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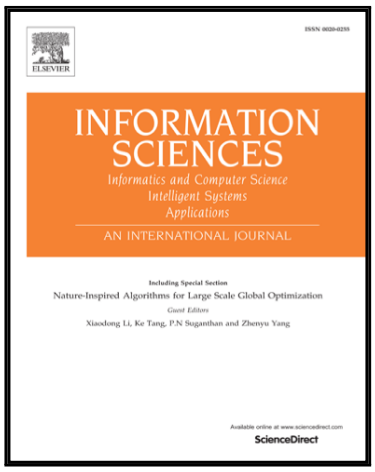

Local Patch Encoding-Based Method for Single Image Super-Resolution

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Local Patch Encoding-Based Method for Single Image Super-Resolution

Yang Zhao, Ronggang Wang, Wei Jia, Jianchao Yang, Wenmin Wang, Wen Gao

***Abstract*—Recent learning-based super-resolution (SR) methods often focus on dictionary learning or network training. In this paper, we discuss in detail a new SR method based on local patch encoding (LPE) instead of traditional dictionary learning. The proposed method consists of a learning stage and a reconstructing stage. In the learning stage, image patches are classified into different classes by means of the proposed LPE, and then a projection matrix is computed for each class by utilizing a simple constraint. In the reconstructing stage, an input LR patch can be simply reconstructed by computing its LPE code and then multiplying the corresponding projection matrix. Furthermore, we discuss the relationship between the proposed method and the anchored neighborhood regression methods; we also analyze the extendibility of the proposed method. The experimental results on several image sets demonstrate the effectiveness of the LPE-based methods.**

***Keywords*—Single-image super-resolution, upsampling, local binary pattern**

1. Introduction

Single image super-resolution (SISR), also known as image upsampling or image upscaling, is a fundamental technique for various applications in machine vision and image processing, such as digital photographs, image editing, high-definition and ultra–high-definition television, medical image processing, object recognition, and recent face hallucination [34]. The goal of image SR is to recover a high-resolution image (HRI) from a low-resolution image (LRI). How to reconstruct high-quality HRI at low cost is still a challenging task.

One basic type of SR method is the interpolation-based algorithm, such as nearest neighbor, bilinear interpolation, bicubic interpolation, and splines. Unfortunately, these methods often produce unnatural artifacts, such as blurring, ringing, and jagged edges. Thus, many interpolation-based methods have been proposed to suppress unnatural artifacts by means of edge prior knowledge [39], different interpolating grids [50], edge sharpening processes [20] , *etc*. These improved methods are able to refine the sharpness of edges but cannot recover high-frequency details.

Another classic type of SR method is the reconstruction-based method, which imposes a similarity constraint between the downsampling of the reconstructed HRI and the original LRI. Early multi-frame reconstruction-based methods fused multiple LRIs of the same scene to recover an HRI. However, the multiple frames were difficult to align and tended to produce extra

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