ELEC 539A – Selected Topics in DSP: Machine Learning for Signal Processing

Term - SPRING 2015 (201501)

Instructor
Dr. W.-S. Lu
Phone: 8692
E-mail: wslu@ece.uvic.ca

Office Hours
Days: Wednesdays
Time: 14:40 – 16:40
Location: EOW 427

Lectures
A01 / CRN 23843
Days: Tuesdays, Wednesdays, Fridays
Time: 13:30 – 14:20
Location: ELL 161

Required Text
Title: Course notes for ELEC 539A
Author: W.-S. Lu
Publisher:
Year: 2015

Optional Text
Title:
Author:
Publisher:
Year:

References:

Assessment:
Assignments: 30 %
Project 30 %
Final 40 %

Note: Failure to complete all laboratory requirements will result in a grade of N being awarded for the course.

Due Dates for Assignments:
Assignment 1: Jan. 14
Assignment 2: Jan. 21
Assignment 3: Jan. 28
Assignment 4: Feb. 4
Assignment 5: Feb. 18
Assignment 6: Feb. 25
Assignment 7: Mar. 4
Assignment 8: Mar. 11
Assignment 9: Mar. 18
 Assignment 10: Mar. 25
The final grade obtained from the above marking scheme will be based on the following percentage-to-grade point conversion:

<table>
<thead>
<tr>
<th>Passing Grades</th>
<th>Grade Point Value</th>
<th>Percentage for Instructor Use Only</th>
</tr>
</thead>
<tbody>
<tr>
<td>A+</td>
<td>9</td>
<td>90 – 100</td>
</tr>
<tr>
<td>A</td>
<td>8</td>
<td>85 – 89</td>
</tr>
<tr>
<td>A-</td>
<td>7</td>
<td>80 – 84</td>
</tr>
<tr>
<td>B+</td>
<td>6</td>
<td>77 – 79</td>
</tr>
<tr>
<td>B</td>
<td>5</td>
<td>73 – 76</td>
</tr>
<tr>
<td>B-</td>
<td>4</td>
<td>70 – 72</td>
</tr>
<tr>
<td>C+</td>
<td>3</td>
<td>65 – 69</td>
</tr>
<tr>
<td>C</td>
<td>2</td>
<td>60 – 64</td>
</tr>
<tr>
<td>D</td>
<td>1</td>
<td>50 – 59</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Failing Grades</th>
<th>Grade Point Value</th>
<th>Percentage for Instructor Use Only</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>E</td>
<td>0</td>
<td>0 - 49</td>
<td>Fail, *Conditional supplemental exam. (For undergraduate courses only)</td>
</tr>
<tr>
<td>F</td>
<td>0</td>
<td>0 – 49</td>
<td>Fail, no supplemental.</td>
</tr>
<tr>
<td>N</td>
<td>0</td>
<td>0 – 49</td>
<td>Did not write examination, Lab or otherwise complete course requirements by the end of term or session; no supplemental exam.</td>
</tr>
</tbody>
</table>

*Assignment of E grade will be at the discretion of the Course Instructor.*

The rules for supplemental examinations are found on page 80 of the current 2014/15 Undergraduate Calendar.

<table>
<thead>
<tr>
<th>Term in which E Grade Was Obtained</th>
<th>Application Deadline for Supplemental Exam</th>
<th>Supplemental Exam Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>First term of Winter Session (Sept – Dec)</td>
<td>February 28 in the following term</td>
<td>First week of following May</td>
</tr>
<tr>
<td>Second term of Winter Session (Jan – Apr)</td>
<td>June 30 in the following term</td>
<td>First week of following September</td>
</tr>
<tr>
<td>Summer Session (May – Aug)</td>
<td>October 31 in the following term</td>
<td>First week of following January</td>
</tr>
</tbody>
</table>

Deferred exams will normally be written at the start of the student's next academic term; i.e., approximately 4 months following the deferral of the exam.
Course Description

1. Course Objectives
To learn the fundamentals of statistical learning principles and state-of-the-art learning algorithms and software implementations.

2. Learning Outcomes
Working knowledge of basic elements of statistical learning theory; working knowledge of problem formulation for machine learning; working knowledge of linear learning models for classification and regression problems; working knowledge of dealing with overfitting in machine learning by means of regularization and cross validation; working knowledge of support vector machines for regression and classification.

3. Syllabus

**Review of Probability Theory**
Classic and axiomatic probability theory. Random variables.

**Review of Optimization Methods**
Unconstrained and constrained optimization: theory and algorithms

**What Is Learning?**
The learning problems. PLA and Adaline algorithms. VC dimensions and bounds.

**Linear Models**

**Overfitting, Regularization and Validation**

**Support Vector Machine and Kernel Methods**

Note to Students:

*Students who have issues with the conduct of the course should discuss them with the instructor first. If these discussions do not resolve the issue, then students should feel free to contact the ECE Chair by email or the ECE Chair's Secretary eceasst@uvic.ca to set up an appointment.*

Accommodation of Religious Observance
See [http://web.uvic.ca/calendar2014/GI/GUPo.html](http://web.uvic.ca/calendar2014/GI/GUPo.html)

Policy on Inclusivity and Diversity
See [http://web.uvic.ca/calendar2014/GI/GUPo.html](http://web.uvic.ca/calendar2014/GI/GUPo.html)

Standards of Professional Behaviour
You are advised to read the Faculty of Engineering document Standards for Professional Behaviour at [http://www.uvic.ca/engineering/assets/docs/professional-behaviour.pdf](http://www.uvic.ca/engineering/assets/docs/professional-behaviour.pdf) which contains important information regarding conduct in courses, labs, and in the general use of facilities.

Cheating, plagiarism and other forms of academic fraud are taken very seriously by both the University and the Department. You should consult
http://web.uvic.ca/calendar2014/FACS/UnIn/UARE/PoAcI.html for the UVic policy on academic integrity.