COMP825 Deep Learning Research Proposal

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Abstract

project significance, project methods, contributions, and evaluations

1 Introduction

(research problems, existing solutions, novel solutions or creative contributions, significance, etc.)

Removing noise from degraded images to recover high quality ones, known as image denoising, is a fundamental task in computer vision. It has been a classic research area yet remains active nowadays (Gu & Timofte, 2019). In addition, it not only greatly affects user experience, but also plays a very important role for subsequent computer vision tasks such as classification and recognition (Gu & Timofte, 2019).

A widely accepted yet simple image degradation model is

$$\boldsymbol{y} = \boldsymbol{x} + \boldsymbol{n} \tag{1}$$

where $\boldsymbol{x}$ refers to the uncorrupted image, $\boldsymbol{y}$ represents the degraded image and $\boldsymbol{n}$ is the additive noise (Gu & Timofte, 2019). Several kinds of noises has been widely studied, including additive white Gaussian noise (AWGN), Poison noise, and salt-and-pepper noise (Gu & Timofte, 2019).

The biggest challenge in image denoising is the loss of information during degradation, making this problem highly ill-posed (Gu & Timofte, 2019). As a result, prior knowledge is required to compensate the lost information to recover high quality image (Gu & Timofte, 2019). This can be the prior modelling of either the images or noise (Chen, Chen, Chao, & Yang, 2018).

internal (use solely the input noisy image) [7, 25, 40] and external (use external images with or without noise) [98, 54, 75, 93] denoising methods. Some works shown that the combination or fusion of internal and external information can lead to better denoising performance [9, 60, 78, 37].

Based on the information used in modelling, image denoising methods can roughly be divided into two categories (Gu & Timofte, 2019):

- Internal: only use the noisy images
- External: use both noisy and clean (ground truth) images

The two kinds of approaches can be combined or mixed to reach better performance (Gu & Timofte, 2019).

In recent years, deep neural networks (DNNs) overtakes traditional methods and became the state-of-art technology on almost every task of computer vision (Gu & Timofte, 2019). In image denoising, a variety of DNN models have been proposed. DNN-based methods requires less human interactions and achieves better performance (Tian, Xu, Fei, & Yan, 2019).

2 Related work

(existing work organized in categories, critical summery and analysis, and statement of contributions, etc.)

DnCNN (Zhang, Zuo, Chen, Meng, & Zhang, 2017) RED (Mao, Shen, & Yang, 2016) MemNet (Mao et al., 2016)

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GAN-CNN Based Blind Denoiser (GCBD) (Chen et al., 2018) GraphCNN (Valsesia, Fracastoro, & Magli, 2019)

3 methodology

(research design, research methods, modelling and algorithms, etc.)

4 timeline and milestones (terms/quarters-based)

Task	Deadline
Final decision on the topic, create research questions	February 1st, 2020
Literature review	March 1st, 2020

5 research resources

(hardware, software, budgets, settings, etc.)

6 planned research outcomes and ways of quality assurance (avoiding risks)

7 references

(9 references at least in total).

Reference

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Mao, X.-J., Shen, C., & Yang, Y.-B. (2016). Image restoration using very deep convolutional encoder-decoder networks with symmetric skip connections. *Proceedings of the 30th international conference on neural information processing systems*, 2810–2818. Red Hook, NY, USA: Curran Associates Inc.

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