Image Super-Resolution using Sparse Coding over Redundant Dictionary based on Effective Image Representations

Muhammad Sajjad, Irfan Mehmood, Sung Wook Baik

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Image Super-Resolution using Sparse Coding over Redundant Dictionary based on Effective Image Representations

Muhammad Sajjad, Irfan Mehmood, Sung Wook Baik*

Tel: +82-02-3408-3797, Fax: +82-02-3408-4339

sajjad@sju.ac.kr , irfanmehmood@sju.ac.kr , sbaik@sejong,ac.kr

College of Electronics and Information Engineering, Sejong University, Seoul, Korea

Abstract: Recent years have shown a growing research interest in the sparse-representation of signals. Signals are described through sparse linear combinations of signal-atoms over a redundant-dictionary. Therefore, we propose a novel super-resolution framework using an overcomplete-dictionary based on effective image-representations such as edges, contours and high-order structures. This scheme recovers the vector of common sparse-representations between low-resolution and corresponding high-resolution image-patches by solving the l_1-regularized least-squared problem; subsequently, it reconstructs the HR output by multiplying it with the learned dictionary. The dictionary used in the proposed-technique contains more effective image-representations than those in previous approaches because it contains feature-descriptors such as edges, contours and motion-selective features. Therefore, the proposed-technique is more robust to various types of distortion. A saliency-map quickens this technique by confining the optimization-process to visually salient regions. Experimental analyses confirm the effectiveness of the proposed-scheme, and its quantitative and qualitative performance as compared with other state-of-the-art super-resolution algorithms.

Keywords: Super-resolution, reconstruction, denoising, representation-coefficients, sparse-coding, overcomplete-dictionary.

1. Introduction

Image super resolution (SR) is an enthusiastic area of research and desirable for many applications. Image SR increases the pixel density of a low-resolution (LR) image to obtain a high-resolution (HR) image. Image SR promises to overcome some of the inherent resolution limitations of low-cost imaging sensors, e.g. surveillance cameras and cell phones. LR images obtained from LR digital devices are reconstructed to an acceptable resolution