COMP 576 Proposal:
Image Denoising using Convolutional Neural Network

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Introduction

In recent years, taking photos with smartphones has become a popular way for people to record their lives. But because of hardware limitations, image denoising still remains one of the most challenging tasks when it comes to processing smartphone images. Therefore, deep learning techniques have received much attention in the area of smartphone image denoising.

Goal

The goal of the project is to train CNN-based models and adjust network structures on SIDD. We anticipate developing a model that can demonstrate better performances of image denoising by comparing results of different network structures.

Methods

There are plenty of methods of imaging denoising with the architecture of Convolutional Neural Network. Here we adopt two methods, Residual Encoder-Decoder Network (REDNet) and Pyramid Real Image denoising (PRIDNet).

- REDNet is a CNN based auto-enoder architecture with skip connections. It contains layers of symmetric convolution (encoder) and deconvolution (decoder).
- PRIDNet is a state-of-the-art deep learning architecture which contains three modules, Channel Attention Module, Multi-Scale Feature Extraction Module (Pyramid Module), and Kernel Selecting Module.

Dataset

We chose the organized dataset called Smartphone Image Denoising Dataset, a.k.a SIDD. The dataset contains 30000 noisy images taken from cameras of 5 types of smartphones: Google Pixel, iPhone 8, Samsung Galaxy S6 Edge, Motorola Nexus 6, and LG G4. It is also classified by its brightness: low light, normal brightness and high exposure. We will first use its small dataset, which contains 160 pairs of images with and without noise. We are going to use 80% of the dataset for training and 20% for testing. If possible, we will use the full dataset for testing the accuracy of the models.

Feasibility

Algorithm feasibility: Many studies, as referenced at the end of this document, have done research in this area, and have produced promising results.

Data feasibility: In the existing research on image denoising, there are already many useful and comprehensive datasets, such as SIDD. SIDD contains different scenes and types of mobile photos.

Project execution plan

Model training, improvement, and testing based on REDNet: Dongwei Li, Danyu Wang
Model training, improvement, and testing based on PRIDNet: Iris Wu, Kunhua Lei
Results analysis: Dongwei Li, Danyu Wang, Iris Wu, Kunhua Lei

References

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