Ph.D. Thesis Review

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Title: Nonlocal Self-Similarity Based Prior Modeling for Image Denoising

Department: Department of Computing

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Reviewer: David Zhang, The Hong Kong Polytechnic University

**General comments**

This thesis contains many contributions to the well-known image denoising problem emerged in image processing and computer vision.

The subject of the thesis is of paramount importance for practical image denoising applications with real-world camera imaging systems. The algorithms developed in this thesis helps enhance the quality of captured images with applications to many different computer vision problems. The developed algorithms and dataset can also boost the research of a new direction on real-world image denoising problem.

An important contribution to the image denoising community is to learn the nonlocal self-similarity (NSS) priors of natural images for image denoising. This idea has already been applied into many different problems such as medical image restoration, and some other tasks.

A second important contribution of the thesis with respect to the image processing is to design an external NSS prior guided internal prior learning for real-world noisy image denoising. The thesis has also provided valuable evaluation of the real-world image denoising methods with different datasets, including a new one provided by the authors.

The third contribution of this thesis is to provide a novel color image denoising algorithm considering the differences in the three channels in the color images. The proposed MCWNNM method can be viewed as a new baseline for color image denoising.

The fourth contribution of this thesis is to provide a trilateral weighted sparse coding (TWSC) scheme for real-world image denoising task. The proposed TWSC method achieves state-of-the-art performance on several benchmark datasets.

The last contribution in the thesis provides a new dataset for evaluating the existing and potential new denoising methods on real-world image denoising task. The scenes need to be more comprehensive.

**Summary**

Even though the final chapter of the thesis does not provide comprehensive scenes of real-world noisy images, the main body of the work, those four novel image denoising algorithms make the overall assessment of this thesis extremely positive.

The results make the four algorithms enjoy actual industrial values to be embedded into real-world camera imaging systems. Therefore, the results of the thesis are relevant to current needs of the image processing community and of industry practice. The main objectives of the five works have been fulfilled, as shown through the evaluation sections in the different contributions, and in the corresponding experimental sections.

The methodology used in the thesis is considered appropriate. In particular all the contributions are well founded on solid mathematical backgrounds, and are proven through exhaustive experiments and, more important, through actual implementation. The thesis satisfies the conditions of a creative scientific work, as is shown through the publications of some of its results in peer-reviewed top conferences of significant impact in the computer vision and image processing community.

The author of the thesis proved his ability to perform research and to achieve scientific results. I recommend the thesis for presentation with the aim of receiving the Degree of Ph.D.

Best regards, January 21th 2018。

David Zhang 