BSAN 6070 : Spring 2023
Introduction to Machine Learning

Loyola Marymount University

Advance knowledge and develop business leaders with moral courage and creative confidence to be a force for good in the global community.

Instructor
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Lecture Times

Section 01: Tuesdays - 06:00 PM - 08:45 PM
Section 02: Wednesdays – 2:00 PM – 4:45 PM

Lecture Locations

In-campus Lectures: Brickyard Room 212 @Playa Vista campus
Live Virtual Lectures: Use Zoom Classroom Link @BrightSpace

Office Hours

Please use **Calendly.com/arin-brahma/office-hours** for specific office hours appointment

- In-person Office Hours @HILTON 221 (Attending via Zoom is also allowed):
  - Tuesdays: 05:00 PM – 6:00 PM
  - Wednesdays: 05:00 PM – 6:00 PM
- On-demand pre-scheduled Virtual Office Hours @Zoom Room
  - Mondays: 2:00 PM – 4:00 PM
  - Thursdays: 6:00 PM – 8:00 PM

  (Accessing Zoom Class Periods and Zoom Office Hours: Go to BrightSpace and find Zoom Classroom / Office Hours Link on the Left Panel)
- Phone number: 949-302-1030. Feel free to contact via Text Messaging

Course Information

Credit Points: 3

Description: This course will provide students a hands-on application-oriented exposure to machine learning (ML), while taking a deep dive into the fundamentals of supervised and unsupervised machine learning algorithms, model selection, feature engineering, data fitting, model evaluation and optimization. Students will also learn how to instantiate, test, and deploy ML models using Python libraries and platforms such as Azure ML, using real life data sets. Finally, students will develop the skills to interpret ML based predictive models to support business decision making.

Prerequisites: BSAN 6030: Programming for Data Management (with a minimum grade of B-)

Prior Knowledge Requirements: This course will require you to write codes in Python for using external data sets to train, test, evaluate, and implement various machine learning models involving various algorithms. The course will focus on teaching the machine learning work flow and explaining the concepts behind the inner workings and logic of various algorithms. The content coverage goals does not allow for teaching Python coding basics. Some amount of prior proficiency in Python coding and coding environments such as Jupyter Notebook, Google Colab, and Github is expected. More specifically, it will be assumed that the students will have hands-on knowledge of the following areas of Python. If you feel you are not fully comfortable in one or more areas listed below, you are strongly encouraged to review your notes / work from the past MSBA courses, do online tutorials etc. to be up to speed. These skills will be essential in succeeding in this course.

- Data pre-processing: Concept of Label Encoding and Hot Encoding
- Selecting, Slicing, Indexing, and Filtering in Pandas DataFrame
- String Operations in Pandas DataFrame
- Python Dictionary Techniques
- Various Useful Pandas DataFrame Techniques
- Visualization in Pandas DataFrame - MatPlotLib and/or SeaBorne

Reference Text/Material

Lecture materials and other content distributed via BrightSpace

Learning Objectives

This course contributes to student achievement of the following M.S. Business Analytics core learning outcomes:

- Students are able to collect data from primary and secondary sources
- Students are able to consolidate and cleanse data coming from multiple sources in multiple format
- Students can design and implement various data architectures for effective storage, management and analysis of data
- Students can use programming languages and software packages to perform statistical analysis on a given data set
- Students can apply data-mining techniques to support decision-making for business problems

Upon completion of this course, students are expected to be able to:

1. Understand data types and structures
2. Import and export data into Python
3. Clean, manipulate, and query data in Python
4. Visualize data using plots in Python
5. Create models to explain data

Software

You may download and install the latest version of Anaconda (Python) and JupyterLab for Anaconda or Google CoLab (https://colab.research.google.com/) on your computer for free. Additionally, you may use LMU Virtual Desktop Infrastructure which already has the applications installed and ready to use.

Evaluation Process

Student learning is evaluated through the following items. However, the exact distribution might further be adjusted or modified during the course with prior notice:

Grade Categories ===>	Computer Assignments (CA)	Team Workshops (TW)	Quiz	Exam #1	Exam #2	Class Participation	Group Project	Attendance	TOTAL
% Weight ===>	25%	5%	5%	20%	20%	2%	20%	3%	100%

Note:

1. **Extra Credit / Bonus Points**: Team members of the "Best Project" > **+2%** Each
2. **Computer Assignments & Peer Reviews**: Each assignment grading – 80% your own work + 20% peer review report for the same assignment. Your assignment submission will be deemed incomplete if corresponding peer review report is not submitted. If it is not submitted at all or submitted after 5 days from the due date, the entire assignment will be assigned a score of Zero.

All issues regarding grading must be brought to the course instructor's attention within one week (7 calendar days) from the date of the posting of the assignment, quiz, or exam grade on BrightSpace. After one week from being posted, assignment, quiz, and examination grades become permanent.

Computer Assignments (CA): All the computer assignments are done and submitted by individual students. The course involves 9 computer assignments (30%) that reflects cumulative learning of students. Moreover, a number of online reading / tutorials might be assigned before class to prepare students for the topic to be covered.
Participation: Expectations for participation and involvement are high. You should come to class prepared to collaborate and create code. You should have read the specified material and prepared for class by doing homework. There is 5% grade assigned in this category.
Final project: The purpose of the final project is to provide you the opportunity to use tools you have learned in class to retrieve, manipulate, and analyze data to address business analytics problems using Machine Learning approach, and also to further practice collaborative group work. Each group is expected to find a public dataset or collect a dataset, identify business and/or societal problems that can be addressed using Machine Learning based predictive analytics. The group will submit a written report that presents the project, the analysis techniques, and the findings. The group expected to present in class, and their score is given based on both their written analysis and presentation.
Exams: There will be TWO exams during the semester. The exam covers material from the beginning of the semester up to the exam date, or as announced by the instructor.
Attendance: Attendance in this course is MANDATORY. 2% grade is assigned to attendance category and it is computed simply by the % of classes attended. One may miss a maximum of ONE class without

being penalized in the grade. Absence backed by a valid doctor's certificate will also be excused for any grade penalty.

Final Grade Scale

The final letter grades will be assigned based on the following scale:

94-100%	A	80-82.9%	B-
90-93.9%	A-	75-79.9%	C+
87-89.9%	B+	70-74.9%	C
83-86.9%	B	Below 70%	F (Fail)

Important Notes

Curving

Curving might or might not be done at the discretion of the instructor at the time of determining the final semester grade. There will not be any prior or advance indication during the semester if a curving will be applied at all. Depending on the overall class performance, a curving, if applied, might be applied at the final semester score level or at any individual grade component level. However, the decision of curving is completely discretionary and not requested or demanded by the students. Also please note that any type of curving (final semester score level or individual grade component level) will be calculated during the final grade calculations AFTER the last grade event, and the need or the decision of such curving may not be known until the final grade calculation time. The goal of curving is generally to benefit maximum number of under-performing students and every student may not benefit equally or proportionately. The curving benefits of each student may vary depending on their scores on individual grade items. The curving calculations or mechanism is also completely discretionary to the instructor.

Exam Make-up Policy

There will be NO make-up exams or "early" exams (especially the final), except in the following special circumstances: If the cause of the absence is a valid hospitalization or sickness (an official electronic notification from the university, not a paper note from the health center), university approved athletic function, a death in the immediate family (with notification from university or an obituary), or a religious observance, the weights used to determine the final grade will be adjusted. Otherwise, the quiz/exam will have a score of 0.

UNIVERSITY POLICY STATEMENTS

A. Academic Honesty

a. General statement

Loyola Marymount University is a community dedicated to academic excellence, student- centered education and the Jesuit and Marymount traditions. As such, the University expects all members of its community to act with honesty and integrity at all times, especially in their academic work. Academic honesty respects the intellectual and creative work of others, flows from dedication and pride in

performing one's own best work, and is essential if true learning is to take place. As an LMU Lion, by the Lion's Code, you are pledged to join the discourse of the academy with honesty of voice and integrity of scholarship.

Academic dishonesty will be treated as an extremely serious matter, with serious consequences that can range from receiving no credit for assignments/tests to expulsion.

- It is never permissible to turn in any work that has been copied from another student or copied from a source (including Internet) without properly acknowledging/citing the source.
- It is never permissible to work on an assignment, exam, quiz or any project with another person unless your instructor has indicated so in the written instructions/guidelines.
- It is your responsibility to make sure that your work meets the standard of academic honesty set forth in the "LMU Honor Code and Process." The LMU Academic Honor Code and Process can be found at: https://academics.lmu.edu/honesty/

b. LMU Academic Honesty Policy (https://academics.lmu.edu/honesty): *Unauthorized Access to or Alteration of Privileged and Proprietary Information*:

- Unauthorized access to and/or use of privileged University documents, files, or information and/or alteration thereof by electronic or any other means.
- Unauthorized access to and/or use of proprietary information. For example, the unauthorized dissemination of research prior to publication.
- Unauthorized access to and/or use of University course resources and materials. For example, distributing any course materials (syllabus, assignments, exams, etc.) without explicit permission from the instructor. Therefore, dissemination or sharing of any classroom recording (e.g., Zoom or other videos posted by the instructor) without the permission of the instructor would be considered "unauthorized use" and, therefore, prohibited
- **Turnitin - Plagiarism Detection Service:** Loyola Marymount University has partnered with the third-party application Turnitin to help maintain our standards of excellence in academic integrity. Turnitin is a suite of tools that provide instructors with information about the authenticity of submitted work and facilitates the process of grading for instructors. Submitted files are compared against an extensive database of content comprising of over 165 million journal articles, 1 billion student papers, and 62 billion current and archived websites. Turnitin produces a similarity report and a similarity score. A similarity score is the percentage of a document that is similar to content held within the database. A similarity report gives the instructor more information about any potential matches and their sources. Turnitin does not determine if an instance of plagiarism has occurred. Instead, it gives instructors the information they need to determine the authenticity of work as a part of a larger process. All submissions to this course may be checked using Turnitin proactively by the students before final submissions.

B. Academic Honesty Considerations in an Online Learning Environment

- In addition to avoiding plagiarism in assignments and submissions, students work in the exams and quizzes are expected to be their original
- The instructor might ask you to explain your work or answers in your quiz, exams, or assignments post submission. Failure to explain your own work will render your work unoriginal and will be considered as a case of academic dishonesty

- In the event an exam or class work is conducted virtually, it is mandatory that students keep their video camera on directly towards the front of their face without any exception. Students must make sure that they check the availability and correct functioning of their video camera well ahead of such events and take steps necessary to correct technical issues, is any. LMU IT Helpdesk might be a helpful resource for this purpose.
- In case of virtual session, during quizzes and exams, students are allowed to use ONLY ONE computer device (a desktop or a laptop) with ONLY ONE display monitor (external monitor or laptop screen)
- Any sort of electronic communication with anyone during the quiz or exam is strictly prohibited
- Students will follow instructor's specific policy regarding cell phone and other electronic devices as informed by the instructor during the quizzes, exams, or other course activities
- Students will sign and certify on the cover sheet of papers or projects that they have followed the Honor Code and that this is their original work
- **A zero-tolerance principle to academic dishonesty is followed in this course. Any violation of University's academic code will result in severe consequences including fail grade in an assignment, quiz, exam, or the entire course, as determined by the instructor. Additionally, the instructor may recommend further actions by the University including expulsion from the degree program altogether.**

C. Expectations for Classroom Behavior in an Online Learning Environment

1. Netiquette

In addition to LMU's *Community Standards*, *The Lion's Code* and Guidelines on *LMU Student Classroom and Course-Related Behavior,* students should adhere to "Netiquette". Your instructor and fellow students need a safe, online learning environment. All opinions and experiences shared, no matter how controversial they may be perceived, must be respected in the spirit of academic discourse. You are encouraged to critique an idea but should not attack an individual. Working as a community of learners, we can build a respectful space for discourse. Below are some tips for good netiquette:

- A virtual classroom is still a classroom
- Although students log in to virtual class room from their private space, once in the virtual class room, students are a part of the entire classroom environment along with other fellow-students and it's not a private space anymore. Just like in a physical classroom, your behavior and etiquettes affect everyone in the session, including your instructor
- You are **required** to have appropriate attire and appearance while attending the virtual class, just as you would in a physical classroom in the campus
- Listen actively: listen to understand, learn, and receive information.
- Present ideas appropriately to your fellow students and the instructor
    - Avoid the use of offensive language.
    - Be aware of Internet Language. For example, do not capitalize all letters since this suggests shouting.
    - Popular emoticons such as ☺ or / can be helpful to convey your tone but do not overuse them.
    - Use an appropriate and respectful tone when communicating formally or informally.

- As in a classroom-based session, engaging in private chat during remote class discussion and presentation is disruptive
- Do not work on other things during class attendance
- It may be tempting to multitask during class, but this will impede your learning
- Your full focus on the conversation and class materials is required
- Before posting your question to a discussion board, check if anyone has asked it already
- Don't post irrelevant links, comments, thoughts or pictures
- If you refer to something your classmate said earlier in the discussion, quote just a few key lines from their post so that others won't have to go back and figure out which post you're referring to
- Respect the opinion of your classmates. If you feel the need to disagree, do so respectfully and acknowledge the valid points in your classmate's argument
- Be willing to express dissent. There should be space for non-majority opinions
- Edit before you push the "Send" button
- Students are expected to attend class sessions without interruptions

2. Zoom Sessions

- Please keep your camera on. This is a requirement in this course, unless excused based on exceptional situations via prior permission from the instructor
- **It is recommended that, to address any concern about the visibility of your private space, you use Zoom's Virtual Background feature to foster a neutral ambience and maintain privacy of your own space, if needed. It can be fun for you and others as well.** Here is a link with instructions to do so: https://support.zoom.us/hc/en-us/articles/360045819512-Using-Virtual-Background-in-a-Zoom-Room

- Please keep your microphones muted until it is your turn to speak.
- Please use the raise hand feature or use the chat if you have a question or comment
- Be an active participant in the breakout sessions.
- All Zoom sessions will be recorded and put on Brightspace. Please review these if you are unable to attend or need to leave early.

3. Safety and Privacy in the remote learning environment

Students and faculty have a reasonable expectation for privacy in all learning spaces. Bimodal and remote learning can involve the use of synchronous video conferencing, asynchronous recorded lectures, live and online discussions, as well as online forums. In these venues, privacy is a priority for a safe learning environment. See *The Lion's Code*

As a member of our online community, please follow these privacy guidelines:

- Videos captured during class meetings should be used only to support student learning
- Do not share screenshots or images from sessions.
- Do not record any sessions with your own device; asynchronous classes will be posted in a secured page on Brightspace and may not be downloaded, manipulated, or distributed, or uploaded to a public page for any reason (unless with instructor permission).
- Do not share class access information such as Zoom links, Zoom password etc.

B. Americans with Disabilities Act–Special Accommodations

Students with special needs who require reasonable modifications, special assistance, or accommodations in this course should promptly direct their request to the Disability Support Services (DSS) Office. Any student who currently has a documented disability (ADHD, Autism Spectrum Disorder, Learning, Physical, or Psychiatric) needing academic accommodations should contact the DSS Office (Daum Hall 2nd floor, 310- 338-4216) as early in the semester as possible. All discussions will remain confidential. Please visit http://www.lmu.edu/dss for additional information. Please ask for help as early in the semester as possible! Students should also keep in mind that resources are available through the Library (https://library.lmu.edu) and Information Technology Services (https://its.lmu.edu). The DSS Office can help students connect with the appropriate person at the Library and ITS.

C. Tentative Nature of the Syllabus

If necessary, this syllabus and its contents are subject to revision. Only written communications from the instructor via email or BrightSpace update will constitute a change or revision of this syllabus and its content. When such communication occurs, students are responsible for keeping track of any changes or modifications distributed in class, emailed to students' LMU Lion accounts or posted on LMU's course management system, Brightspace. If you are absent from an in-person or online class meeting, it is the student's responsibility to check Brightspace and with the professor to see if you missed any important class announcements. Students should not rely on word-of-mouth from classmates. In case of missed class announcements, or if in doubt, or further clarity is needed, students are required to contact the instructor directly and receive necessary information and clarifications.

OTHER POLICY STATEMENTS

- **Expectations for Classroom Behavior** (https://academics.lmu.edu/media/lmuacademics/centerforteachingexcellence/documents/LMU%20Student%20Classroom%20and%20Course-Related%20Behavior.pdf). See also Expectations for Classroom Behavior in an Online Learning Environment.
- **Electronic devices in the virtual classroom**
  Please turn off and put out of sight all electronic devices (other than those and when allowed) during class-time. The interruptions and/or distractions they cause disrupt class and interfere with the learning process. Even if you are not on video, it's distracting to you.
- **EIBC - Effective Infectious Behavior Control** (https://studentaffairs.lmu.edu/media/studentaffairs/osccr/documents/2021-COVID-19-Excellent-Infectious-Behavior-Control-Guidelines-and-Policy.pdf).
- **Student responsibility for checking identified communication channels**

  a. Use your lion.lmu.edu email address. Check it often or forward it to your other email address.
  b. To support this course on Brightspace you will need access to the Internet and a supported Web browser (Internet Explorer, Chrome, Firefox, etc.). To ensure that you are using the recommended personal computer configurations, please refer to the Brightspace tutorial link.
  c. Technical assistance: If you need technical assistance at any time during the course or to report a problem with Brightspace you can seek assistance from the HELP Desk. helpdesk@lmu.edu.

- **Reporting Requirements of Sexual or Interpersonal Misconduct**
  As "responsible employees," faculty are required to report any case of suspected sexual or interpersonal misconduct and cannot protect student confidentiality. For information about confidential counseling on campus and for general information about consensual relationships, sexual harassment, and sexual assault, please see the LMU Cares website: http://studentaffairs.lmu.edu/lmucares/.
- **Student Self-Care**
  Please prioritize your self-care. LMU has many health and wellness resources available to support you at every step of your journey. Learn more at lmu.edu/lionwellness.
- **Emergency Preparedness Information**
  Public Safety can be reached 24/7 365 at 310.338.2893 (or x222 from a campus phone). In a life-threatening emergency, call 9-1-1 first and then call Public Safety if possible. To report an incident, call Public Safety, submit an e-report on the Public Safety website or via the Rave Guardian mobile app, or visit Public Safety in Foley Annex. Review evacuation information and other safety tips posted in each learning space. Make sure you're registered to receive emergency alerts – confirm your contact info at lmu.edu/alert, and download Rave Guardian in the Apple or Google Play store. For more information and emergency preparedness tips, visit https://publicsafety.lmu.edu.

Academic Integrity – Course Rules

A zero-tolerance principle to academic dishonesty is followed in this course. Any violation of University's academic code will result in severe consequences including fail grade in an assignment, quiz, exam, or the entire course, as determined by the instructor. Additionally, the instructor may recommend further actions by the University including expulsions from the program altogether.

Special Accommodations

Students with special needs who require reasonable modifications, special assistance, or accommodations in this course should promptly direct their request to the Disability Support Services (DSS) Office. Any student who currently has a documented disability (ADHD, Autism Spectrum Disorder, Learning, Physical, or Psychiatric) needing academic accommodations should contact the DSS Office (Daum Hall 2nd floor, 310-338-4216) as early in the semester as possible. All discussions will remain confidential. Please visit http://www.lmu.edu/dss for additional information.

Emergency Preparedness

To report an emergency or suspicious activity, contact the LMU Department of Public Safety by phone (x222 or 310-338-2893) or at the nearest emergency call box. In the event of an evacuation, follow the evacuation signage throughout the building to the designated safe refuge area where you will receive further instruction from Public Safety or a Building Captain. For more safety information and preparedness tips, visit http://www.lmu.edu/emergency.

Lecture Topics and Schedule

2023 Spring LMU Academic Calendar: https://registrar.lmu.edu/calendars/2023spring/

PLEASE REFER TO THE DETAILED WEEKLY LECTURE SCHEDULE POSTED AT BRIGHTSPACE. THIS SCHEDULE MIGHT CHANGE AND UPDATED OFTEN. IT IS YOUR RESPONSIBILITY TO KEEP AN EYE ON THIS SCHEDULE AND PREPARE FOR CLASSES, ASSIGNMENTS, QUIZZES, AND EXAMS ACCORDINGLY.

Following is the weekly lecture topics as of 5-Jan-2023.

Lecture Topic	Prep for NEXT CLASS	ML Computer Assignments (CA)	CA DUE DATES	Team Workshop (TW)	Team Workshop Topic
Intro to the Course, Business Analytics, ML Concepts, Supervised/Un Learning, Model Development Process. Skill Survey	Reading: R01 - EDA and Data Quality Book Chapter	Team Formation. CA Set-up Guide (Virtual)			
Hands-on Python / ML Primer on EDA	Reading: R02 - Why Probabilty is important in ML	CA01: Data Exploration, Cleansing & Transformation		TW-01	How to choose the right ML Model
Algorithm Learning 1: Naïve Bayes	Lecture Video: Performance Evaluation	CA02: Naïve Bayes Coding	CA01 Due	TW-02	AutoEDA using AutoViz
Model Performance Measurement	Lecture Video: Decision Trees		CA02 DUE	TW-03	Text Classification using Naïve Bayes
Algorithm Learning 2: Decision Trees	Lecture Video: Ensemble Methods	CA03: Decision Tree Coding		TW-04	ROC Analysis
Algorithm Learning 3: Ensemble Methods, Random Forest		CA04: Random Forest Coding	CA03 DUE	TW-05	Decision Tree Example
Exam #1			CA04 DUE		
*** NO CLASS - Spring Break ***					
Feature Engineering, Dimension Reduction, Hyper-paremeter Tuning and Optimization					
Algorithm Learning 4: kNN and Clustering		CA05A: kNN based Recommender System Coding			
Model Interpretation. Explainable AI.	Lecture Video: Neural Network & Deep Learning Overview	CA05B: Clustering Coding	CA05A DUE		
Algorithm Learning 6: RNN & LSTM		CA06: LSTM Coding	CA05B Due		
Algorithm Learning 8: Text Analytics: BERT and GPT 3		CA07: BERT Coding	CA06 Due		
Full Stack ML, Model Pipeline, ML Ops			CA07Due		
Additional Topic / Guest Lecture					
Exam #2					
ML Project Presentation					

Important Dates:

Last day to add or drop a class without a grade of W: 13-Jan-2023
Last day for withdrawal deadline for 100% tuition refund*: 13-Jan-2023
Withdrawal deadline for 50% tuition refund*: 27-Jan-2023
Withdrawal deadline for 25% tuition refund*. No tuition refund after this date: 3-Mar-2023
Last day to withdraw from classes or apply for Credit/No Credit grading: 17-Mar-2023

* Consult the refund/cancellation schedule for the academic category corresponding to your enrollment status. Fees are non-refundable after the 100% withdrawal refund period.

========== END OF SYLLABUS ==========