I. Course Prefix, Number, and Title

MTRE 4490 – Machine Learning for Robot Perception
Fall Semester 2017

II. Instructor, Office, and Telephone Number

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Office Location: Q 320
Office Hours: 9-10 am MTWHF

III. Learning Objectives

By the end of this course, students should:

- Implement various machine learning techniques using training, validation, and test data splits
- Understand the mechanics of how standard machine learning techniques optimize their parameters
- Build code for simple machine learning algorithms from the ground up
- Capably use freely available libraries for coding machine learning solutions
- Perform basic image and point cloud data pre-processing and feature extraction

IV. Textbooks

Recommended textbooks: *Machine Learning – An Algorithmic Perspective* by S. Marsland from the CRC press, *Learning OpenCV 3 Computer Vision with Python* by J. Minichina and J. Howse from Packt Publishing, and *Hands-On Machine Learning with Scikit-Learn and TensorFlow* by Aurélien Géron.

Extra material: Udacity's free Intro to Machine Learning online course

V. Course Outline

Date		Topic	Due
Aug	14	Python review and classes	
Aug	16	Machine learning basics	
Aug	18	k-means clustering	
Aug	21	Project	
Aug	23	Principal component analysis	
Aug	25	Project	
Aug	28	Project	
Aug	30	Project	
Sep	1	Project	
Sep	6	Decision trees	Project 1
Sep	8	Haar-like features	
Sep	11	Sliding window search	
Sep	13	Non-maximum suppression	
Sep	15	Project	
Sep	18	Project	
Sep	20	Project	
Sep	22	Project	
Sep	25	Image pre-processing	Project 2
Sep	27	Edge detection	
Sep	29	Histogram of oriented gradients	
Oct	2	Naïve Bayes	
Oct	4	Support vector machines	
Oct	6	Project	
Oct	9	Project	
Oct	11	Project	
Oct	13	Project	
Oct	16	Perceptrons	Project 3
Oct	18	Multilayer perceptrons	
Oct	20	Early stopping	
Oct	23	Image rotations	
Oct	25	Artificial data	
Oct	27	Project	
Oct	30	Project	
Oct	1	Project	
Oct	3	Project	
Nov	6	Convolution neural networks	Project 4
Nov	8	Project	
Nov	10	Project	
Nov	13	Project	
Nov	15	Project	
Nov	17	Project	
Nov	27	Project	
Nov	28	Project	
Dec	1	Project	
Dec	4	Wrap-up	Project 5

VI. Evaluation and Grading

Case Studies

The grade in this course is based solely on performance in five projects implementing machine learning algorithms to solve real-world problems relevant for robot perception. Projects are to be completed individually, and must be reflections of each student's own work. While collaboration in encouraged for developing strategies for solving the problems, no code may be shared. Without tests, it is of utmost importance that all students adhere to this policy (see Academic Honesty Statement below). Each project includes a rubric describing what must be completed to receive specific grades.

VII. Academic Honesty Statement

Every KSU student is responsible for upholding the provisions of the Student Code of Conduct, as published in the Undergraduate and Graduate Catalogs. Section II of the Student Code of Conduct addresses the University's policy on academic honesty, including provisions regarding plagiarism and cheating, unauthorized access to University materials, misrepresentation/ falsification of University records or academic work, malicious removal, retention, or destruction of library materials, malicious/intentional misuse of computer facilities and/or services, and misuse of student identification cards. Incidents of alleged academic misconduct will be handled through the established procedures of the University Judiciary Program, which includes either an "informal" resolution by a faculty member, resulting in a grade adjustment, or a formal hearing procedure, which may subject a student to the Code of Conduct's minimum one semester suspension requirement.

No student shall receive, attempt to receive, knowingly give or attempt to give unauthorized assistance in the preparation of any work required for submission for credit as part of a course (including examinations, laboratory reports, essays, themes, term papers, etc.). When direct quotations are used, they should be indicated, and when the ideas, theories, data, figures, graphs, programs, electronic based information or illustrations of someone other than the student are incorporated into a paper or used in a project, they should be duly acknowledged.

Collaboration on assignments among students and other individuals is wholeheartedly encouraged. In order to avoid possible plagiarism issues, limit such collaboration to discussion of how to approach the problem and what strategies, equations, and techniques should be used to solve it. When actually writing down your solution, ensure you are not in the same room as outside collaborators nor referencing a copy of their work. Your solution will then be written in your own words and therefore not plagiarized.

VIII. Attendance Policy

Forcing everyone to come to every class is not practical. Each student bears responsibility for material covered in class. If students choose to miss class, that is their decision. In general, late assignments are not accepted nor can make-up tests be administered. Extenuating circumstances can result in exceptions to these rules, but agreement must be reached with the instructor in advance of the assignment or test that will be missed.