# Regional Varying Image Super-Resolution

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## Abstract

*In this paper a new method for single image Super-Resolution using some high resolution images is proposed. It is assumed that each high resolution image shows a region of the low resolution image, with some differences about illumination or view point. These differences may be due to taking photos in different times, camera motion or unequal zooming. In the proposed method each high resolution image is mapped to a resized version of the given low resolution image using homography matrix and RANSAC method, which are known in computer vision context. The mapped image is fused with the LR image for producing a synthesized image. The mentioned method is repeated for each of the HR images. The resulting image has higher resolution only on its regions corresponding to HR images. The experimental results show the superior performance of the proposed method against some other methods in term of final perceived quality.*

## 1. Introduction

In recent years digital cameras have been papular. Many of these devices, have optical zoom and can save photos with different resolutions. Enhancing the images and videos is one of the growing domain of image processing applications. Among the various image enhancement and restoration methods, Super-Resolution(SR) methods are the only ones which produce an output image that has higher resolution than the input image. The special case which we have one input and one output named as Single-Input Single-Output (SISO) category in Super-Resolution context[3]. The origin of the more general from of Super-Resolution known as Multiple Input Single Output(MISO) come back to work of Tsai and Huang [17] in 1984, motivated by the need to improve the resolution of images acquired by the Landsat 4 satellite [3]. The analysis performed by Lin and Shum[12], indicates that to achieve super resolution at large magnification factors, reconstruction based algorithms are not favorable and one should try other kinds of super resolution algorithms, such as model-based or example-based algorithms. The model-based approaches import plausible high-frequency textures from an image database into the low resolution image. Figure 1 shows one Low Resolution (LR) and three High Resolution (HR) images –as training data– from bas relief of Darius. The view point, resolution and the illumination of images are slightly different with each other. These methods have gained significant interests in recent years because it promises to overcome the limit of reconstruction-based SR [15].

(a) LR Image (b) HR No.1 (c) HR No.2 (d) HR No.3

**Figure 1. One LR and three HR images of a portion of bas relief of Darius, which have different resolutions, illuminations and view points.**

In previous example-based super-resolution algorithms [2, 6, 10] during the training phase, pairs of LR and the corresponding HR image patches are collected. Then, in the super-resolution phase, each patch of the given LR image is compared to the stored LR patches, and the HR patch corresponding to the nearest LR patch is selected as the output. Freeman *et al*.[6] used a set of HR images as training data set. The super-resolution was performed by the Nearest Neighbor-based estimation of high-frequency patches based

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