

SYDE 672 Statistical and Multidimensional Image Processing (Fall, 2022)

Instructor: Amir Nazemi anazemi@uwaterloo.ca
Text: Statistical Image Processing and Multidimensional Modeling
See textbook home page at <http://ocho.uwaterloo.ca/book>
Home Page: SYDE 672 on Learn
Synchronous Class Times (In person) : Mondays 11:30-12:50, Wednesdays 11:30-12:50

Tutorial / Office hours / Informal discussion included in class times.

Course Grading:

1. Problem sets (four assignments): two analytical, to strengthen analytical understanding of material presented in class, and two short Matlab tasks, which relate to statistical modeling and estimation (probably one on Kalman filtering, perhaps one on random fields). These will be done individually. 40% of term mark.
2. Term project: The range of possible project topics is extremely broad; I will be suggesting ideas and good journals to look at. The project can involve a critical review of recent papers in the literature, or a computer analysis and simulation of some topic of interest (perhaps in your research area).
 - 5% — Short (up to one page) proposal due by end of October
 - 5% — Short (5-10 minutes) overview presentation in class, end of November
 - 5% — One page summary to accompany presentation, end of November
 - 45% — Project report

Course Outline:

- 1 Review - linear algebra, linear systems, statistics.
Inverse problems and ill-posedness.
- 2 Estimation problems; interpretation dualities.
Kalman filter derivation and usage.
- 3 Multidimensional modeling and estimation.
- 4 Conditional methods: coordinate descent, expectation-maximization.
- 5 Changes of basis: Bag of features, Gabor functions.
- 6 Implicit models: Markov random fields, Gibbs fields, Sim. annealing.

It is expected that students understand the university position on copying (in terms of assignments) and plagiarism (in terms of the project). All work / figures which are not your own must be explicitly identified.