Syllabus

Course Title: CSCE 790 Learning in Robotics

Instructor: Ioannis Rekleitis,
Storey Innovation Center
Computer Science and Engineering
Room 2235
550 Assembly Street, Columbia, SC
Email: yiannisr@cse.sc.edu

Class meeting:

11:40 am - 12:55 pm Tuesday/Thursday Swearingen Engr Ctr 2A07

Course Description: In this course we will study the latest methods in Machine Learning as they apply to the field of robotics. In particular we will study: Reinforcement learning, Gaussian Processes, Deep Learning, and Deep Reinforcement Learning. The course will be divided into studying background material and state of the art papers.

Course learning outcomes:

- Develop necessary research skills
  - Conduct a literature review on a selected topic
  - Present a scientific paper
  - Summarize the content of a presentation
- Develop the ability to work with robotic systems
- Develop the ability to work with learning frameworks

Prerequisites:

There are no prerequisite courses. However, students are expected to have strong software development skills. Projects are likely to involve some combination of C++, Python, bash, Linux, ROS, LATEX, and other tools as needed. Experience in machine learning and robotics is recommended, but strong students may be able to acquire the necessary background on-the-fly.

Required text(s):

There are no required textbooks. The following books contain recommended background material:

1. Gaussian Processes for Machine Learning, Carl Edward Rasmussen and Chris Williams, the MIT Press, 2006, online version.
2. Machine Learning: a Probabilistic Perspective. Kevin P. Murphy, MIT Press.
3. Reinforcement Learning, An Introduction. Richard S. Sutton and Andrew G. Barto. MIT Press.
4. Jason M. O'Kane, A Gentle Introduction to ROS, independently published, 2013. Electronic copies freely available from the author's website.

Schedule, deliverables, and evaluation:

Assignment 1: Programming Assignment using ROS.
Grade: 10%

Assignment 2: Literature review. Find and read the existing published material related to your project. Write a summary of this related work, suitable in tone and format for the related work section of a high-quality published paper. This summary should have at least 30 citations, of which the overwhelming majority should be to published academic conference or journal papers.
Grade: 10%

Assignment 3: Programming Assignment using Reinforcement Learning.
Grade: 10%

Assignment 4: Programming Assignment using GP.
Grade: 10%

Assignment 5: Programming Assignment using a CNN
Grade: 10%

Presentations: In class presentation
Grade: 30%

Summaries: Prepare one-paragraph summary for each research paper presentation.
Grade: 10%

Class Participation
Grade: 10%

Schedule:

Week 1> Introduction to Robotic Systems
Week 2> Reinforcement Learning Principles
Week 3> Reinforcement Learning Principles
Week 4> Reinforcement Learning in Robotics
Week 5> Gaussian Processes (GP) Concepts
Week 6> Gaussian Processes (GP) in higher dimensions
Week 7> Gaussian Processes (GP) in Robotics
Week 8> Deep Learning Concepts
Week 9> Convolutional Neural Networks
Week 10> CNN in Robotics
Week 11> CNN in Robotics
Week 12> Learning By Demonstration
Week 13> Deep Reinforcement Learning
Week 14> Review

Grading Scheme:
>90% : A
>87% : B+
>80% : B
>77% : C+
>70% : C
>60% : D
<60% : F

Academic Integrity:
You are expected to practice the highest possible standards of academic integrity. Any deviation from this expectation will result in a minimum academic penalty of your failing the assignment, and will result in additional disciplinary measures. This includes improper citation of sources, using another student's work, and any other form of academic misrepresentation.

Attendance Policy:
When you miss class, you miss important information. If you are absent, you are responsible for learning material covered in class. If you are absent when an assignment is due, you must have submitted the assignment prior to the due date to receive credit. If you miss more than 20% of the classes, whether excused or unexcused, your grade will be dropped one letter grade.

Accommodating Disability:
Reasonable accommodations are available for students with a documented disability. If you have a disability and may need accommodations to fully participate in this class, contact the Office of Student Disability Services: 777-6142, TDD 777-6744, email sasds@mailbox.sc.edu, or stop by LeConte College Room 112A. All accommodations must be approved through the Office of Student Disability Services.

Diversity:
In order to learn, we must be open to the views of people different that ourselves. In this time we share together over the semester, please honor the uniqueness of your fellow classmates and appreciate the opportunity we have to learn from one another. Please respect each others' opinions and refrain from personal attacks or demeaning comments of any kind. Finally, remember to keep confidential all issues of a personal or professional nature that are discussed in class.