CS 722: Advanced Machine Learning

Fall 2021

Section: 1001

**Instructor:** Mingon Kang

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**Office hours:** T/W: 4:00 PM – 5:15 PM

**Class website: UNLV** WebCampus (https://www.it.unlv.edu/webcampus)

Catalog Description   
Explores the theoretical frameworks of advanced machine learning algorithms and techniques based on a probabilistic approach with a focus on the derivation, implementation, and evaluation of such models

**Textbook:**

None

**Student Learning Outcomes**

Upon completion of this course, students will:

* Develop an appreciation for capabilities and limitations of modern machine learning techniques
* Understand the mathematical and theoretical foundations of a wide variety of machine learning algorithms including linear regression, logistic regression, support vector machines, classification and regression trees, and neural networks
* Implement machine learning algorithms to analyze data in multiple domains
* Evaluate the performance of models generated from data

**Prerequisites**

CS 422 or CS 622

**Tentative Schedule:**

The tentative schedule is shown below.

|  |  |  |  |
| --- | --- | --- | --- |
| **Week** | **Dates** | **Topics** | **HW** |
| 1 | Aug 23 – Aug 25 | - Discussion of course syllabus and policies  - Introduction to Research  - Introduction to Machine Learning  - Introduction to Research in Machine Learning | HW1: Research topics |
| 2 | Sep 30 - Sep 1 | - Reading/Writing research papers  - Advanced Topics in Machine Learning | HW2: Research paper summary |
| 3 | Sep 6 – Sep 8 | - No class on Sep 6  - Discussion about Advanced topics in Machine Learning  - Presentation of research topics |  |
| 4 | Sep 13 – Sep 15 | - Evaluation Strategy  - Advanced linear regression models (Multitask learning, LASSO) | HW3: Evaluation Strategy and Discussion |
| 5 | Sep 20 – Sep 22 | - Optimization |  |
| 6 | Sep 27 – Oct 29 | - Maximum likelihood estimation | HW4: Implementation I |
| 7 | Oct 4 – Oct 6 | - Decision Trees |  |
| 8 | Oct 11 – Oct 13 | - Latent Variable Models  - Principal Component Analysis  - Linear Discriminative Analysis |  |
| 9 | Oct 18 – Oct 20 | - Partial Least Squares (PLS)  - Canonical Correlation Analysis (CCA) |  |
| 10 | Oct 25 – Oct 27 | - Expectation-Maximization Algorithm | HW5: Implementation II |
| 11 | Nov 1 – Nov 3 | - Support Vector Machine |  |
| 12 | Nov 8 – Nov 10 | - Network Inference Learning |  |
| 13 | Nov 15 – Nov 17 | - Neural Network and Deep Learning |  |
| 14 | Nov 22 – Nov 24 | - Project Presentation |  |
| 15 | Nov 30 – Dec 1 | - Project Presentation |  |
| 16 | Dec 6 – Dec 10 | - Final |  | |

**Grading**  
Grades will be based on following: Homework 30%

Final 20%

Project 30%

Presentation 20%

Grades will be posted throughout the semester.

Grading is as follows:

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| A | A- | B+ | B | B- | C+ | C | C- | D | F |
| >90 | 90-85 | 85-80 | 80-75 | 75-70 | 70-65 | 65-60 | 60-55 | 55-45 | <45 |

Graded assignments will be returned to you as soon as possible. It is your responsibility to check the grade summaries for posting errors. Any score issues must be identified to the instructor within three classes after grade releases. Score are final after that.

Two tests will be given during the semester. Each test will be somewhat comprehensive but will strongly emphasize material covered since the last test. Tests will be announced two or three class days in advance. There will be NO MAKEUP for missed tests.

**Academic Misconduct**Academic integrity is a legitimate concern for every member of the campus community; all share in upholding the fundamental values of honesty, trust, respect, fairness, responsibility and professionalism. By choosing to join the UNLV community, students accept the expectations of the Student Academic Misconduct Policy and are encouraged when faced with choices to always take the ethical path. Students enrolling in UNLV assume the obligation to conduct themselves in a manner compatible with UNLV's function as an educational institution.

An example of academic misconduct is plagiarism. Plagiarism is using the words or ideas of another, from the Internet or any source, without proper citation of the sources. See the Student Academic Misconduct Policy (approved December 9, 2005) located at: <http://studentconduct.unlv.edu/misconduct/policy.html>  
**Department of Computer Science Academic Integrity Policy**  
Each student enrolled in a course offered by the Department of Computer Science is expected to do his/her own work when preparing written or programming assignments, as well as, examinations. He/she must adhere to the academic integrity policy provided by his/her instructor and the university. It is also each student's responsibility to notify the instructor if he/she becomes aware of any activities that would violate the academic integrity policy of the class.

**Academic Integrity Policy**Each student is required to do his/her own work on examinations, written and programming assignments and exercises without outside assistance except as noted below. It is also each student's responsibility to notify the instructor if he/she becomes aware of any activities that would violate the academic integrity policy of the class.

Consequences of violating the academic policy:

* an Alleged Academic Misconduct Report will be completed, and a copy sent to the [Office of Student Conduct](http://studentconduct.unlv.edu/)
* 1st violation - student(s) will receive a grade of zero on the assignment/examination
* 2nd violation - a grade of F will be issued for the course; no further assignments/labs/exams can be completed for credit

**Drop Policy**   
The last day to drop the course is Friday, August 27, 2021.  
  
**Copyright**  
The University requires all members of the University Community to familiarize themselves with and to follow copyright and fair use requirements. **You are individually and solely responsible for violations of copyright and fair use laws. The university will neither protect nor defend you nor assume any responsibility for employee or student violations of fair use laws.** Violations of copyright laws could subject you to federal and state civil penalties and criminal liability, as well as disciplinary action under University policies. Additional information can be found at: [www.unlv.edu/provost/copyright](http://www.unlv.edu/provost/copyright).

**Disability Resource Center (DRC)**  
The UNLV Disability Resource Center (SSC-A 143, <http://drc.unlv.edu/>, 702-895-0866) provides resources for students with disabilities. If you feel that you have a disability, please make an appointment with a Disabilities Specialist at the DRC to discuss what options may be available to you. If you are registered with the UNLV Disability Resource Center, bring your Academic Accommodation Plan from the DRC to the instructor during office hours so that you may work together to develop strategies for implementing the accommodations to meet both your needs and the requirements of the course. Any information you provide is private and will be treated as such. To maintain the confidentiality of your request, please do not approach the instructor before or after class to discuss your accommodation needs.  
  
**Religious Holidays**   
Any student missing class quizzes, examinations, or any other class or lab work because of observance of religious holidays shall be given an opportunity during that semester to make up missed work. The make-up will apply to the religious holiday absence only. It shall be the responsibility of the student to notify the instructor within the first 14 calendar days of the course for fall and spring courses (excepting modular courses), or within the first 7 calendar days of the course for summer and modular courses, of his or her intention to participate in religious holidays which do not fall on state holidays or periods of class recess. For additional information, please visit: [http://catalog.unlv.edu/content.php?catoid=6&navoid=531.](http://catalog.unlv.edu/content.php?catoid=6&navoid=531)  
  
**Transparency in Learning and Teaching**

The University encourages application of the transparency method of constructing assignments for student success. Please see these two links for further information:

<https://www.unlv.edu/provost/teachingandlearning>

<https://www.unlv.edu/provost/transparency>

**Incomplete Grades**  
The grade of I - Incomplete - can be granted when a student has satisfactorily completed three-fourths of course work for that semester/session but for reason(s) beyond the student's control, and acceptable to the instructor and the Department, cannot complete the last part of the course, and the instructor believes that the student can finish the course without repeating it. The incomplete work must be made up before the end of the following regular semester. If course requirements are not completed within the time indicated, a grade of F will be recorded and the GPA will be adjusted accordingly. Students who are fulfilling an Incomplete do not register for the course but make individual arrangements with the instructor who assigned the I grade.

**UNLV Writing Center**   
One-on-one or small group assistance with writing is available free of charge to UNLV students at the Writing Center, located in CDC-3-301. Although walk-in consultations are sometimes available, students with appointments will receive priority assistance. Appointments may be made in person or by calling 702-895-3908. The student's Rebel ID Card, a copy of the assignment (if possible), and two copies of any writing to be reviewed are requested for the consultation. More information can be found at: <http://writingcenter.unlv.edu/>

**UNLV Library Resources**

Students may consult <https://www.library.unlv.edu/consultation> with a librarian on research needs. For this class, the subject librarian is Sue Wainscott. See: <https://www.library.unlv.edu/contact/librarians_by_subject> for more information. UNLV Libraries provides resources to support students’ access to information. Discovery, access, and use of information are vital skills for academic work and for successful post-college life. Access library resources and ask questions at [https://www.library.unlv.edu](https://www.library.unlv.edu/).

**Rebelmail**   
By policy, faculty and staff should e-mail students' Rebelmail accounts only. Rebelmail is UNLV's official e-mail system for students. It is one of the primary ways students receive official university communication such as information about deadlines, major campus events, and announcements. All UNLV students receive a Rebelmail account after they have been admitted to the university. Students' e-mail prefixes are listed on class rosters. The suffix is always @unlv.nevada.edu.  
 **Final Examinations**  
The University requires that final exams given at the end of a course occur at the time and on the day specified in the final exam schedule. See the schedule at: [http://www.unlv.edu/registrar/calendars.](http://www.unlv.edu/registrar/calendars)