CS 677 ~ Pattern Recognition
Spring 2020
West Virginia University

Instructor and Office Hours:
- Thirimachos Bourlai, Ph.D. (ThBourlai@mail.wvu.edu)
- Office: AERB 255 ESB Addition
- Office hours: Wed 8:30 a.m. – 9:30 a.m.

Lecture Details:
- Time: Tue and Thu, 11:00 a.m. - 12:15 p.m.
- Room: ESB-201

Textbook:
- Suggested Material that will help you:
  - C. M. Bishop, "Pattern Recognition and Machine Learning", 2006
  - Computational Statistics Handbook with MATLAB (3rd Edition or later) - Book by Angel R. Martinez and Wendy L. Martinez

Suggested Prerequisites:
- STAT462, MATH343, or equivalent
- An undergraduate level understanding of probability, statistics and linear algebra is assumed
- Basic knowledge on Signal and Image Processing is essential
- Intermediate knowledge of MATLAB is essential
- Experience in programming is recommended (C, C++, C#, python)

Course Description:
This course will introduce a graduate audience to salient topics in Machine Learning, and Pattern Recognition - (Supervised and Unsupervised Learning):

- Supportive Material to Linear Algebra and Probability Theory
- Introduction to pattern recognition
- Linear Regression
- Logistic Regression
- Gradient Descent
- Neural Networks
- SVMs
- Bayesian decision theory
- Linear Discriminant functions
- Clustering
- Dimensionality Reduction
  - Principal Component Analysis, Multidimensional Scaling and Isomaps
- Density estimation schemes
- Nearest-neighbor rule
- Feature Extraction (briefly – supportive material)
- Pattern Recognition Case Studies (Invited Speakers / Experts)
The topics will be taught not necessarily in the aforementioned order.

- The project component of this course will test the student's ability to design and evaluate classifiers on appropriate datasets

Weight/Distribution of Course Points:
The tentative weight associated with each grading component is as follows:

- Homework and Quizzes - 10%
- Project: Meeting Milestones & Reports - 15%
- Midterm exam - 25%
- Final exam - 25%
- Project* - 25%, including
  (i) Final Project Report,
  (ii) Presentation, project, and
  (iii) DEMO that the code is working

* NOTE: Regarding the Project: It is not acceptable that the students propose to work on a class project that is the same as the one they work in their own research, i.e. funded work in their labs.

Final Grading Scale:
The grading scheme (%) will be as follows:

<table>
<thead>
<tr>
<th>Grade</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>&gt;= 90</td>
</tr>
<tr>
<td>B</td>
<td>&gt;= 80, &lt;90</td>
</tr>
<tr>
<td>C</td>
<td>&gt;= 70, &lt;80</td>
</tr>
<tr>
<td>D</td>
<td>&gt;= 60, &lt;70</td>
</tr>
<tr>
<td>F</td>
<td>&lt; 60</td>
</tr>
</tbody>
</table>

Grading Policy:
- A hard-copy of the homework and project reports has to be turned in before lecture begins on the due date.
- No make-up for midterm and finals, including demo presentations for individuals or a group of students.
- Make-up for exams will be issued only under exceptional circumstances provided prior arrangements are made with the instructor.
- Instructor reserves the right to deny requests for make-up exams.

Course Outcomes:
- A good knowledge of Bayesian decision theory and Bayesian learning.
- Fundamental understanding of feature extraction (selected topics), and of classifiers such as nearest-neighbor rule, linear discriminant function, neural networks and SVMs.
- Ability to evaluate the performance of various classifiers on real-world datasets.

Course and Institutional Policies

Attendance Policy:
- Missing or late submission of presentations and reports receive zero credit.
- Makeup exams and quizzes for university-excused reasons only (illness, family emergency, etc.).
- Notice must be given prior to missed exam/quiz via university email.
- Unexpected missing exams and quizzes will result in zero credit.
- Attendance is not mandatory but highly recommended.
Participation Policy:
Participation in in-class examples and discussion is strongly encouraged but it will not assessed

Late Assignment and Missed Exam Policy:
Excused exam/quiz absence must be retaken as soon as the student is able to return to campus, and should be scheduled prior to original exam date if possible.

Institutional Policies:
Students are responsible for reviewing policies on:
- Inclusivity,
- Academic Integrity (see overview below)
- Social Justice (see overview below)
- Incompletes,
- Sale of course materials,
- Sexual misconduct,
- Adverse weather, as well as
- Student evaluation of instruction, and
- Days of special concern/religious holiday statements.

Academic Integrity:
- The integrity of the classes offered by any academic institution solidifies the foundation of its mission and cannot be compromised. Therefore, I will enforce rigorous standards of academic integrity in all aspects and assignments of this course. For the detailed policy of West Virginia University regarding the definitions of acts considered to fall under academic dishonesty and possible ensuing sanctions, please see the Student Conduct Code at http://www.arc.wvu.edu/rightsa.html. During the course of completing an assignment, should you have any questions about improper research citations or references, or any other activity that may be interpreted as an attempt at academic dishonesty, please see me before the assignment is due to discuss the matter.

Social Justice:
- "West Virginia is committed to social justice. I concur with that commitment and expect to maintain a positive learning environment based upon open communication, mutual respect, and non-discrimination. Our University does not discriminate on the basis of race, sex, age, disability, veteran status, religion, sexual orientation, color or national origin. Any suggestions as to how to further such a positive and open environment in this class will be appreciated and given serious consideration. If you are a person with a disability and anticipate needing any type of accommodation in order to participate in this class, please advise me and make appropriate arrangement with Disability Services (293-6700)."