



Image Super Resolution

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Abstract – This Article present Super Resolution which is a process of enhancing the detail content of image it enhance the resolution of the single low resolved image and bring out the hidden details that are already present in the image but not clearly visible. It uses Edge Enhancement based, Patch based methods for Character recognition, Commercial uses, Leisure and entertainment and so far.

Keywords-component – Super Resolution; image registration; edge enhancement

I. INTRODUCTION

Resolution is the term used to describe the detail the image holds in terms of number of dots, Or Pixels per inch used to display an image.

Low-Resolution (LR): Pixel density within an image is small, therefore offering less details.

High-Resolution (HR): Pixel density within an image is larger, therefore offering more details.

Super-Resolution (SR): Enhancing detailed information obtained from one or multiple LR images.

Motivation:

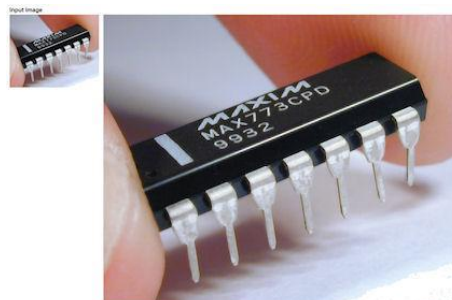
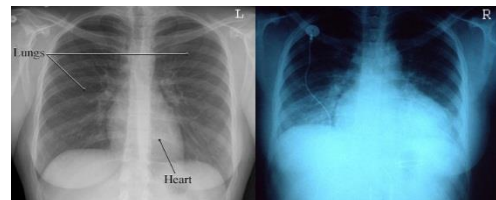
Not feasible to install Expensive Cameras

E.g. cell phones, computer vision applications

Medical Imaging

E.g. Doctor can make better diagnosis based on high resolution images

Satellite imaging

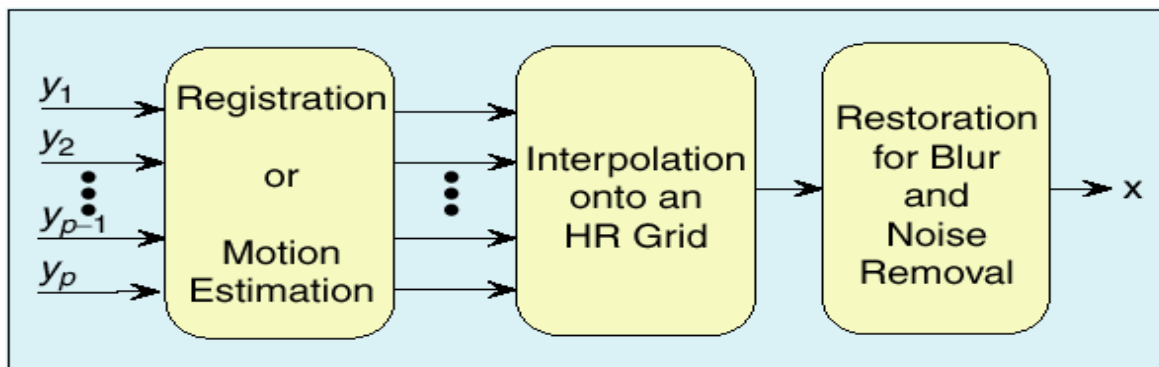


Hence, a need to increase the resolution of images using image processing techniques arises which leads to Image Super Resolution. **Super Resolution** is a process of enhancing the detail content of image through the single low-resolution image or multiple low-resolution images of the same scene.

II. RELATED RESEARCH

To enhance the resolution of the single low resolved image and bring out the hidden details that are already present in the image but not clearly visible.

Non Uniform Interpolation approach: 3 stages



Super resolution challenges

Image registration

The image registration is a basic image processing problem that is well known as ill-posed. The problem is more difficult in the SR setting, where the observations are low-resolution images with heavy aliasing artifacts.

Computation Efficiency

Another difficulty limiting practical application of SR reconstruction is its intensive computation due to large number of unknown samples, which require expensive matrix manipulations

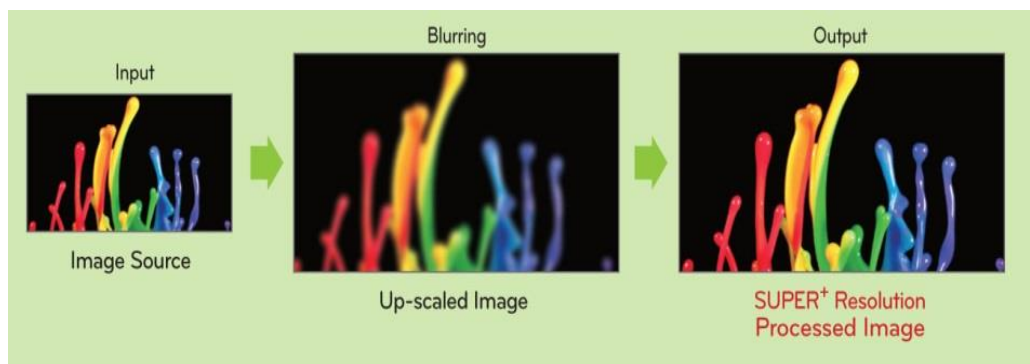
Robustness Prospects

Traditional SR techniques are vulnerable to the presence of deviation due to motion errors, inaccurate blur models, noise, moving objects, motion blur, moving scene etc.

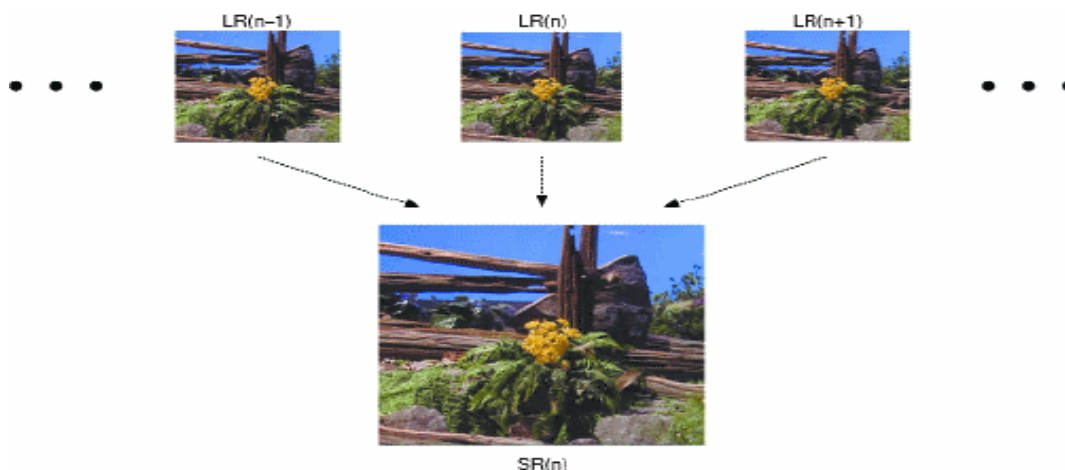
It had works well for: High-Resolution 3-D Movies of Cells, 'Super-resolution' microscope possible for nanostructures, Machine Learning in Multi-frame Image super resolution.

III. PROPOSED WORK

A Single image super resolution



Super resolution from multiple images



Here are two major classes of super-resolution:

- 1) reconstruction-based super-resolution
- 2) recognition-based super-resolution

Recognition-based super-resolution is trying to detect or identify certain pre-configured patterns in the low resolution data. It has a limited application area (e.g. forensic face-detection). It can be dependent or independent of a particular imaging system. The image-system-dependent method has the advantage of taking into account all the characteristics of a particular system and thus producing better results.

Edge Enhancement based

First step is accurately align individual low-resolution images with sub-pixel precision. After the images are aligned, a number of techniques are possible, both iterative and non-iterative, complex or simple, slow or fast. In all the techniques is that information encapsulated in the aliased components is used to recover spatial frequencies beyond sensor resolution and a de-blurring is used to reverse degradation caused by the optical system.



Patch based



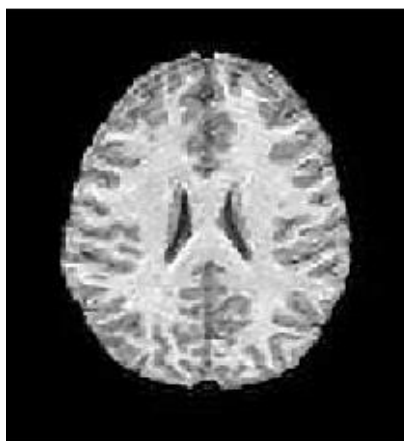
A large set of small blocks, called patches, of HR images and corresponding LR patches. Divide the input LR image into small blocks, i.e., LR patches. For each LR patch find corresponding HR patch from the collection of patch pair. Place these HR patches to the corresponding location to form HR image.

Super-resolution reconstruction for MRI image

Original



Super resolved



Super-resolution reconstruction for general application

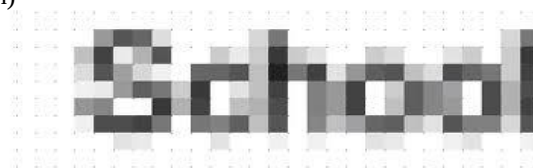


Low Resolution Image



Super-resolution Image

It majorly used in Character recognition (printed and handwritten)



Commercial (Bar code reading, bank cheques, signature ...)



Leisure and entertainment (museums, film industry, photography...)



Medical (X-rays, CT, MRI, PET, SPECT, ultrasound, intensity ...)



Police (fingerprints, surveillance, DNA analysis, biometry ...)



Traffic and transport (Road, airport, seaport, license identification ...)



V. CONCLUSION

This article presents the overview of methods used for image super-resolution reconstruction using single image and multiple images. It also describes advantages and drawbacks related to the methods in order to assist the proper understanding of the readers. Patch based method is usually less costly, but requires additional knowledge base in the form of vocabulary. The application areas are Character recognition, surveillance, DNA analysis, biometry, X-rays, CT, MRI and so far.

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