

ECE 551 Problems: Course Plan

Fall 2020

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1 Course Objectives

- C1. Synthesize current academic literature review on a Machine Learning (ML) based problem.
- C2. Demonstrate an understanding of the basics of Machine Learning.
- C3. Design an independent research investigation connected to chosen Machine Learning problem.
- C4. Analyze and discuss the motivation, data, methodology, and results of chosen Machine Learning (ML) problem against existing ML literature.
- C5. Communicate your project proposal, progress, method, and results through oral and written reports.

2 Module #1 Project Proposal

2.1 Learning Objectives

- O1.1 Review the course syllabus, course expectations, and prepare a computer system for Machine Learning research.
 - Learn how to navigate through UNM learn: <http://online.unm.edu/help/learn/students/index.html>
 - Learn how to upload images and videos in UNM learn through the link: <http://online.unm.edu/help/learn/students/media/index.html>

- O1.2 Identify a research topic, perform literature review, and an initial research plan.

2.2 Required Materials

- R1.1 Advice_on_Writing.pptx to understand the main parts of your paper proposal.
- R1.2 Paper-Types.pptx to understand the different types of IEEE papers.
- R1.3 Example papers in IEEE-paper-examples.zip.

3 Module #2 Basics of Machine Learning and Classification

3.1 Learning Objectives

- O2.1 Demonstrate an understanding of the basics of Machine Learning and Classification
- O2.2 Develop basic programs in Python

3.2 Required Materials

R2.1 READ and execute the code given in cs228-python-tutorial.ipynb. Use the files in Basic-Python-Files.zip as background material. The packet includes a complete reference for Python and a guide for Matlab users.

R2.2 READ the presentation in Intro-to-ML.pdf. You will need to understand the material for the assignment.

R2.3 READ the presentation in Basic-Classification.pdf. You will need to understand the material for the assignment.

4 Module #3 Basics of Deep Learning

4.1 Learning Objectives

O3.1 Demonstrate an understanding of the basic operations of Deep Learning architectures

O3.2 Demonstrate an understanding of the fundamentals of Convolutional Neural Networks

O3.3 Demonstrate an understanding of a typical Deep Learning architecture for different applications

4.2 Required Materials

R3.1 READ Deep-Learning-Basics.pdf

R3.2 READ Deep-Learning-Advanced.pdf

R3.3 READ Basic-Python-Classification-Examples.pdf

R3.4 READ Keras.pdf if you choose to work in Tensorflow.

5 Module #4 Revising the Proposal

5.1 Learning Objectives

O4.1 Review and rewrite the project proposal.

O4.2 Demonstrate an understanding of the revision process.

5.2 Required Materials

R4.1 READ the feedback that you have received on your project proposal.

6 Module #5 Midterm Project Report

6.1 Learning Objectives

O5.1 Practice technical presentation skills

O5.2 Engage in interactive dialogue to discuss the technical challenges

O5.3 Revise and organize a technical presentation to summarize findings and identify challenges.

6.2 Required Materials

R5.1 READ the Midterm Project Presentation guide.

7 Module #6 Project Update

7.1 Learning Objectives

- O6.1 Develop and apply Machine Learning methods.
- O6.2 Adapt the Machine Learning methods based on preliminary results.

7.2 Required Materials

- R6.1 Project update guidelines.

8 Module # 7 Final Presentation

8.1 Learning Objectives

- O7.1 Defend your Machine Learning methodology in an oral presentation.
- O7.2 Analyze results and draw conclusions.
- O7.3 Receive feedback for your final paper.

8.2 Required Materials

- R7.1 Guidelines document for project presentation.

9 Module #8 Final Project Materials

9.1 Learning Objectives

- O8.1 Adapt the final presentation and project based on feedback obtained during the oral presentation.
- O8.2 Summarize the different components of the project, defend the methodology, and analyze the results in writing up the final project research paper.

9.2 Required Materials

- R8.1 Sample Journal Papers from Module # 1
- R8.2 L^AT_EX and PDF paper starting guide. This uses the L^AT_EX IEEE format. An IEEE Word format document is also included.
- R8.3 Final project and presentation submission guidelines are given in the final submission link.

Module	Learning Objective	Required Materials	Required Assessments/Activities	Due Date	Points Possible	Course Objective Alignment
Week 1 08/17 - 08/23 Project Proposal	O1.1, O1.2	R1.1, R1.2, R1.3	1. Project Proposal 2. Software Installation	08/24/2020	5+5=10	C1, C5
Week 2 08/24 - 08/30 Basics of Machine Learning and Classification	O2.1, O2.2	R2.1, R2.2 R2.3	Quiz 1 Assignment 1	08/31/2020	20	C2
Week 3 08/31 - 09/06 Basics of Deep Learning	O3.1, O3.2 O3.3	R3.1, R3.2, R3.3, R3.4	Quiz 2: Basics of DL	09/08/2020	10	C1, C4, C5
Week 4 09/08 - 09/13 Revising the Proposal	O4.1, O4.2	R4.1	Revised Proposal	09/14/2020	20	C1, C2, C4, C5
Week 5 09/14 - 09/20 Midterm Project Report	O5.1, O5.2, O5.3	R5.1	Midterm Progress Report & Presentation	09/21/2020	10	C3, C4, C5
Week 6 09/21 - 09/27 Project Update	O6.1, O6.2	R6.1	Brief Project Update	09/28/2020	5	C3, C4, C5
Week 7 09/28 - 10/04 Final Presentation	O7.1, O7.2 O7.3	R7.1	Final Presentation	10/05/2020	50	C3, C4, C5
Week 8 10/05 - 10/11 Final Project Materials	O8.1, O8.2	R8.1, R8.2 R8.3	Final Project Revised Presentation Responses to Review	10/12/2020	200	C4, C5

ECE 551 Problems.
Special Section for AOP and Online Students Focused on Machine
Learning Projects
Fall 2020

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1-6 to a maximum of 9 Δ Credit hours

1 Course Description

The course will cover the basics of Python, basics of Applied Machine Learning through Python, and requires a project based on applying the learned Machine Learning concepts. Student must approach the instructor the semester before enrollment to develop a plan of study. A formal presentation and paper are required. The required amount of work will be proportional to the number of credit hours. Thus, a student that take ECE 551 for 6 hours of credit should be expected to approximately provide twice the amount of work that is required for another student taking the course for 3 credit hours. The required work will be reflected in the project proposal and hence be discussed with the instructor.

2 Course Goals

The goal of the project is to support students in applying modern Machine Learning methods in their projects. The students will learn how to properly prepare their datasets, develop custom methods, apply them to their projects, and carefully analyze the results.

2.1 Student Learning Outcomes/Course Objectives

Refer to separate Course Plan document.

3 Prerequisites and Co-requisites

The course assumes basic knowledge of Machine Learning concepts that is covered in ECE 517, ECE 533, ECE 516, or an equivalent course. More specifically, the course requires the use of Python for Machine Learning, basic Statistical Learning concepts, a review of fundamentals of Machine Learning, and Deep Learning.

4 Specific Course Requirements

Prerequisite: Permission of instructor. Please contact the instructor prior to taking the course. The instructor will need to verify that the student has sufficient background to conduct a project in Machine

Learning and to also verify that a potential project can be identified.

Required Project Presentation Times: You are required to present a midterm (week of 09/14 - 09/20) and a final presentation (week of 09/28 - 10/04). Times are to be arranged with the instructor. However, any time during Friday or Monday afternoon should work.

Optional Meeting Times: You can setup meeting times with the instructor as needed. Times can be arranged. However, Friday and Monday afternoons are preferred.

5 Technical Skills

In order to participate and succeed in this class, you will need to be able to perform the following basic technical tasks:

- Use UNM Learn (help documentation located in "How to Use Learn" link on left course menu, and also at [Online Student Documentation](#)).
- Both L^AT_EX and Word are allowed for your project report. You can also use L^AT_EXor Powerpoint for your presentation.
- Skype or Zoom are preferred for web conferencing. If you are working with one of the students in the Image and Video Processing and Communications Lab (ivPCL), you are likely to join a specific channel in Slack. Follow the specific App instructions for testing your audio settings. The standard test is to have your voice recorded and replayed back to you. Make sure that you can hear your voice played back to you. Please test your audio prior to every online meeting. My Skype id is mspattichis. For Zoom, all you need is an email invitation from me.
- **Optional: Install Matlab:** Matlab is available on Mac, Linux, and Windows. Matlab can help you with providing ground truth for your project. Refer to <http://it.unm.edu/download/> on how to download and install Matlab on your machine.
- **Required: Anaconda and Python** Anaconda and Python are required. Refer to https://www.tensorflow.org/tutorials/eager/custom_training_walkthrough for an overview. A separate installation guide will be provided in Assignment #0.
- **Complete Labs for Machine Learning and Textbooks** To install the labs for the Machine Learning labs, simply do:

```
git clone https://github.com/amueller/introduction_to_ml_with_python
git clone https://github.com/ageron/handson-ml2
git clone https://github.com/falloutdurham/beginners-pytorch-deep-learning
```

6 Technical Requirements

Computer requirements:

- A high speed Internet connection is highly recommended.
- [Supported Browsers and Operating Systems](#)
- You will need a recent, no more than four years old, computer (Mac or PC) to run the latest version of Python and Anaconda (see below). An updated web browser should be sufficient to access your online course.
- For the best experience when using the Kaltura Media Tools inside UNM Learn, be sure to use a [supported browser](#) on a desktop.

- Microsoft Office products are available free for all UNM students (more information on the [UNM IT Software Distribution and Downloads page](#)).

For UNM Learn Technical Support: (505) 277-0857 (24/7) or use the Create a Support Ticket link in your course.

6.1 Web Conferencing

It is important to monitor your project progress through interactive video conferencing sessions. These sessions will be scheduled weekly based on your time zone. Ideally, they will be scheduled in the afternoon, mountain time. The separate course schedule document will provide times for these web conferencing times. Screen sharing will be needed to demonstrate your progress on the project.

For the online sessions, you will need:

- A USB headset with microphone. Headsets are widely available at stores that sell electronics, at the UNM Bookstore or online. Modern bluetooth headsets would also work. However, USB headsets were found to be more reliable for most connections. If you are working in a noisy environment (e.g., near an air-condition), you may need a headset with noise cancellation to reduce the background noise. Alternatively, you should mute yourself when you are not talking through the microphone. If you hear an echo, it is because you have the speaker close to the microphone. You can thus eliminate the echo by reducing the volume, moving the speaker away from the microphone, or muting yourself. Please refer to software instructions for testing your audio connection prior to each meeting.
- A high-speed internet connection is highly recommended for these sessions. You can turn off your video to reduce bandwidth requirements.
- A wireless Internet connection may be used if successfully tested for audio quality prior to web conferencing.
- For UNM Web Conference Technical Help: (505) 277-0857.

6.2 Tracking Course Activity

UNM Learn automatically records all students' activities including: your first and last access to the course, the pages you have accessed, the number of discussion messages you have read and sent, web conferencing, discussion text, and posted discussion topics. This data can be accessed by the instructor to evaluate class participation and to identify students having difficulty.

7 Textbook and Supplemental Materials

7.1 Required Textbooks

The class requires the following textbooks:

Aurelien Geron. *Hands-on machine learning with Scikit-Learn, Keras, and TensorFlow: Concepts, tools, and techniques to build intelligent systems*. O'Reilly Media, second edition, 2019.

Ian Pointer. *Programming PyTorch for Deep Learning: Creating and Deploying Deep Learning Applications*. O'Reilly Media, 2019.

Optionally, some of the fundamentals of Machine Learning can be found in:

Andreas C. Müller and Sarah Guido. *Introduction to machine learning with Python: a guide for data scientists*. O'Reilly Media, Inc.", 2016.

The books *Hands-On Machine Learning with Scikit-Learn & Tensorflow* and *Introduction to Machine Learning with Python* are freely available to all UNM students. To access them, simply go to <https://libguides.unm.edu/Safari>. There are several other Python textbooks available through this link.

8 Coursework and Participation

8.1 Instructor Response Time

I routinely check the course for postings at the end of the day and for emails throughout the day and weekends. You can anticipate a 24 to 48 hour response from me, Monday – Thursday. I will try and respond to all weekend (Friday afternoon to Sunday) emails and postings by noon on Monday or earlier. If you do not get a response within two days, please email me again. Grades for submitted student work will be posted within 5 calendar days.

8.2 Procedures for Completing Coursework

8.2.1 Late Submissions

Prior to each deadline, you will need to email the instructor if you are going to submit an assignment late. You can take up to two days late for up to two assignments. Beyond this, you may lose up to 10% per late day. All written work needs to be submitted online via UNM Learn. If you have a difficulty using a tool to complete work, use the [Create a Tech Support Ticket](#) link in the Course Menu immediately and notify your instructor as well.

8.2.2 Course Schedule

Refer to external schedule document.

8.2.3 Expectations for Participation

- The amount of time that you are expected to spend on the course is proportional to the credit hours. Expect to spend 9-12 hours per week for the 3-hour project depending on your prior experience with Python and Machine learning.
- students are expected to learn how to navigate in Learn
- students are expected to communicate with one another in team projects
- students are expected to keep abreast of course announcements
- students are expected to use the Learn course email as opposed to a personal email address
- students are expected to keep instructor informed of class related problems, or problems that may prevent the student from full participation
- students are expected to address technical problems immediately
- students are expected to observe course netiquette at all times

8.2.4 Netiquette

Please respect others during interactive online discussion. Refer to the [UNM Discussion & Blog Netiquette](#).

8.2.5 Grading Procedures

- Homework should be graded within a calendar week after submission.
- Project feedback is best given through interactive sessions.
- Ask the instructor for scheduling an interactive session as needed.

8.2.6 Grading Scale

Although it is difficult to assess project grades, the following table should serve as a guide of the expectations of the instructor.

Final Grade	Project Comment	Homework & Quizzes
A ⁺	Journal or conference paper quality	Excellent
A	Excellent project in every respect	Excellent
A ⁻	Good results and original method	Very good
B ⁺	Descent results with an original method	Very good
B	Limited results with an original method	Good
B ⁻	Some results but method is of limited originality	Completed
C ⁺	Good methods but results lacking	Completed
C	Unacceptable	Incomplete
F	Unacceptable	Incomplete

9 UNM Policies

9.1 Title IX: Gender Discrimination

In an effort to meet obligations under Title IX, UNM faculty, Teaching Assistants, and Graduate Assistants are considered “responsible employees” by the [Department of Education](#) (see pg. 15). This designation requires that any report of gender discrimination which includes sexual harassment, sexual misconduct and sexual violence made to a faculty member, TA, or GA must be reported to the Title IX Coordinator at the [Office of Equal Opportunity](#). [Read more about campus policy regarding sexual misconduct.](#)

9.2 COPYRIGHT ISSUES

All materials in this course fall under copyright laws and should not be downloaded, distributed, or used by students for any purpose outside this course.

[The UNM Copyright Guide](#) has additional helpful information on this topic.

9.3 Accessibility

The American with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodations of their disabilities. If you have a disability requiring accommodation, please contact the [UNM Accessibility Resource Center](#) in 2021 Mesa Vista Hall at 505-277-3506. Information about your disability is confidential.

- [Blackboard’s Accessibility statement](#)
- [Microsoft’s Accessibility statement](#)

No accessibility statement has been found for [Anaconda](#) or [PyTorch](#). However, [Microsoft’s Accessibility statement](#) should be consulted when running this software.

9.4 Academic Integrity

The University of New Mexico believes that academic honesty is a foundation principle for personal and academic development. All University policies regarding academic honesty apply to this course. Academic dishonesty includes, but is not limited to, cheating or copying, plagiarism (claiming credit for the words or works of another from any type of source such as print, Internet or electronic database, or failing to cite the source), fabricating information or citations, facilitating acts of academic dishonesty by others, having unauthorized possession of examinations, submitting work of another person or work previously used without

informing the instructor, or tampering with the academic work of other students. You should be familiar with UNM's [Policy on Academic Dishonesty](#) and the [Student Code of Conduct](#) which outline academic misconduct defined as plagiarism, cheating, fabrication, or facilitating any such act.

9.5 Drop Policy

If you consider dropping the course, please contact the instructor to setup a meeting to discuss different options. UNM Policies: This course falls under all UNM policies for last day to drop courses, etc. Please see or the UNM Course Catalog for information on UNM services and policies. Please see the UNM academic calendar for course dates, the last day to drop courses without penalty, and for financial disenrollment dates.

9.6 UNM Resources

For library services, go to <http://library.unm.edu/> to link to a specific library or to contact a librarian. You can also refer to [Student Health & Counseling \(SHAC\) Online Services](#).

9.7 FOR MILITARY-CONNECTED STUDENTS

There are resources on campus designed to help you succeed. You can approach any faculty or staff for help with any issues you may encounter. Many faculty and staff have completed the GREEN ZONE training to learn about the unique challenges facing military-connected students. If you feel that you need help beyond what faculty and/or staff can give you, please reach out to the Veterans Resource Center on campus at 505-277-3181, or by email at vrc@unm.edu.