CMSC 630 Project part 1

Image processing and filtering

Project deadline: 15th March 2021 11:59pm UTC-05:00

Bartosz Krawczyk, Ph.D.

Department of Computer Science School of Engineering Virginia Commonwealth University

1. Dataset

Students will work on supplied dataset of 500 real-life cancerous smear images coming from Wroclaw Academic Hospital in Poland. Images come from patients suffering from various forms of cervical cancer. There are 7 types of cancerous cells being identified, which will be used in later stages of the project. All images are in RGB format in .bmp file system, of 768x568 resolution taken under a microscope with 400x magnification. The dataset consists of following types of cells:

- 50 columnar epithelial cells
- 50 parabasal squamous epithelial cells
- 50 intermediate squamous epithelial cells
- 50 superficial squamous epithelial cells
- 100 mild nonkeratinizing dysplastic cells
- 100 moderate nonkeratinizing dysplastic cells
- 100 severe nonkeratinizing dysplastic cells

2. Requirements

Following requirements are necessary for completion of the project:

- Designed program must work in a batch setting, taking as an input a given set-up file with location of images and required functions to be run.
- Program can be implemented in any language.
- API or software packages for image processing are not allowed. All functions must be original implementation of the student. Exceptions include functions for opening/saving an image.
- Program should output not only processed images, but also required statistics to be collected.
- Students must submit the code of their program plus a written report discussing the implementations, used functions and obtained results.

3. Functionality to be implemented

During the first stage of the project students must implement the following functionality:

- General framework for processing all of images in a batch setting with supplying set-up initializing file.

- Noise addition functions that will allow to corrupt each image with:
    - o Salt and pepper noise of user-specified strength
    - o Gaussian noise of user-specified parameters
- Converting color images to selected single color spectrum.
- Histogram calculation for each individual image.
- Averaged histograms of pixel values for each class of images.
- Histogram equalization for each image.
- Selected image quantization technique for user-specified levels.
- Filtering operations:
    - o Linear filter with user-specified mask size and pixel weights.
    - o Median filter with user-specified mask size and pixel weights.
- Display the following performance measures
    - o Processing time for the entire batch per each procedure
    - o Averaged processing time per image per each procedure
    - o MSQE for image quantization levels