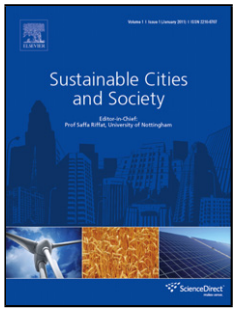

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Medical image super-resolution by using multi-dictionary and random forest

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Research highlight
► Cluster the patches and update dictionaries iteratively to reduce the total error.
► Random forest is trained offline to select most suitable dictionary for each patch.

Abstract
Smart City has become the direction of the development of city. Telemedicine is an important part of Smart City. Telemedicine always provides clinical health care according to the medical images of the patient. High resolution images are expected for remote diagnosis. Super-resolution technology can improve the resolution of medical images. Recently, sparse coding based super-resolution has attracted more attentions. Sparse coding based super-resolution tries to find the sparse representation of low-resolution (LR) image patches from low resolution dictionary, then reconstructs high-resolution (HR) image patches using sparse representation and HR dictionary. In this paper, we propose a sparse-based scheme for medical image super-resolution. First, we jointly divide the training patches into several clusters. Multiple dictionaries are learned from each cluster to collectively provide the least super-resolution error for the training patches. Second, random forest is trained based on the training patches and their cluster labels. Finally, for an input LR image patches, we use trained random forest to determine which cluster the patch belong to, then use the corresponding dictionary to reconstruct the patch. Thus, all the input LR patches are reconstructed with smallest error. All the reconstructed HR patches are synthesized into a completed HR image. The proposed scheme is applied to test a set of medical images. Experimental results show that both objective evaluation (PSNR) and subjective evaluation (visual effect) are improved when compare to other example-based methods.

Keywords: Medical image, Super-resolution, Multi-dictionary, Sparse coding, Random forest

1. INTRODUCTION

HR images are expected both in human visual system and image processing. Many fields are pursuing HR images such as remote sensing, medical imaging, machine vision and so on. In order to increase the resolution of images, we can use hardware measures: upgrading the image sensor manufacturing technology, or using a huge size sensor. Due to the constraints of the physical system, upgrading the hardware is usually expensive and has a long cycle, especially in some special fields like Computerized Tomography (CT), Magnetic Resonance Imaging (MRI) in medical imaging. Therefore, another good option is to use a specific algorithm to improve the spatial resolution of images. In the recent two decades, an image processing technique: super-resolution (SR) has attracted more attentions. SR refers to introduce more details into observed LR images,