Department of Mathematical and Statistical Sciences
Marquette University
Summer 2021

Course: MATH 4931/MSSC 5931. Topics in Mathematics or Statistics. 3 cr. hrs.
Topic: Statistical Machine Vision
Time: MoTuWeTh 11:30 am - 1:05 pm
Place: Synchronous Distance Learning via MS Teams
Instructor: Daniel B. Rowe, Ph.D.
Office Hours: TuTh 1:05 pm – 2:05 pm
E-mail: daniel.rowe@marquette.edu
Required text:
None. Course material will be presented via lecture slides or handouts.
Grading:
Grades will be based upon submitted homework, presentation of homework solutions in class, and a final term project.
MATH 4931/MSSC 5931:
Students in MSSC 5931 will have additional assignments.

Topics:

- Discrete image representation.
- Image enhancement via local pixel weighting
- (spatial kernel filter and image space convolution).
- Pixel noise reduction via local averaging (smoothing filters).
- Edge enhancement via local differencing (gradient filters).
- Statistical properties of local averaging or differencing (change in pixel mean, variance, and correlation).
- Image text recognition, letter or word identification (letter A, word MATH) or image object detection (car, face) via statistical correlation (template matching).
- Line tracing (road lane lines) within an image via discrete derivatives, gradients, and Hessians.
- Weighted time averaging (temporal recursive filters) for pixel noise reduction in image sequences.
- Identifying and tracking of objects including orientation through a sequence of images (car moving across a scene in a sequence of images).
- Image object segmentation (outlining image objects of interest).
- Connected component analysis object identification (determining the pixels that make up objects within an image).
- Image object representations (perimeter, area, elongation, etc.), feature extraction.
- Statistical classification of image objects using features (square, circle, and rectangle).
- Throughout computational implementation and examples will be given with Matlab.
- Additional topics if time permitting may include the DFT to perform convolutions faster in frequency space.