GEORGIA INSTITUTE OF TECHNOLOGY
SCHOOL OF ELECTRICAL AND COMPUTER ENGINEERING

ECE 6258/4803 BMED 8813: DIGITAL IMAGE PROCESSING **Term Project** Fall 2023

Teams: Students can work on the term project individually or in teams of no more than two students. You may utilize Piazza to team up. A team of two students is expected to perform roughly double the work of an individual student.

Topic: The project is to denoise and enhance images from the CURE-OR, CURE-TSR, CURE-TSD, SSID, and Set-12 datasets. You have the option to replace one of these datasets with a dataset of remote-sensor images or medical images. Every team must focus on at least 2 denoising or enhancement methods, but not more than four methods, to denoise and enhance all images in all five datasets. This way, you can spend your time analyzing the performance on all images and all different types of distortions. In some cases, a method may do well in certain type of noise but in other types. Analyzing such discrepancies is crucial and is expected to be part of your term paper. Evaluation of the performance should be based on IQA metrics for all datasets. The IQA methods must include at least PSNR, SSIM, CW-SSIM, UNIQUE, MS-UNIQUE, CSV, and SUMMER. Also, you should evaluate performance using detection/recognition accuracy metrics whenever that is possible. Here are some inks:

CURE-OR: D. Temel*, J. Lee*, and G. AlRegib, "CURE-OR: Challenging Unreal and Real Environments for Object Recognition," in *IEEE International Conference on Machine Learning and Applications (ICMLA)*, Orlando, FL, Dec., 2018, [PDF], [Code]

Dataset: https://github.com/olivesgatech/CURE-OR

Note: A smaller version of CURE-OR is called mini-CURE-OR and can be found here: https://github.com/olivesgatech/mini-CURE-OR; you could use this to get quick output before you apply your methods on the large CURE-OR

CURE-TSR: . Temel, G. Kwon*, M. Prabhushankar*, and G. AlRegib, "CURE-TSR: Challenging Unreal and Real Environments for Traffic Sign Recognition," in *Advances in Neural Information Processing Systems (NIPS) Workshop on Machine Learning for Intelligent Transportation Systems*, Long Beach, CA, Dec., 2017, [PDF], [Code]

Dataset: https://github.com/olivesgatech/CURE-TSR

CURE-TSD: Dataset: https://github.com/olivesgatech/CURE-TSD

SSID: Dataset: https://www.eecs.yorku.ca/~kamel/sidd/index.php

Set-12: Dataset: https://paperswithcode.com/dataset/set12

PSNR: use the formulation we have in class, in dippykit or Matlab, or online

SSIM: use the formulation we have in class, in dippykit or Matlab, or online

CW-SSIM: Code is available online

UNIQUE: [PDF][Code][Link]

MS-UNIQUE: https://github.com/olivesgatech/MS-UNIQUE

CSV: https://github.com/olivesgatech/CSV

SUMMER: https://github.com/olivesgatech/SUMMER

Recognition for CURE-OR: https://github.com/olivesgatech/CURE-OR

Recognition for CURE-TSR: https://github.com/olivesgatech/CURE-TSR

Detection for CURE-TSD: https://github.com/olivesgatech/CURE-TSD

Progress Reports (15% of the project's grade): On October 20, 2023, teams are expected to submit a one-page progress report that details the completed tasks, details of the individual's work, and their overall plan.

Term Paper and Poster (85% of the project's grade): The term paper and poster are due on December 01, 2023 at 05:00 p.m. The term paper must follow an *IEEE* Double-column, single-space, 11-pt font size format. Use a Letter size template. A template can be found HERE. The Poster is expected to be a visual summary of the term paper. Some templates can be found here: https://github.com/zhoubolei/bolei_awesome_posters. Depending on the final number of students in class, we may hold a poster session or have online video recordings. More on this will be announce in early November 2023.

Note: Undergraduate students who choose to do the project for a bonus of up to 10% will be evaluated based on a poster AND a term paper. Undergraduate students can work on in groups of sizes 1 to 2 members. Such intentions and teams must be declared by the progress report deadline of October 20, 2023.