

DSBA 6156: Applied Machine Learning
Spring 2023
Dr. Joseph Tenini

Contact Information:

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Office Hours: Thursdays 9:00 am – 10:00 am via google meet (check Canvas for details)

Course Description:

Prerequisite: Some programming experience, preferably in Python.

Machine Learning is quickly becoming a non-negotiable and fundamental skill for those who propose to create value from data. Gone are the days when an analyst could stare at spreadsheets and concoct stories filed under the heading of “insights”. Today’s marketplace requires a principled approach set firmly atop the foundation of machine learning, statistics, and software development. In this course, we aim to provide this abstract foundation along with a curated set of practical applications, which will aim to further develop the conceptual understanding and provide crucial practice in bringing these concepts to bear on real world problems.

At its core, the course aims to cover the three main tasks of machine learning (unsupervised learning, supervised learning, and reinforcement learning) in the most commonly encountered language (Python). The teaching style will be example driven and rely heavily on practical problems and projects.

Objectives of the Course:

Upon completion of this course, students should be able to:

- Explain basic concepts in:
 - Supervised Learning
 - Unsupervised Learning
 - Reinforcement Learning
- Demonstrate basic competency in Python programming.
- Create valuable ML-based solutions and analysis from real world data and data science problems.

Schedule of Topics, Exams & Presentations:

We will cover the following topics with some exceptions to the below order: (**tentative**)

- Unsupervised learning
 - Matplotlib and Visualization [in Python]
 - Data Preprocessing [in Python]
 - Dimensionality reduction, clustering
 - Natural language processing - embeddings
- Supervised Learning

- o Linear Models – Regression, Classification
- o Trees, forests, and ensembles
- o Deep learning
- o Calibration and imbalanced data
- o Model evaluation, model interpretation, and feature selection
- o Parameter tuning and automatic machine learning
- o Time series analytics
- Reinforcement learning
 - o Recommender systems
 - o A/B testing
 - o Bandit problems

Instructional Method:

Materials presented in this course will be covered through lectures, assigned reading, and projects. Most of the concepts will be covered through the use case-based hands-on experience. In the end, students will have both the theoretical understanding of machine learning concepts and concrete experience of putting such concepts and principles into practice.

Textbooks:

There is **no required textbook** for the class, however the following references are very useful and freely available online:

1. *The Elements of Statistical Learning - Data Mining, Inference, and Prediction*. Hastie, Tibshirani, Friedman. Second Edition.
 - o <https://www.sas.upenn.edu/~fdiebold/NoHesitations/BookAdvanced.pdf>
2. *Reinforcement Learning: An Introduction*. Sutton, Barto. Second Edition
 - o <http://www.incompleteideas.net/book/the-book-2nd.html>
3. *Deep Learning*. Goodfellow, Bengio, Courville.
 - o <https://www.deeplearningbook.org/>
4. Python-related documentation:
 - o Python: <https://www.python.org/doc/>
 - o Numpy: <https://numpy.org/doc/stable/>
 - o Pandas: <https://pandas.pydata.org/docs/>
 - o Scikit-learn: <https://scikit-learn.org/stable/>

Course Requirements and Grading Policy:

Projects (3)	60%
Midterm	20%
Final	20%

Additional Policies:

Attendance:

Students are expected to attend all class meetings and to arrive before the class starts. Class topics are integrated, with each week building on prior weeks. If a student misses a class due to work or other reasons, it is their responsibility to get notes from peers; instructors do not hold extra repeat class sessions.

Grade Discussions:

The instructor and TA will discuss grades only in-person or via video conference (and not via e-mail) and only with the student (not with parents, spouses, etc). Office hours are listed in the syllabus.

Academic Integrity:

All students are expected to adhere to the [UNC Charlotte Code of Student Academic Integrity](http://legal.uncc.edu/policies/ps-105.html) (<http://legal.uncc.edu/policies/ps-105.html>) as specified in the current [Catalog](http://catalog.uncc.edu/) (<http://catalog.uncc.edu/>). Among other things, this code forbids cheating, fabrication or falsification of information, multiple submission of academic work, plagiarism, abuse of academic materials, and complicity in academic dishonesty.

Diversity Statement

No student will be discriminated against in the class based upon age, race, nationality, religion, sexual orientation, gender identity/expression, veteran's status, country of origin, or group affiliation. Likewise, all participants in this class will be expected to respect other members who fall into these categories. Any student who does not behave in a respectful manor with their classmates will be withdrawn from the class.

Special Needs:

If you have a documented disability and require accommodation in this course, contact Disability Services, Fretwell 230, phone: 687 4355 voice/TDD) the first week of the semester. Information about available services may be found at <http://legal.uncc.edu/policies/ps-51.html>. Accommodations for learning will be arranged by that office and communicated to the Instructor. If you speak English as a second language, please inform the instructor.

Religious Accommodation:

It is the obligation of students to provide faculty with reasonable notice of the dates of religious observances on which they will be absent by submitting a [Request for Religious Accommodation Form](http://legal.uncc.edu/policies/ps-134.html) to their instructor prior to the census date for enrollment for a given semester <http://legal.uncc.edu/policies/ps-134.html>. The census date for each semester (typically the tenth day of instruction) can be found in UNC Charlotte's Academic Calendar (<http://registrar.uncc.edu/calendars/calendar.htm>).

Inclement Weather:

University Policy Statement #13 states the University is open unless the Chancellor announces that the University is closed. The inclement weather hotline number to call is

704-786-2877. **In the event of inclement weather, check the announcements section of Canvas.** The instructors will use their best judgment as to whether class should be held, understanding that some of you commute from far away and the instructors will notify you by email if class is canceled.