COURSE DESCRIPTION

Department and Course Number	CS461	**Course Coordinator**	Russ Abbott
Course Title	Machine Learning	**Total Credits**	4

Current Catalog Description:

Means that enable computers to perform tasks for which they were not explicitly programmed; learning paradigms include inductive generalization for examples, genetic algorithms, and connectionist systems such as neural nets.

Textbook:

Mitchell, Tom., *Machine Learning*, McGraw-Hill, 1997.

References:

At the discretion of the instructor.

Course Goals:

- To introduce students to tools and techniques for modeling complex systems and for the automatic creation computer programs. Subsidiary goals will depend on the approach(es) the instructor chooses to take.
    - To introduce students to the theories, tools, and technologies used to study complexity, including evolutionary computing and agent-based modeling.
    - To introduce students to inductive generalization from examples and other traditional learning paradigms.
    - To introduce students to the use of artificial neural nets for learning.

These course goals contribute to the success of **Student Learning Outcomes 1.a, 1.d, 1.e, 2, 3, 4, 5, and 6**.

Prerequisites by Topic:

- Fluent in at least one programming language
- Fluent in data structures and algorithms
- Computational complexity

Major Topics Covered in the Course:

This list represents the possible topics covered on this course. At the discretion of the instructor, the course focuses on some of these topics.

- Agent-based modeling
- Modeling probability density functions and optimization in artificial neural networks, decision trees, Gaussian process regression (k-Nearest Neighbor and expectation-maximization algorithm), Bayesian networks, Markov Random Fields, and support vector machines.
- Complex systems; the nature of emergence, evolutionary programming and optimization through evolutionary programming

Laboratory Projects (specify number of weeks on each):

At the discretion of the instructor. Projects range from weekly assignments to three more significant projects covering 3 weeks each over the course of the term.

Estimate Curriculum Category Content (Quarter Hours)

Area	Core	Advanced	Area	Core	Advanced
Algorithms		1.0	Data Structures		1.0
Software Design		1.0	Prog. Languages		1.0
Comp. Arch.					

Oral and Written Communications:

Students are required to submit and discuss the source code and documentation of the work that they do.

Social and Ethical Issues:

No significant component.

Theoretical Content:

At the discretion of the instructor, possibly including an introduction to theoretical foundations of agent-based modeling, types of learning algorithms, complex systems, and evolutionary programming

Problem Analysis:

Students are required to identify the issues involved when required to design a system that learns and evolves.

Solution Design:

Solution design involves developing programs that use techniques such as agent based modeling, learning from observation, artificial neural networks, and evolutionary programming.