CSE 702 Seminar in Pattern Theory

University at Buffalo SUNY

Syllabus for Spring 2008

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Course Webpage: http://www.cse.buffalo.edu/~jcorso/t/2008F_702

Syllabus: http://www.cse.buffalo.edu/~jcorso/t/2008F_702/syllabus.pdf.

Meeting Times: Thursday 1-3

Location: Bell 242

Office Hours: Wednesday 1-2:30 or by appointment

Main Course Material

Course Overview: This seminar will focus on Grenander's Pattern Theory from a practical, contemporary perspective. Pattern Theory is the study of patterns from a representational perspective rather than a recognition one. Miller and Grenander write "Pattern theory attempts to provide an algebraic framework for describing patterns as structures regulated by rules, essentially a finite number of both local and global combinatory operations. Pattern theory takes a compositional view of the world, building more and more complex structures starting from simple ones. The basic rules for combining and building complex patterns from simpler ones are encoded via graphs and rules on transformations of these graphs." We will explore various theoretical aspects of modern pattern theory (e.g., probabilistic graphical models, grammars, matrix groups, information measures, manifolds, Markov processing and sampling) in the context of practical problems in computer vision and medical imaging.

Students will be required to give one or two (depending on seminar size) prepared lectures during the semesters.

Course Project: If letter grading is desired by student, s/he will complete a research-level term project on some pattern theoretic problem. The project should align well with his/her own research and will be designed in conjunction with the professor.

Prerequisites: It is assumed that the students have working knowledge of the material in pattern recognition (CSE 555), computer vision (CSE 573), machine learning (CSE 574) and Bayesian vision (CSE 672). Permission of the instructor is required if these pre-requisites have not been met.

Course Goals: After taking the course, the student will have a working knowledge of pattern theory and be able to take pattern theoretic approaches in their research.

Textbooks: We are lucky to have an advance copy of Mumford and Desolneux's new book on Pattern Theory. I will distribute copies of this text to the class. This will be our main course material.

Supplementary texts are

1. Grenander, "Elements of Pattern Theory." Johns Hopkins Studies in Mathematical Sciences. 1996.

2. Grenander and Miller, "Pattern Theory: From Representation to Inference." Oxford University Press. 2007.

Grading: Grading is S/U; letter grading is available as an option and requires a project.

Student Participation: Each student will be responsible for *leading the discussion* on an entire chapter from the text. We will spend two weeks on each chapter. During the first week, we will cover the chapter material (During this time, the leader will essentially give a lecture (slides or board is fine). Each student will have read the chapter. We will emphasize discussion as we cover the chapter material.) During the second week, the student will cover solutions to three of the exercises at the end of each chapter. The student will indicate which exercises s/he has chosen by (or before) the first of the two weeks, and everyone is expected to complete the exercises. While the student has full power (almost) over which exercises are selected, at least one must be computational in nature and at least one must be theoretical in nature.