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EE 478/578 Intelligent Robotics I (4).

TEXTBOOK:

1. George F. Luger, "Artificial Intelligence. Structures and Strategies for Complex Problem Solving," Benjamin/Cummings Publ. Co., 2001.
2. Fred Martin, “Robotic Explorations. A Hands-on Introduction to Engineering.”

ADDITIONAL TEXTS:

3. Stuart Russell and Peter Norvig, "Artificial Intelligence. A Modern Approach." Prentice Hall.
4. Marek Perkowski, Anas Al-Rabadi, Alan Mishchenko, ``Evolvable Robots, Universal Decision Diagrams, Quantum Logic, Intelligent Animated Puppets, and Other Machine Learning Projects for Inquisitive Minds". (Textbook in preparation).

NOTES ON TEXTBOOKS USE:

1. The main class textbook is Luger.
2. Russell/Norvig (RS) is more advanced and only for project use.
3. Our book has only auxiliary material and does not replace RN or LS.

GOALS:

- This is an introductory course in robotics. Only elementary knowledge of C++ or Basic is sufficient. Every student participates in building a complete robot by designing robot’s body, software or hardware. Some projects are related to speech recognition and computer vision.
- The course introduces the main software ideas used in intelligent robotics.
- Students learn about building small mobile robots with sensors. Servos and cameras.
- Lisp programming for robotics applications: search and recursion.
- Using Intel’s and Carnegie Mellon software packages for robot vision

  This year the choices will include:
  1. OREGON CYBER THEATRE - a variety of stationary, wheeled and walking robots-puppets. Hexapods, quadrupeds and bipeds. Improve mechanics, add sensors, and improve software. Radio control. Interaction.
  2. Team of hexapod robots for robots soccer. Design a special kit to build various six-legged animals and control them from Basic Stamp, servo-controllers and remotely by radio from central vision-based PC. Mechanics, image processing, software, radio interfacing.

3. Talking head – soccer robot competition commentator. Sound-movement synchronization, speech generation. Hidden Markov Models. One of existing talking heads will be used, this is mostly software and speech project.

- Students completing this course have a good working knowledge of fundamentals of mobile and intelligent robotics, building robot components and subsystems and basic robot vision.

PREREQUISITES BY TOPIC:

Background in Basic, Pascal, or C programming equivalent to EAS 101.

TOPICS:

1. Introduction to Robotics and Artificial Intelligence. Types of robots and robots in the lab. Projects to be done this year. Robot competitions (3 hours).

2.Programming in LISP, including recursion, mobile robot environments, language generation, combinatorial problems, genetic algorithms and other topics as examples of LISP codes (7 hours).

3.Motors, servos and sensors (4 hours).

4.Kinematics and Inverse kinematics (1 hour)

5.State Space Search theory (2 hours).

6.Heuristic Search, problem representation (3 hours).

7.Introduction to machine learning and computer vision (8 hours).

8. Robot architectures: state machines, deliberative, subsumption, hybrid, neural (7 hours)

9. Basic navigation and manipulation. Rule-based systems (3 hours).

10. Evolutionary robots and learning robots (3 hours).

11. Project discussions, project related material like software packages and interfacing. Examples of robot systems and mobile robots. Robot soccer (3 hours).

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COMPUTER USAGE:

- Students use the departmental network of PC-based computers to solve various problems. Students will write programs in Basic, Visual Basic, C or C++. Home computers can be used and software downloaded to robots through serial or parallel ports.
- All projects are related to programming Basic Stamp and PC. For many projects knowledge of only Basic is sufficient.

ESTIMATED CONTENT:

- Engineering Science: 2 credits or 50%.
- Engineering Design: 2 credits or 50%.