

**University of California, Riverside
Electrical Engineering**

EE242: Intelligent Systems

Research Projects

25% of your grade will be on a research project you will work on during the quarter. The research projects can be done individually or as teams, depending on the scope of the project. The research projects will focus on interesting intelligent system problems that are selected by you and/or the instructor. Students are encouraged to propose ideas for their research projects. It is expected that each research project will initially require a literature search, followed by the development of a methodology (hardware and/or software). In terms of implementation, most projects can be carried out in a variety of environments. MATLAB can be used for algorithm development and for graphics. Simulation environments can be used for many other things, e.g., CSIM (discrete event simulation libraries) and Simulink (system simulation in MATLAB). Ideally, the projects should have elements of sensory processing, knowledge representation, and/or behavior generation. Results and conclusions should also be presented in a final research project report, due at the end of the quarter.

Example topics include:

- 1) ***distributed robotics, a.k.a. multi-agent systems***—this can take on many forms and the research could focus on sensory processing, natural group behavior resulting from programmed individualized behavior, centralized vs. distributed control (architecture), etc. See the Robotics and Automation “Distributed Robotics” issue.
- 2) ***Planning Methodologies***—planning is an important part of long-term, complicated behaviors, such as navigation, manufacturing, etc. Various planning algorithms can be examined and implemented for specific applications.
- 3) ***Fuzzy Control Systems***—fuzzy control systems can be developed for a variety of projects, such as the inverted pendulum, vehicle motion, etc.
- 4) ***Learning Techniques***—a variety of learning techniques can be implemented and compared for applications such as gaming, object recognition, speech processing, or any other process-based application.
- 5) ***Intelligent Transportation Systems***—various ITS bundles can be examined within the “Intelligent System” framework. Various examples include: 1) traffic simulation as a multi-agent system (car following logic, lane change logic); 2) structures for inter-vehicle and wide area communications, ATMIS (Advanced

Traveler and Management Information Systems), AVCSS (Automated Vehicle Control and Safety Systems), etc.

- 6) ***Production System Implementation***—an “expert system” can be implemented for a particular process. Applications are wide open, see books for references.
- 7) ***Micromouse Simulation***—the IEEE project of micromouse can be implemented in simulation.
- 8) ***Robot Sumo Simulation***—the robot sumo contest simulation environment can be developed and various “behaviors” can be downloaded into different robots.
- 9) ***Speech Recognition Systems***—a speech recognition system can be developed almost entirely in MATLAB.
- 10) ***Computer Vision Systems***—many processes and algorithms in computer vision (robot vision) can be implemented in an “intelligent system” framework. The OpenCV environment or MATLAB can be used.