

## **EE 599 – Machine Learning for Medical Applications**

**Units: 3**

**Term—Day—Time: Spring 2016, MW 3:30 to 4:50 PM**

**Location:**

**Instructor: Prof. Cauligi Raghavendra**

**Office:** EEB 216

**Office Hours:** MW 2 to 3 PM and by appointment

**Contact Info:** [raghu@usc.edu](mailto:raghu@usc.edu), (213) 740-9133

### **Course Description**

Application of machine learning models and algorithms to medical applications, learning from data and classification of disorders. Overview of health data, collection with sensors, body area networks, brain image data and other publicly available medical applications data. Issues and methods for handling real world data with respect to missing and inconsistent data. Application of existing machine learning techniques to brain image data to classify various mental disorders, including Alzheimer's, Autism, TBI and PTSD, etc. Brain image data to include MRI, fMRI, and SPECT data. Students will learn about machine learning applications to real world medical data through examples and reading papers. Students are expected to work on a team project and write a report.

### **Learning Objectives**

Students will learn about issues with real world data and how to deal with them in analyzing data; Students will learn about methodologies for applying machine learning to medical applications and for real world data

Doing literature search, conduct research and working on a team project

**Prerequisite(s):** Knowledge of machine learning algorithms and software tools

**Recommended Preparation:** EE 660 or CSCI 567 or other machine learning course

### **Course Notes**

Materials will be from papers and slides used in class. There will be guest lectures.

### **Technological Proficiency and Hardware/Software Required**

Students are required to have familiarity with Matlab, Scikit learn, or other ML tools, and coding language of their choice. Access to Matlab is provided on campus. ML tools are publicly available. Students can use their own machines or use machines provided on campus.

### **Required Readings and Supplementary Materials**

Required readings and supplementary materials are published papers. There is no text book for this course.

### **Description and Assessment of Assignments**

This is a research and project oriented course. Students are required to choose a medical application problem of their interest early in the semester, do literature survey, learn and acquire data from public sources, design and apply machine learning to that problem, and write a term paper. Students are expected to participate in class discussions, make short presentations during the semester, and a final presentation on their project at the end of semester. Each team will make a presentation of their project towards the end of the semester.

### Grading Breakdown

How will students be graded overall, including the assignments detailed above. Participation should be no more than 15%, unless justified for a higher amount. All must total 100%.

Assignment	Points	% of Grade
Summary writeup 1	10	
Summary writeup 2	10	
Participation	10	
Short presentation 1	5	
Short presentation 2	5	
Project and report	40	
Final Presentation	20	
<b>TOTAL</b>	100	0

### Assignment Submission Policy

Assignments are assigned in class and it is written summary of papers read related to the project. Assignments are written reports

### Additional Policies

In team projects, each member should contribute to the success of the project. Responsibility of each member to be documented in the report. Expectation is for the project to be a publishable work.

### Course Schedule: A Weekly Breakdown

**Note: This is a very tentative outline and is in draft form, to give you an idea of course topics to be covered. Since there will be several guest lectures the exact schedule will change and finalized at the beginning of Spring semester. Number of lectures per topic is approximate. Student presentation times to be finalized.**

	Topics/Daily Activities	Readings and Homework	Deliverable/ Due Dates
<b>Week 1</b> Dates	Introduction and overview of course Basics of Machine learning, data, and tools to use	Paper 1	Class discussion
<b>Week 2</b> Dates	Applying Machine learning and useful things to know	Papers 2	Class discussion
<b>Week 3</b> Dates	Real world data; medical applications data	Papers 3,4	Class discussion

	Guest lecture		
<b>Week 4</b> Dates	Medical applications data Guest Lecture	Papers 5	Choose topic and identify team Select papers on topic
<b>Week 5</b> Dates	Health data, Sensors, Body area networks	Papers 6,7	Short write up on literature
<b>Week 6</b> Dates	Short presentations by Student teams	Papers 8,9	Short write up on project proposal and plan
<b>Week 7</b> Dates	Data preparation, feature selection and evaluation	Papers 10,11	
<b>Week 8</b> Dates	Heart imaging, heart attack prediction		
<b>Week 9</b> Dates	Short presentations by student teams		Short write up on papers
<b>Week 10</b> Dates	Machine learning for mental disorders	Papers 12,13,14	
<b>Week 11</b> Dates	Mental disorders continued	Papers 12,13,14	
<b>Week 12</b> Dates	Cancer, tumor detection, brain networks	Papers 15,16	
<b>Week 13</b> Dates	<b>Project Presentations</b>		
<b>Week 14</b> Dates	<b>Project Presentations</b>		
<b>Week 15</b> Dates	<b>Project Presentations</b>		<b>Final Project Report Due</b>
<b>FINAL</b> Date			Date: For the date and time of the final for this class, consult the USC <i>Schedule of Classes</i> at <a href="http://www.usc.edu/soc">www.usc.edu/soc</a> .

## Statement on Academic Conduct and Support Systems

### Academic Conduct

Plagiarism – presenting someone else’s ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in *SCampus* in Section 11, *Behavior Violating University Standards* <https://scampus.usc.edu/1100-behavior-violating-university-standards-and-appropriate-sanctions>. Other forms of academic dishonesty are equally unacceptable. See additional information in *SCampus* and university policies on scientific misconduct, <http://policy.usc.edu/scientific-misconduct>.

Discrimination, sexual assault, and harassment are not tolerated by the university. You are encouraged to report any incidents to the *Office of Equity and Diversity* <http://equity.usc.edu> or to the *Department of Public Safety* <http://adminopsnet.usc.edu/department/departement-public-safety>. This is important for the safety of the whole USC community. Another member of the university community – such as a friend, classmate, advisor, or faculty member – can help initiate the report, or can initiate the report on behalf of another person. *The Center for Women and Men* <http://www.usc.edu/student-affairs/cwm/> provides 24/7 confidential support, and the sexual assault resource center webpage <http://sarc.usc.edu> describes reporting options and other resources.

## Support Systems

A number of USC's schools provide support for students who need help with scholarly writing. Check with your advisor or program staff to find out more. Students whose primary language is not English should check with the *American Language Institute* <http://dornsife.usc.edu/ali>, which sponsors courses and workshops specifically for international graduate students. *The Office of Disability Services and Programs* [http://sait.usc.edu/academicsupport/centerprograms/dsp/home\\_index.html](http://sait.usc.edu/academicsupport/centerprograms/dsp/home_index.html) provides certification for students with disabilities and helps arrange the relevant accommodations. If an officially declared emergency makes travel to campus infeasible, *USC Emergency Information* <http://emergency.usc.edu> will provide safety and other updates, including ways in which instruction will be continued by means of blackboard, teleconferencing, and other technology.