Larry D. Pyeatt
Statement of Research Goals

My main research interests are probabilistic AI techniques and mobile robot navigation in complex unstructured environments. My most recent work deals with robust control and learning for partially observable, uncertain, and non-stationary environments, and using machine learning techniques to control sedation of surgical patients. My research interests can be divided into three general areas:

Probabilistic Techniques: I am investigating partially observable Markov decision process (POMDP) techniques. My research in this area is aimed at efficiently finding exact and approximate policies for POMDP problems. So far, the application domain for this work has been autonomous mapping and navigation of indoor environments. My next goal is to extend the current techniques to work in large outdoor environments. Outdoor robotics pose several grand challenges in the area of mobile robotics.

Sensor Modeling: In order to use the probabilistic mapping techniques, it is necessary to convert a stream of sensor data into a stream of local maps. Data from multiple local maps, possibly generated from different sensors, can be fused to form a global map. For some sensors, such as laser and sonar, the sensor model is well understood and easy to implement. However, no good model for stereo vision exists.

Learning Actions: The behaviors that humans perform are quite often either completely reflexive or were learned at an early age and have since become reflexive in nature. Higher level behaviors are ordered sets of these sub-cognitive behaviors. I am very interested in developing solutions for learning these low-level sub-cognitive behaviors in order to provide them to intelligent agents for ordering in high-level behaviors. For my dissertation work, I developed a framework for using POMDP based navigation with reinforcement learning (RL) to provide adaptive low-level actions. This work was a proof of concept and was done completely in simulation. Some of my current work is aimed at extending the architecture to run on a real robot.

My future research plans involve continued effort in learning and control, and application of probabilistic techniques in domains other than robotics. In particular, I am interested in applying probabilistic machine learning techniques in healthcare and clinical settings. I have also begun investigating distributed computing and adaptive wireless networks to support computation and communication between computers, sensors, and robots. I would also enjoy working on issues of human-robot interaction, including gesture recognition, learning through imitation, and understanding high-level spoken commands.