Course Syllabus

SIE 571 Pattern Recognition and Robotics

Course Description
Pattern recognition algorithms classify input data based on statistical information. A mobile robot needs pattern recognition algorithms to make sense of its spatial environment based on sensor input. The course will introduce the mathematical framework of pattern recognition and present practical applications in robotics. The course will also cover supervised neural network learning algorithms.  
Cr. 3.

Course texts
There is no assigned textbook for this course. A collection of readings will be handed out during the semester.

PowerPoint slides of lecture material will be available on a course web page.

Course Goals and Objectives
• Introduce students to pattern recognition foundations  
• Develop an understanding of the software design methods of mobile robotics  
• Expose students to practical work with mobile robots

Faculty Information
Dr. Reinhard Moratz  
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Office Hours
Office hours for this course will be announced at the beginning of the semester. Alternatively, contact me by email to arrange a time to meet.

Grading, Class Policies and Course Expectations
Grades in this course will be based on the quality and completion of the course project (50%) and the homework assignments (40%). Ten percent of the course grade is dependent on attendance and participation in class. As a graduate level course, you are expected to exhibit high quality work that demonstrates sound understanding of the concepts and their complexity. Earning an “A” represents oral and written work that is of exceptionally high quality and demonstrates superb understanding of the course material. A “B” grade represents oral and written work that is of good quality and demonstrates a sound understanding of course material. A “C” grade represents a minimally adequate completion of assignments and participation demonstrating a limited understanding of course material. A “C+” grade or lower is typically unacceptable at the graduate level.

Academic Integrity: Academic dishonesty includes cheating, plagiarism and all forms of misrepresentation in academic work, and is unacceptable at The University of Maine. As indicated in the University of Maine’s on-line “Student Handbook,” plagiarism (the submission of another’s work without appropriate attribution) and cheating are violations of The University of Maine Student Conduct Code. An instructor who has probable cause or reason to believe a student has cheated may act upon such evidence, and should report the case to the supervising faculty member or the Department Chair for appropriate action.
**Disabilities (ADA) Statement:** Students with disabilities who may need services or accommodations to fully participate in this class should contact Ann Smith, Director of Disability Services in 121 East Annex, (voice) 581-2319, (TTY) 581-2325 as early as possible in the semester.

**Class Disruption:** In the event of an extended disruption of normal class activities, the format for this course may be modified to enable its completion within its programmed time frame. In that event, you will be provided an addendum to the syllabus that will supersede this version.

**Course topics:**

Week 1  
Course introduction and overview  
History of pattern recognition  
History of robotics

Week 2  
Robot sensors  
Segmentation algorithms  
Probabilistic foundations of pattern recognition

Week 3  
Decision theory  
Bayesian inference  
Multivariate Gaussian distributions

Week 4  
Linear models for classification  
Convex decision regions  
Perceptron rule

Week 5  
Neural activation functions  
Multilayer perceptrons  
Backpropagation rule

Week 6  
Introduction into R software for statistic calculations  
Visualisation methods  
Definition of course project

Week 7  
Human way finding  
Least-angle strategy  
Path integration

Week 8  
Obstacle avoidance  
Odometry
Simple navigation strategies

Week 9
Path planning
Interactive route planning
Route graphs

Week 10
Human robot interface design
Linguistic spatial reference
Instruction maps

Week 11
Kalman filters
Simultaneous localization and mapping
Cycle detection

Week 12
Robot architectures
Skill layer
Deliberative layer

Week 13
Robot simulation
Service robotics
Outdoor robotics

Week 14
Military robotics
Safe robotics
Robot ethics

Week 15
Project integration
Presentation class projects
Course Wrap-up