Class Overview

CPS 1/296
Ron Parr

About The Instructor

- Ron Parr, Assistant Professor
- parr@cs.duke.edu
- D209 LSRC, 660-6537
- Office Hours: W@10:00 – or just come by

- My 7th year at Duke
- Interests
  - Probabilistic Robotics
  - MDPs, Reinforcement learning
  - Perception

What is a 1/296 Class???

- X96 means that the class is "experimental"
  - Offered 0 or few times before
  - Course details still in flux
- 1/296 means concurrent undergrad/grad
- Not necessarily more advanced than lower numbered classes
- Unofficial consequences:
  - Some hiccups
  - Often more lenient grading

What is Covered?

- We cover a wedge of robotics
  - Sensing
  - Tracking
  - Mapping
- We do not emphasize
  - Control
  - Mechanical issues

What are the prof's goals?

- Develop a real (non x96) robotics class
- Promote interest in robotics & AI at Duke
- Teach students
  - How to read research papers in AI/Robotics
  - How to get a robot to do something cool
  - The big concepts behind it all:
    - Probability/statistics
    - Linear algebra
    - Tracking and filtering
    - Graphical models
    - Color and perception

What do you need to know already?

- Would be nice if everybody knew C, linux, statistics, basic linear algebra, advanced algorithms, etc., but this isn't realistic
- Need to know:
  - Programming
  - Basic matrix operations
  - Very basic probability
  - Basic analysis of algorithms

What will students do in this class?

- Complete coverage of robotic mapping from the photons hitting a sensor to the image file produced by the robot
- Sensors, lenses, color, image processing, tracking, mapping
- Accomplished through incremental projects
  - Image processing
  - Scene reconstruction using lens equations
  - Implementation of a Kalman filter
  - Implementation of a mapper

What about the presentation?

- Students will do an in-class presentation based upon a current research paper in robotic mapping
- Why?
  - Learning to read papers is an important skill
  - CS classes overuse textbooks, resulting in students who are ill prepared for research and ill prepared for the real world
  - Oral presentations are increasingly important in the real world, but are not emphasized adequately in education

How will the presentation work?

- I will provide a list of papers
- Two weeks before the presentation, students must turn in a draft set of powerpoint slides
- One week before the presentation ,students must schedule a practice talk with me
- Presentations:
  - 30 minutes
  - Should be critical
- Remainder of class time used for discussion

So, where are the robots?

- Option 1:
  - I purchase iRobot create packages
  - You provide laptop
  - Camera TBD
  - Pros: Plentiful robots, rugged yet disposable
  - Cons: Software glitches
- Option 2:
  - Refurbish our existing robots
  - Pros: Heavy duty hardware, mores tablesoftware platform
  - Cons: Refurbishment required, downtime can be long, robot sharing
- Option 3:
  - Virtual/synthetic robots
  - Option 3a: You are the robot
  - Option 3b: I provide sensor logs

Difference Between 196 & 296

- Undergrad requirements:
  - Implement basic mapper under assumption of distinctive landmarks
  - Present content of paper
- Graduate requirements
  - Implement basic mapper under assumption of distinctive landmarks, but finish earlier than undergrads
  - Present content of paper + "project" (= results of applying/extending the ideas in the paper)

Grading

- Grade is based on assignments
  - Programming
  - Demonstration of correctness
  - Some Derivations
- For undergrads: Presentation = 1 assignment
- For grads: Presentation/project = 2 assignments
- Undergrads can do project for extra credit

Collaboration Policy

- Discussion is *encouraged*
- System level code sharing allowed if cited
  - Low level routines for accessing files
  - Code for controlling devices
  - etc.
- Derivations must be written up independently
- AI/Robotics code must be written independently