THE HONG KONG POLYTECHNIC UNIVERSITY
香港理工大學

MEMO

To : Chair, BoE / Interim Head / Chief Supervisor / Co-supervisor / Research Student ✓

From : Ms Ada So, EO (RO)

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PhD Examination – Mr XU Jun (COMP)
~~1st External Examiner~~/2nd External Examiner:
Prof. Pheng Ann HENG

------- For your information, I enclose the Examiner's Report(s) received from the above member(s) of the Board of Examiners (BoE). The Chair of the BoE will be asked to make a decision on whether the oral examination can proceed upon the receipt of comments from all of the members of the BoE.

Ms Ada So
Executive Officer
Research Office

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External Examiner's Report

Xu Jun (Department of Computing), PhD candidate
Thesis Title: Nonlocal Self-Similarity Based Prior Modeling for Image Denoising

Part A :
Does the thesis submitted by Mr Xu Jun form an adequate basis for an oral examination?

(Please tick) : [✓] Yes [ ] No

Part B :
The ratings and comments below will be released to members of the Board of Examiners before the oral examination. Can they be released to the candidate after the oral examination?

(Please tick) : [✓] Yes [ ] No

Part C :

Comments to be released to the candidate before the oral examination:

Please refer to attached report.

Signature : _____

Name : Prof. Pheng Ann HENG

Institution : The Chinese University of Hong Kong

Date : 9.3.2018

Part C:

Comments to be released to the candidate before the oral examination:

In this thesis, the candidate has carried out in-depth research in the area of image denoising by developing a set of works to exploit the nonlocal self-similarity (NSS) prior for image denoising, including synthetic and real image denoising. In addition, the candidate also constructed a new dataset for the study of the real-world image denoising.

Specifically, the candidate first proposed an image denoising work by learning the NSS priors of natural clean images in an offline manner, which can help to preserve the details of natural images and be much faster than most online denoising methods.

Then, the candidate presented three works to process the complex noise in real-word noisy images. Specifically, the candidate proposed to learn the NSS prior from the external natural images, and then applied the learned external prior to guide the internal NSS prior learning in input real-world noisy images. After that, the candidate presented a color image denoising method by incorporating the noise variances of different channels of the input color image into WNNM [16] model. The third real image denoising work was to model the noise in each local region as a Gaussian distribution and exploit the sparse coding framework equipped with a triple weighted scheme. Extensive experiments in this thesis demonstrated that all the works have outperformed performances than state-of-the-art techniques, Lastly, the candidate constructed a large benchmark dataset of real-world color noisy images by using several representative cameras with different setting conditions, and this dataset had the potential to largely boost the research of the real-world image denoising.

Overall, those research works presented in this thesis showed that the candidate is knowledgeable about the research field he is working on. The candidate published a set of research papers, and some of them were accepted (or minor) in top-level conferences and journals, such as the ICCV and TIP.

Meanwhile, the candidate may further revise the thesis based on the below issues:

1. In this thesis, the candidate proposed four image denoising methods. What are the relations of the proposed methods? Which one is the best? Which one is fastest? Is it possible to apply those denoising methods in the industry case? Do you think what the main factors are to affect the usage of your methods in the industry?

2. In the Chapter 2, the candidate presented comparisons under different noise levels, e.g., the noise σ=20-100 in Table 2.1 (Page 30). What about the denoising comparisons with very large noise levels, like σ>=150? Have you tried to use some noise level estimation methods to automatically compute σ? If yes, what are the performances?

3. Note that the image denoising task can be regarded as a specific task of image restoration research problem, where we are required to recover a latent image from the restored input. I am wondering if all your image denoising methods can be adapted to other image restoration tasks, like single-image rain streak removal, snow removal, structure-preserving image smoothing? If yes, how to achieve the adaptations?