. This method is suitable for noisy input images.

The significant image textures is preserved an up scaled image is obtained by using the following interpolation methods New Edge-Directed Interpolation [1, 2]. The input image is spitted into several regions based on features, then hybrid interpolation is applied to obtain super resolution image in an iterative curvature based interpolation [3, 4].

The high frequency details can be retained by using learning based methods [5, 6, 7, and 8]. The efficiency of the system depends upon training set of images; generally it is derived from the input pair of low resolution and high-resolution images. Since the similarity among the training set as well as the test set is not a constant, so it is very difficult to derive a universal training set for low resolution images with random scaling elements. The three main approaches used in learning-based approaches are Supervised SR, unsupervised SR, and domain-specific SR are, Generative Adversarial Networks (GANs) is deep learning based super resolution model used for trained.

Visual significance of any image mainly depends on edges, so in our work Gradient Profile Sharpness (GPS) metric used for detection of edges.The GPS metric is a combination of triangle and Gaussian model. An image may consists of short, heavy or combination of this gradient profiles are extracted by using triangle, Gaussian or Mixed model respectively. The super resolution image is obtained by combining these profiles linearly. The training set can also be derived from original LR images are resized to different scales were proposed in [6, 7, 8, 9,] so that we can overcome the acquiring of training sets externally.

In Reconstruction-based method, SR image is generated by extracting the similar regions of the image using the interpolation and searching algorithm. But it is computationally expensive. The reconstruction based method super-resolution approach is widely used, since it is easily integrated with frequently used image processing operations like to improve the overall appearance of an image known as image enhancement, in the process of removing of noise from an image de-noising [10], whenever an image acquired from the moving platform the quality of the image is bad, the appearance of an image can be improved by using de-blurring [11] if an image is acquired under bad light illumination condition it is not possible to identify the different parts of an image and by using a contrast enhancement [12] processes each section of an image can be made in to visible clearly.

II. METHODOLOGY

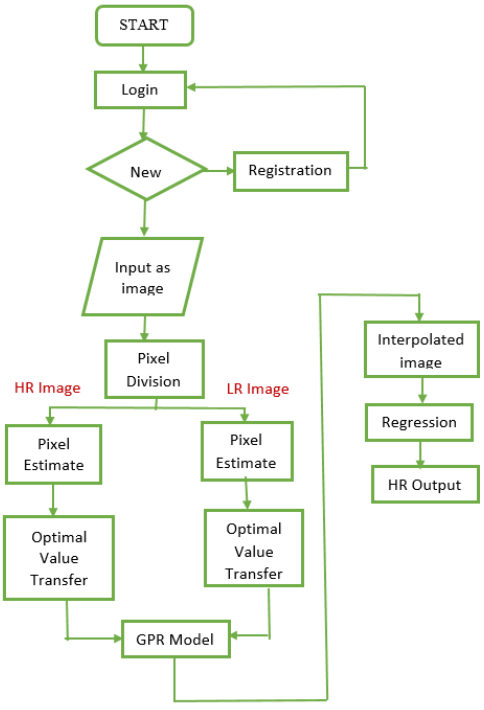

Fig. 1. Detection of various stages of lung cancer system flow diagram

General Flow diagram of Super Resolution Reconstruction of Image Gradient Profile Sharpness is as shown in the Fig. 1. Input Image is pre-processed and converted color image into grey scale.The neighborhood pixel values of the image is highlighted by taking into consideration of the dissimilar content in the image introduced the pixel-wise classification is carried out by performing Pixel Division operation. The input image is divided into several sections based on different features of an image .In this process the individual components are divided separately to produce the output value.in order to achieve higher resolution the neighboring pixel value has to be considered by using Pixel Estimation process.by using this process even if input data may be incomplete, it is derived from the Pixel Estimation process.

Gradient Profile Sharpness Model: the quality of image depends upon the Edge sharpness factor. Using a Gradient field the edge will be enhanced by reducing the effects of noise.The GPS model is used to extract the edge sharpness metric which consists of triangle and a mixed Gaussian gradient description models. The triangle model is suitable for sharp edges of an image, usually the intensity variation is small and gradient profiles are short. A mixed Gaussian model is obtained by the combination of two Gaussian models. This model is suitable for smooth edges of an image with dense tails leads to complex profile shapes and longer gradient profiles.

A rectilinear GPS conversion link is framed by considering the various image resolutions pairs of GPS values and, pixel values are generated automatically in all super-resolution application.

HR image is generated by summation of the converted gradient profiles of the input image. Research is carried out to assess the projected approach generates super resolution image with improved visual appearance of an original image.

During the implementation of an algorithm, the edge details of an image are safeguarded by using the bilinear interpolation algorithm. During the resolution improving process a fractional part of an image is considered to add the pixel values by considering the neighbor pixels in the input image i.e. zoom operation.is performed. That introduces the visual distortion removed by using bilinear interpolation algorithm.

Regression is a statistical method used to model and analyse the relationships between images through the pixel distribution and often times how they contribute and are related to producing a super resolution image. This work produces an HR output only for the 300 dpi of various image formats.

The regression is utilized during the post-process stage, to preserve the discontinuity at major edges of the image. Colour Transfer used retain the colour of super resolution image same as that of original image. This is achieved by considering the each pixel impact on the entire image intensity and variations of pixel from the neighbourhood. When this process is carried out leads to a grain and colour distortion. By introducing a gradient correction the effects of grain is reduced, however colour distortion is not avoided. This problem can be overcome by performing a bilinear interpolation of each colour standard reconstruction algorithm is applied. This algorithm works on low pass filtering operation, which removes the most of the aliasing component present in the luminance signal. Visual satisfactory result is obtained by removing the grain influence and distortion in the super resolution image.

III. RESULT AND DISCUSSION

Gradient Profile Sharpness (GPS) is nothing but the ratio of the edge contrast of extracted gradient profile (h) to the spatial scattering (d) denotes the edge spatial range of extracted gradient profile.

$\eta = h/d.$

The structure of the proposed algorithm consists of four sections.

- GPS is extracted by the combination of triangle and mixed Gaussian representations.
- For various image resolutions GPS transformation relationship is estimated.
- HR image gradient field is obtained by the using the gradient profiles of an input image..
- The simulation is run on MATLAB r2013a, running on Windows XP backed by Intel i5 processor.

Finally Generated HR image is compared with an input image.

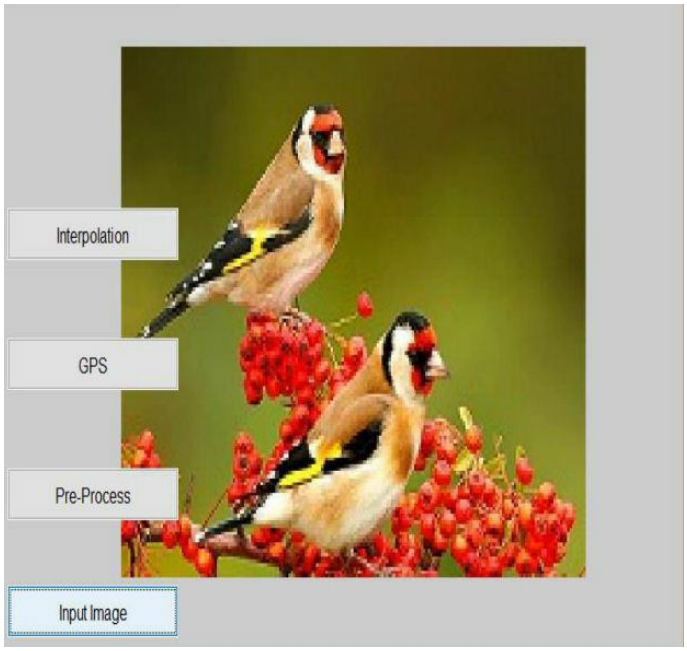

Fig.2. Low resolution input image

In the above Fig. 2 the low resolution image is taken as input.

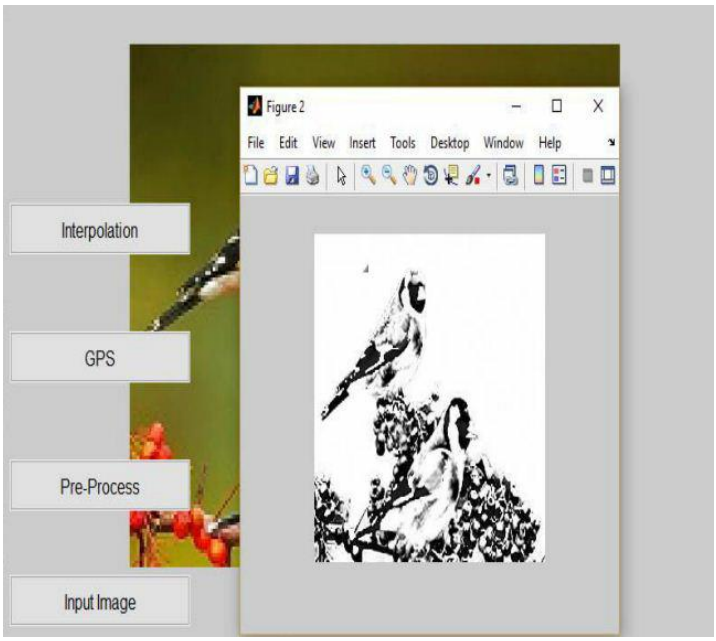

Fig.3. Pre-processed image

In the above Fig. 3 the input image is converted into grey scale image.

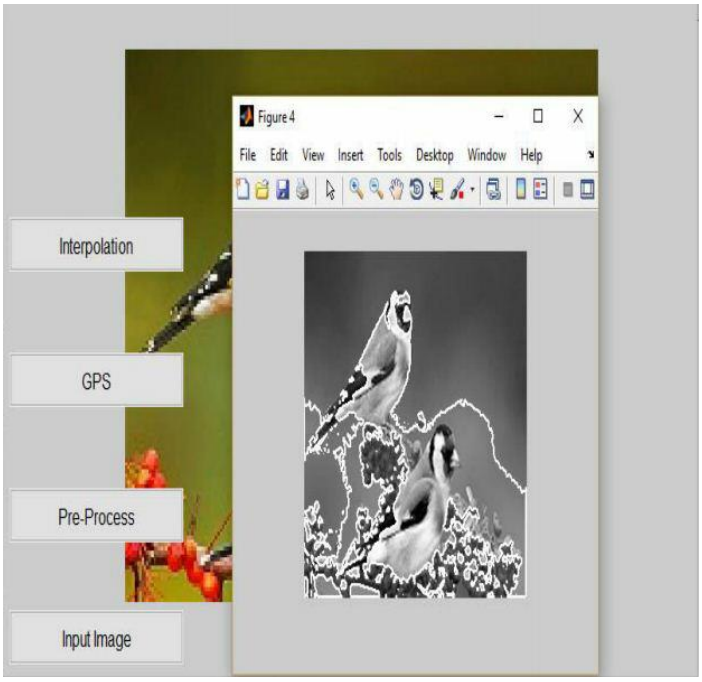

Fig.4. Gradient Profile Sharpness

In the above Fig. 4 the boundary values are extracted.

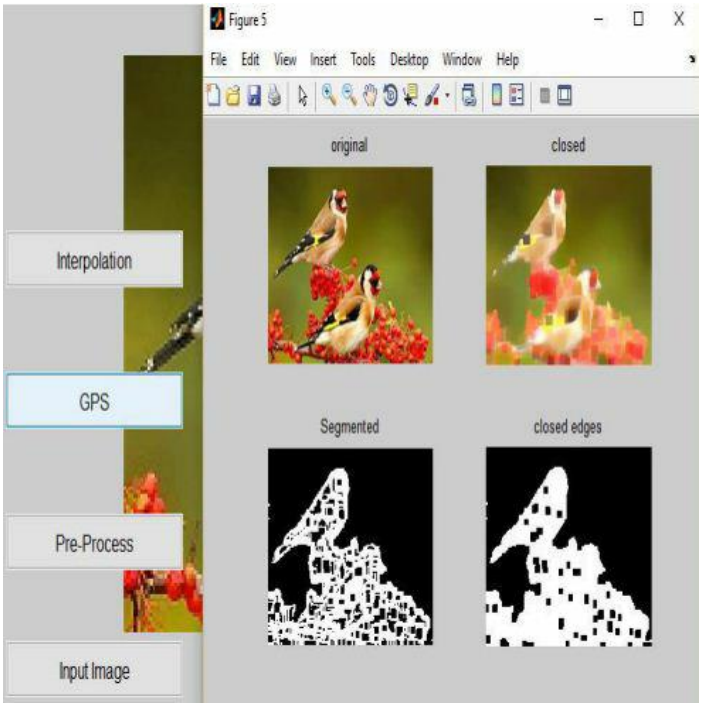

Fig.5. Gradient Profile Sharpness

In the above Fig. 5 the image is partitioned into different segments like original, closed,closed edges,segmented to extract more details from the image.

Figure 6. Interpolation

In the above figure 6 the low resolution input image converted into high resolution output image.

Figure 7. Sharpened Image

In the above figure 7 the enhancement of sharpness takes place.

IV. CONCLUSION

The proposed work established on edge information of an image. Using GPS input image is represented with various features gradient profiles. By the summation of these features super resolution image is obtained. The images were superior both visually and structurally. The suggested approach produce super-resolution image with minute noticeable artifacts.

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