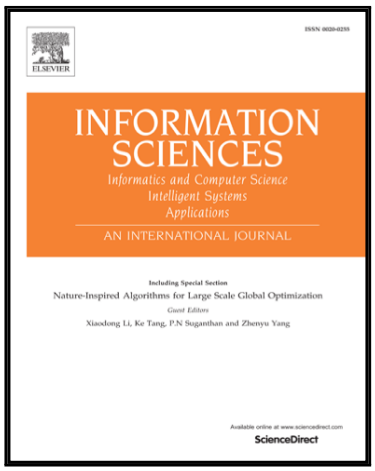

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Robust face super-resolution via iterative sparsity and locality-constrained representation

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Abstract

The performance of image super-resolution (SR) process is highly affected by impulse noise hence, a novel iterative sparsity and locality-constrained representation (ISLcR) based face super-resolution model is proposed here. The proposed model computes data fidelity in high-resolution (HR) and low-resolution (LR) face spaces aiming to compensate the lost information in LR space from the HR space. For this purpose, supporting HR face is computed using the proposed ISLcR model. Further, reconstruction residual of both data fidelity is handled by the locality with sparsity regularization term. The use of both types of data fidelity and locality with sparsity regularization help in reduction of noise, generate a more discriminable outcome, and makes the process computationally viable. The superiority of the proposed ISLcR based face SR model over existing state-of-art methods has been established by conducting the experiments on public standard human face datasets and the images from locally recorded surveillance video. The experimental results indicate that the proposed model has outshined all the existing methods.

Keywords: Position-patch and dictionary based model, Super-resolution, Impulse noise robust, Face hallucination, Sparsity constraint, Iterative approach.

1. Background

Many real-world applications suchlike computer-human interaction, face recognition, and intelligence surveillance systems demand high-quality images. However, the factors such as low-resolution capturing system, storage and processing errors [8], and transmission noise degrade the quality and resolution of the controlling objects significantly making the implementation of above applications a challenge. To address these problems, image super-resolution (SR) techniques are introduced in literature which aim to produce high-resolution (HR) version of captured low-resolution (LR) images.

The existing SR methods can be classified as (i) general image SR [10, 4, 11, 29, 12, 13, 23, 42, 31, 9], and (ii) specific image SR e.g., face SR [2, 41, 3, 45, 43, 44, 34, 14, 28, 27, 38, 1, 20, 19, 15, 22, 18, 26, 24, 6, 33, 32]. Few face SR (or hallucination) models require multiple frames of an input face while others work with a single frame of an input face along with some dictionary faces. Based on this, the existing face hallucination models are categorized as (i) reconstruction-based SR, and (ii) dictionary (or learning/training)-based SR. As insights derived from the literature, dictionary-based face SR models perform well over reconstruction-based method especially to deal with larger magnification factor.

The dictionary based SR models can be of two types namely global face-based SR and local patch-based SR. Presently, patch-based SR techniques are widely in use because of their stronger synthesizing and discriminable features preserving capability over other type of SR technique. The review of various face SR models are presented below.

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