The Hong Kong Polytechnic University

Department of Computing

External and Internal Nonlocal Self-Similarity based Models for Image Denoising

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A thesis
submitted in partial fulfilment of the requirements
for the degree of

Doctor of Philosophy

July 10, 2017

CERTIFICATE OF ORIGINALITY

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_____ (Signed)

Jun Xu (Name of student)

Abstract

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> *"Mens cujusque is est Quisque" – "Mind Makes the Man"*
>
> **— Samuel Pepys**

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1.1 The Camera Imaging Pipeline

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1.2 The Image Noise

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1.3 The Proposed Methods

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1.4 Thesis Structure

Chapter 2

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Literature Review

2

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2.1 Synthetic Grayscale Image Denoising

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2.2 Realistic Color Image Denoising

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3 External Non-local Self-Similarity Prior for Additive White Gaussian Noise

> *Innovation distinguishes between a leader and a follower.*
>
> — **Steve Jobs**
> (CEO Apple Inc.)

3.1 Introduction

Fig. 3.1: Figure example: *(a)* example part one, *(c)* example part two; *(c)* example part three

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Fig. 3.2: Another Figure example: *(a)* example part one, *(c)* example part two; *(c)* example part three

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3.2 System Design

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3.3 Demo System

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3.4 Calibration

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3.5 Conclusion

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4 External Prior Guided Internal Prior Learning for Real Noisy Image Denoising

> *Innovation distinguishes between a leader and a follower.*
>
> — **Steve Jobs**
> (CEO Apple Inc.)

4.1 Learning External Nonlocal Self-Similarity Priors

Fig. 4.1: Figure example: *(a)* example part one, *(c)* example part two; *(c)* example part three

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5 Internal Nonlocal Self-Similarity Prior for Real Color Image Denoising: A Low Rank based Method

> *Users do not care about what is inside the box, as long as the box does what they need done.*
>
> **— Jef Raskin**
> about Human Computer Interfaces

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5.2 Related Work

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5.3 Method

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5.4 Experimental Results

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5.5 Summary

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6 Internal Nonlocal Self-Similarity Prior for Real Color Image Denoising: A Sparse Coding based ethod

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>
> **— Jef Raskin**
> about Human Computer Interfaces

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6.2 Related Work

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7 A Large Real Noisy Image Dataset, with A Comprehensive Evaluation of State-of-the-arts

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>
> — **Jef Raskin**
> about Human Computer Interfaces

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8 Conclusions

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8.1 Section 1

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8.2 Section 2

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8.3 Future Work

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