ECE 5307 (Approved): Introduction to Machine Learning for ECE

Course Description

Introduction to Machine Learning. Coverage includes linear regression, linear classification, model and feature selection, neural networks, clustering, and principle components analysis. Python will be used for implementation examples.

Prior Course Number: 4300, 5300
Transcript Abbreviation: Intro Machin Learn
Grading Plan: Letter Grade
Course Deliveries: Classroom, 100% at a distance
Course Levels: Undergrad, Graduate
Student Ranks: Senior, Masters, Doctoral
Course Offerings: Autumn, Spring
Flex Scheduled Course: Never
Course Frequency: Every Year
Course Length: 14 Week
Credits: 4.0
Repeatable: No
Time Distribution: 3.0 hr Lec, 2.0 hr Lab
Expected out-of-class hours per week: 7.0
Graded Component: Lecture
Credit by Examination: No
Admission Condition: No
Off Campus: Never
Campus Locations: Columbus
Prerequisites and Co-requisites: Prereq: ECE major; and CSE 1222 or ENGR 1281; and Math 2568 and Stat 3470; or grad standing.
Exclusions: Not open to students with credit for ECE5300 or ECE 4300 or ECE 4194.02 Sp19 or MECHENG 5194 Au19
Cross-Listings:

Course Rationale: Adding 1 hour laboratory component, and changing from 5300 to 5307, allows us to add

more in-depth instruction on coding.

The course is required for this unit's degrees, majors, and/or minors: No
The course is a GEC: No
The course is an elective (for this or other units) or is a service course for other units: Yes

Subject/CIP Code: 14.1001
Subsidy Level: Doctoral Course

Programs

Abbreviation	Description
CpE	Computer Engineering
EE	Electrical Engineering

Course Goals

Learn how to formulate and solve linear regression problems, linear classification problems, and clustering problems.

Learn how to implement basic machine-learning tasks in Python.
Gain familiarity with model-order selection, feature selection, neural networks, and PCA.
Gain experience applying concepts from linear algebra and probability to engineering tasks.

Course Topics

Topic	Lec	Rec	Lab	Cli	IS	Sem	FE	Wor
Introduction to Machine Learning	1.0							
Linear Regression	6.0		4.0					
Model-order Selection and Feature Selection	6.0		4.0					
Linear Classification, Logistic Regression, and Support Vector Machine	6.0		4.0					
Optimization	3.0		2.0					
Neural Networks and Deep Learning	9.0		6.0					
Principal Components Analysis and Clustering	6.0		4.0					

Representative Assignments

Homework problems that involve deriving and/or analyzing aspects of machine-learning algorithms.
Coding labs that involve programming a machine-learning method in Python and applying it to a real-world dataset.

Grades

Aspect	Percent
Homework	19%
Labs	19%
Two midterm exams	38%
Final project	19%
Participation	5%

Representative Textbooks and Other Course Materials

Title	Author
An Introduction to Statistical Learning	G. James, D. Witten, T. Hastie, and R. Tibshirani
Machine Learning with Python Cookbook	C. Albon
Deep Learning with PyTorch	E. Stevens and L. Antiga
Hands-On Machine Learning with Scikit-Learn, Keras & TensorFlow	A. Geron

ABET-EAC Criterion 3 Outcomes

Course Contribution		College Outcome
***	a	An ability to apply knowledge of mathematics, science, and engineering.
	b	An ability to design and conduct experiments, as well as to analyze and interpret data.
**	c	An ability to design a system, component, or process to meet desired needs.
	d	An ability to function on multi-disciplinary teams.
**	e	An ability to identify, formulate, and solve engineering problems.
	f	An understanding of professional and ethical responsibility.

Course Contribution		College Outcome
	g	An ability to communicate effectively.
	h	The broad education necessary to understand the impact of engineering solutions in a global and societal context.
	i	A recognition of the need for, and an ability to engage in life-long learning.
	j	A knowledge of contemporary issues.
**	k	An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

CpE ABET-EAC Criterion 9 Program Criteria Outcomes

Course Contribution		Program Outcome
***	1	an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
	2	an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
	3	an ability to communicate effectively with a range of audiences
	4	an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
*	5	an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
	6	an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
	7	an ability to acquire and apply new knowledge as needed, using appropriate learning strategies

EE ABET-EAC Criterion 9 Program Criteria Outcomes

Course Contribution		Program Outcome
***	1	an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
	2	an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
	3	an ability to communicate effectively with a range of audiences
	4	an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
*	5	an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
	6	an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
	7	an ability to acquire and apply new knowledge as needed, using appropriate learning strategies

Additional Notes or Comments

```
Change from ECE 5300 to add lab
```

Prepared by: Philip Schniter