CoE 4TN4 Project
Camera Image Signal Processing (ISP) Pipeline
Phase 2 (due date: March 30, 2024)

the model will denoise and demosaic at the same time

the regression models we built for phase one is done on clean data, so we can't re-use. so we need to retrain the regression model in phase one.

February 29, 2024

In phase 2 of the project, students will build upon their progress in phase 1 to complete, improve and evaluate all modules of camera image signal processing pipeline.

Students are required to perform the following tasks.

blue channel normally has most of the noises. green is the cleanest. we add different guassian strength

simulate the real device by adding random guassian noise

1 Denoising of camera mosaic data

Simulate noisy mosaic images by adding Gaussian random noises to the "clean" training mosaic images used in phase 1. The noise levels for the three primary colors are different, with the σ value of the Gaussian noise being 1, 2 and 4 for the green, red and blue samples.

Retrain the demosaicing regression models with the above synthesized noisy mosaic data. Your goal is to make the trained regression model to perform the dual tasks of denoising and demosaicing and reconstruct the RGB image.

Alternatively, you may also first perform denoising of the mosaic data in a separate step, and then feed the denoised mosaic data to the demosaicing regression model of phase 1 to reconstruct the RGB images.

In either case, use experimental results to demonstrate that your new method works better on real-world camera data than the regression model built in phase 1. You are encouraged to find available raw camera mosaic data to test your method and compare your results with those of other competing methods.

2 Automatic white balancing

Carry out a self study of automatic white balancing problem, choose a suitable white balancing algorithm or design your own, and implement it in the camera image signal processing pipeline. Should you carry out white balancing before or after demosaicing? Either way justify your design decision.

You need to find or/and synthesize hue shifted color mosaic data for your experiments to demonstrate the validity of your algorithm design and implementation.

3 Locally adaptive image enhancement

Carry out a self study of locally adaptive image enhancement approach, choose such a suitable algorithm or design your own, and implement it in the camera image signal processing pipeline.

Conduct experiments to demonstrate the validity of your algorithm design and implementation.

4 Written report

You need to write a report detailing your algorithms, camera simulation process, data set preparation, implementation and experimental results. You are encouraged to explore deep learning methods for demosaicing and denoising (optional), and compare your results with those of deep learning.

Up to 20 percent bonus will be awarded for innovative work or/and interesting insight. So please highlight those points in the report if you feel you deserve the bonus.