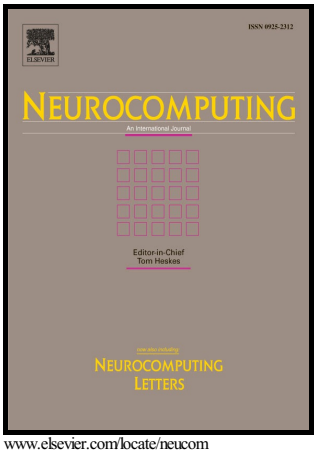


www.elsevier.com/locate/neucom

# Research on the Natural Image Super-Resolution Reconstruction Algorithm based on Compressive Perception Theory and Deep Learning Model

Ganglong Duan, Wenxiu Hu, Jianren Wang

PII: S0925-2312(16)30478-7
DOI: http://dx.doi.org/10.1016/j.neucom.2015.12.125
Reference: NEUCOM17103

To appear in: *Neurocomputing*

Received date: 9 October 2015
Revised date: 16 December 2015
Accepted date: 16 December 2015

Cite this article as: Ganglong Duan, Wenxiu Hu and Jianren Wang, Research or the Natural Image Super-Resolution Reconstruction Algorithm based o Compressive Perception Theory and Deep Learning Model, *Neurocomputing* http://dx.doi.org/10.1016/j.neucom.2015.12.125

# Research on the Natural Image Super-Resolution Reconstruction Algorithm based on Compressive Perception Theory and Deep Learning Model

Ganglong Duan, Wenxiu Hu, Jianren Wang
Xi'an University of Technology, Shaanxi 710054, China
gl-duan@xaut.edu.cn

*Abstract*

*With the bursting development of machine learning and artificial intelligence, the pattern recognition based image processing techniques are growing faster than ever before. In this paper, we conduct theoretical analysis on the natural image super-resolution reconstruction algorithm based on compressive perception theory and deep learning model. The image restoration is the purpose of the degraded image processing which make its recovery as it had been before the degradation of ideal image. According to the views of Fourier optics, optical imaging system is a low pass filter, due to the general influence of optical diffraction. The deep neural network with hierarchical unsupervised training method stratified greed training beforehand matter will be the result of the training as the novel learning supervision probability model of the initial value to make good use of the optical imaging system. The adopted compressed sensing theory points out that as long as signal is compressible or sparse, so, if there is a transformation matrix is not related observation matrix on signal can directly obtain compressed form of the original signal. Our research adopts the advances of the mentioned technique, in the training step, we use deep neural network to automatically capture the features and in the reconstruction procedure we use the compressive sensing and dictionary learning theory to reconstruct the high resolution image. By enhancing both of the steps, our experimental result indicates the feasibility of the novel algorithm. The prospect is also discussed in the final part.*

***Keywords:*** *Image Super-Resolution; Compressive Perception and Sensing; Deep Learning Model; Neural Network Structure; Optimization; Natural Images; Image Restoration.*

## 1. Introduction

Areas such as remote sensing, military reconnaissance and medical imaging needs to target high resolution image, but due to restrictions on the size of CCD pixels or high resolution CCD camera are expensive, volume and weight is very big which can't meet the requirements of high resolution image can be obtained directly. The necessary to make further data processing the acquired image to fully tap the image contains abundant information [1-3]. In the case of the camera imaging system parameters are known, the former and prior super resolution image reconstruction technology of solving nonlinear system of equations by iteration the method to obtain high resolution images of the optimal solution and resolution image reconstruction of surplus. Super-resolution image refers to the use of one or a few pieces of low resolution images and reconstruct the high pixel density and includes more details of high resolution images. As a kind of methodology that holds the characteristics of significantly improving the quality of image without extra hardware enhancement, the super-resolution technique has captured sufficient applications on the video surveillance, medical imaging, remote sensing images, and other fields [4-9]. From the mathematical point of view, the image super-resolution problem is a pathological problem and to solve this problem there must be reasonable prior assumptions. The reconstruction based approach is to use the