MATH 581 (Spring 2009) : Image and Data Analysis

Kevin R. Vixie (vixie@speakeasy.net)
Thomas J. Asaki (tasaki@wsu.edu)
Bala Krishnamoorthy (kbala@wsu.edu)
Time: MWF 2:10–3:00
Room: Sloan 46
Pullman Campus, WSU
(This Course is Crosslisted at U of I: Math 541)
http://datachallengecooperative.org/math581

Background and Motivation: As scientists and citizens, we are being overwhelmed by an exponentially increasing flood of data. From video and hyperspectral streams, distributed sensor networks with thousands of nodes, and network monitoring to automated astronomical surveys and astrophysical space instruments, the need for cleverness and innovation in data analysis and information extraction only increases with time. How can we extract useful information in real time from streaming data, keeping only the useful bits as the stream flies by? How do we optimize the use of sparse measurements from extremely high dimensional systems? Can we precisely quantify uncertainty propagation in the high or infinite dimensional systems typical of data processing pipelines? Questions like these are far from settled. They will require advances on all fronts: theoretical, experimental, and computational. This course will introduce many concepts and techniques being used to address these types of challenging data problems.

Topics: A broad range of topics will come up naturually as we follow one particularily rich path through the subject: image denoising → image segmentation → shape characterization and data signatures → learning from data. Examples of topics: optimization, shapes from images, level set methods, curvature measures, bar codes for shapes, principal component analysis (PCA) and its nonlinear cousins, and data comparison metrics. See website for more detail.

Prerequisites for this course: are an excellent grasp of vector calculus and linear algebra, and a willingness to work – in particular, we welcome motivated undergraduates. Evaluation will be through projects rather than through homework or exams. These computational projects will involve applications jointly defined by the student and instructors and will employ various computer packages and programming languages.