COURSE and TITLE:
BAI 476: Machine Learning for Business Intelligence

COURSE DESCRIPTION

Data is the lifeblood of modern business. Organizations increasingly rely on data-driven decision making to stay competitive, and those that do not leverage data effectively risk falling behind. Machine learning—one of the most important areas within Artificial Intelligence (AI)—enables companies to uncover patterns, interpret complex datasets, and adapt to new information over time. Its goal is to allow systems to learn from data, reason through uncertainty, and make decisions with minimal human input. In essence, machine learning empowers intelligent systems to improve continuously through experience.

The rapid evolution of machine learning has led to a wide range of powerful applications across industries. Today, machine learning supports voice assistants, personalized recommendation systems, autonomous vehicles, high-frequency trading platforms, crime-prevention analytics, game-playing agents (from Go to Atari), fraud detection engines, email spam filters, and clinical diagnostic tools. These capabilities are not exclusive to major tech companies such as Google, Meta, Apple, Amazon, and Nvidia; businesses across all sectors—finance, healthcare, retail, manufacturing, consulting, and government—are investing heavily in machine learning to strengthen their strategic, operational, and customer-driven decisions.

Because machine learning enables organizations to identify profitable opportunities, mitigate risks, optimize operations, and improve customer experiences, it is essential for our students to gain a strong understanding of both foundational and state-of-the-art techniques.

This course serves as a comprehensive introduction to machine learning. Students need a background in probability, calculus, and basic programming, and Python will be the primary language used in examples, assignments, and applied projects. The course covers key mathematical ideas, computational methods, and algorithmic tools that define modern machine learning. Students will explore core models, understand how to evaluate and compare them, and learn how machine learning systems are designed for both accuracy and computational efficiency. The curriculum places strong emphasis on hands-on implementation using Python to prepare students for real-world analytical environments.

To ensure concepts are grounded in real business problems, the course incorporates an expanded set of case studies and applied projects focused on practical, high-impact applications. These include projects such as House Price Prediction for real estate analytics, Ethical AI in hiring and HR decision making, Credit Card Fraud Detection for financial risk mitigation, Market Segmentation and customer clustering for targeted marketing, Face Recognition and its business/security implications, and Text Mining for extracting insights from customer reviews, financial reports, and social media data. Students will not only implement machine learning models but also interpret results, assess business value, and communicate insights to decision makers—skills essential for today's business analytics and AI professionals.

PREREQUISITES

BAI 210/STA308 and CSC/DSP 310

COURSE LEARNING OBJECTIVES

The learning objectives of this course are as follows:

1. To enable students to develop knowledge, skills and understanding around a range of subjects in the field of machine learning, e.g.,
    - supervised machine learning, unsupervised learning,
    - feature engineering
    - data engineering
    - cross-fold validation
    - Evaluation metrics
2. To enable students to implement techniques for solving problems using machine learning and related project pipelines.
3. To enable students to understand and utilize the various libraries offered in Python to do machine learning.
4. To enable students to effectively interpret and communicate machine learning results through written and oral reports.

REQUIRED TEXTS

1. Machine Learning: A Probabilistic Perspective by Kevin P. Murphy, publicly available at https://www.cs.ubc.ca/~murphyk/MLbook/pml-toc-1may12.pdf, Free PDF of the book will be provided.
2. Data Mining for Business Analytics: Concepts, Techniques and Applications in Python by Galit Shmueli, Peter C. Bruce, Peter Gedeck, Nitin R. Patel, ISBN: 978-1119549840 (2019). Wiley.

TECHNOLOGY REQUIREMENTS

To successfully complete this course, you will need access to a computer with reliable, high-speed Internet access and appropriate system and software to support the Brightspace learning platform. Typical technical requirements for users are:

Windows 7 (XP or Vista) 64 MB Ram 28.8 kbps modem (56k or higher recommended) SoundCard & Speakers External headphones with built-in microphone Mozilla Firefox 9.0 or higher	Mac OS X or higher 32 MB Ram 28.8 kbps modem (56k or higher recommended) SoundCard & Speakers External headphones with built-in microphone Mozilla Firefox 9.0 or higher; Safari 5.0 or higher

Also requires Word 2007 (PC) 2011 (MAC) or newer, PowerPoint, Excel, Adobe Flash, and Adobe Acrobat Reader.

BRIGHTSPACE HELP

Here is the link to access Brightspace https://brightspace.uri.edu as well as the Brightspace resource page https://web.uri.edu/brightspace/. 24/7 chat support is also available on the Brightspace homepage under HELP.

CLASSROOM PROTOCOL

For this online course, Brightspace is our "classroom." Please refer to the Brightspace YouTube video tutorials before you get started and refer back to them as a resource as needed while you complete this course.

In the online learning environment, "attendance" is measured by your PRESENCE in the site as well as your CONTRIBUTIONS to the site. The importance of regular log-ins and active participation cannot be overstated.

COURSE Formats

Pre-class Activity: Some hands-on training materials will be provided a week prior to the class and students will be **required** to do hands-on exercises before coming to class. These exercises will be particularly useful for our hands-on labs in class.
In-Class Activity: The class will be a mix of lecture and hands-on labs. Lectures will focus on theory and concepts underlying analytics and programming techniques. The second half of the class will be hands-on activities that will give the student the opportunity to implement solutions in at least two different programming environments.

METHODS OF EVALUATION

The criteria used to evaluate students will be as follows:

Class Participation	5%
Homework Assignments	35%
Mid-term Project	25%
Final Project	35%
TOTAL	1000

Grade	Point Range
A	92.5-100
A-	90-92.4
B+	87.5-89.9
B	82.5-87.4
B-	80.0-82.4
C+	77.5-79.9
C	72.5-77.4
C-	70.0-72.4
D+	67.5-69.9
D	60.0-67.4
F	0-59.9

DESCRIPTIONS OF ASSIGNMENTS

- **Workbook Assignments** Students will work on multiple assignments throughout the semester. All assignments are to be done individually unless otherwise stated. The workbook assignments are due by 21:00 PM on Friday of the week in which they are scheduled. Any assignments received after this time will be considered late and assessed a penalty. Unless otherwise specified on the assignment, late submissions will be allowed up to one week after the due date. No credit will be received after this time.

- **Class Participation** Every member of the class is expected to participate in every class. Participation is one of the major keys to active learning. Each student will be judged on the quality and quantity of participation in class discussions. I expect students to be interactive in the class. Contributions that add new insights or advance the discussions, including clarifying questions, are expected. Students who fail to contribute throughout the semester, as well as those who miss more than 2-weeks worth of classes, will lose up to a letter grade (10 points) off their final average.

- **Mid-term Project:** We will focus on numerous case studies throughout the semester. There will be one mid-term project in the middle of the semester to reinforce key machine learning concepts. It will largely revolve around homework and lab exercises.

- **Final Project:** We will focus on numerous case studies throughout the semester. You will be expected to take final projects (provided or possibly proposed by you) and complete them from idea to implementation, where you will benchmark your experiments, document your key findings, and present your project in slide and video format. We will discuss projects in more detail as the semester progresses.

- **Makeup:** There will be no make-up for any in-class quizzes, assignments or labs due to the absence of the student. There will be a penalty for assignments received after the due date. No credit will be given to late assignments once corrected assignments have been returned.

- **Teamwork:** Teamwork and study groups are encouraged and may be required for some assignments. However, copying, plagiarizing, etc. will not be tolerated.

ATTENDANCE AND OTHER CLASS POLICIES

Requirements for students' attendance and participation will be defined by each instructor based on the following policy:

- Monday of the first week is considered the first day of class for online and blended instruction. This includes instruction for fully online classes and online instruction supporting blended classes.
- Regular onsite attendance is expected for student success. If a student misses more than one onsite class or one week of engagement in an online class, the student may, at the discretion of the instructor, fail the course. Students are expected to attend all classes, particularly the first night of class.
- Students who will miss more than one class have the responsibility to discuss their attendance with the instructor in advance. Students should also consider withdrawing from a course if they will be absent more than once. Instructors may, but are not obligated to, accommodate students under extraordinary circumstances, but the student must request accommodation and provide requested supporting documentation.
- If a student misses a portion (e.g., arriving late or leaving early) of an onsite course, the student's grade may be adversely affected. Students who are not in attendance for at least 75 percent of any scheduled class may be considered absent for that class. Students should discuss missing portions of a class with their instructor to determine how their grade may be affected.
- Regular online attendance/participation and engagement is expected for student success in both fully online and blended courses. Online participation is evident through posting to a discussion board, wiki, virtual office or classroom meeting, a drop box, attending a virtual seminar, completing real-time activities or quizzes, or other course-related activities (synchronous or asynchronous).
- Schools and programs may have different attendance policies. Refer to school and program specific information for additional attendance policies.

NETIQUETTE FOR ONLINE COURSE

- Be polite and respectful of one another.
- Avoid personal attacks. Keep dialogue friendly and supportive, even when you disagree or wish to present a controversial idea or response.
- Be careful with the use of humor and sarcasm. Emotion is difficult to sense through text.
- Be helpful and share your expertise. Foster community communication and collaboration.
- Contribute constructively and completely to each discussion. Avoid short repetitive "I agree" responses and don't make everyone else do the work.
- Consider carefully what you write. Re-read all e-mail and discussion before sending or posting.

- Remember that e-mail is considered a permanent record that may be forwarded to others.
- Be brief and succinct. Don't use up other people's time or bandwidth.
- Use descriptive subject headings for each e-mail message.
- Respect privacy. Don't forward a personal message without permission.
- Cite references. Include web addresses, authors, names of articles, date of publication, etc.
- Keep responses professional and educational. Do not advertise or send chain letters.
- Do not send large attachments unless you have been requested to do so or have permission from all parties.
- 2 word postings (e.g.: I agree, Oh yeah, No way, Me too) do not "count" as postings.

URI ACADEMIC WRITING STANDARDS

Specific writing standards differ from discipline to discipline, and learning to write persuasively in any genre is a complex process, both individual and social, that takes place over time with continued practice and guidance. Nonetheless, URI has identified some common assumptions and practices that apply to most academic writing done at the university level. These generally understood elements are articulated here to help students see how they can best express their ideas effectively, regardless of their discipline or any particular writing assignment.

Venues for writing include the widespread use of e-mail, electronic chat spaces and interactive blackboards. URI is committed to guaranteeing that students can expect all electronic communication to meet Federal and State regulations concerning harassment or other "hate" speech. Individual integrity and social decency require common courtesies and a mutual understanding that writing--in all its educational configurations--is an attempt to share information, knowledge, opinions and insights in fruitful ways.

Academic writing (as commonly understood in the university) always aims at correct Standard English grammar, punctuation, and spelling.

The following details are meant to give students accurate, useful, and practical assistance for writing across the curriculum of URI.

Students can assume that successful collegiate writing will generally:

- Delineate the relationships among writer, purpose and audience by means of a clear focus (thesis statements, hypotheses or instructor-posed questions are examples of such focusing methods but are by no means the only ones) and a topic that's managed and developed appropriately for the specific task.
- Display a familiarity with and understanding of the particular discourse styles of the discipline and/or particular assignment.
- Demonstrate the analytical skills of the writer rather than just repeating what others have said by summarizing or paraphrasing
- Substantiate abstractions, judgments, and assertions with evidence specifically applicable for the occasion whether illustrations, quotations, or relevant data.
- Draw upon contextualized research whenever necessary, properly acknowledging the explicit work or intellectual property of others.
- Require more than one carefully proofread and documented draft, typed or computer printed unless otherwise specified.

PROFESSIONAL CONDUCT

Cheating and plagiarism are serious academic offenses, which are deal with firmly by the College and University. Scholastic integrity presumes that students are honest in all academic work. **Cheating** is the failure to give credit for work not done independently (i.e., submitting a paper written by someone other than yourself), unauthorized communication during an examination, or the claiming of credit for work not done (i.e., falsifying information). **Plagiarism** is the failure to give credit for another person's written or oral statement, thereby falsely presuming that such work is originally and solely your own.

If you have any doubt about what constitutes plagiarism, visit the following website: https://honorcouncil.georgetown.edu/whatisplagiarism, the URI Student Handbook, and University Manual sections on plagiarism and cheating at http://web.uri.edu/studentconduct/student-handbook/.

Students are expected to be honest in all academic work. A student's name on any written work, quiz or exam shall be regarded as assurance that the work is the result of the student's own independent thought and study. Work should be stated in the student's own words, properly attributed to its source. Students have an obligation to know how to quote, paraphrase, summarize, cite and reference the work of others with integrity. The following are examples of academic dishonesty.

- Using material, directly or paraphrasing, from published sources (print or electronic) without appropriate citation;
- Claiming disproportionate credit for work not done independently;
- Unauthorized possession or access to exams;
- Unauthorized communication during exams;
- Unauthorized use of another's work or preparing work for another student;
- Taking an exam for another student;
- Altering or attempting to alter grades;
- The use of notes or electronic devices to gain an unauthorized advantage during exams;
- Fabricating or falsifying facts, data or references;
- Facilitating or aiding another's academic dishonesty;
- Submitting the same paper for more than one course without prior approval from the Instructor.

Please note the following section from the University Manual:

> **8.27.17.** Instructors shall have the explicit duty to take action in known cases of cheating or plagiarism. The instructor shall have the right to fail a student on the assignment on which the instructor has determined that a student has cheated or plagiarized. The circumstances of this failure shall be reported to the student's academic dean, the instructor's dean, and the Office of Student Life. The student may appeal the matter to the instructor's dean, and the decision by the dean shall be expeditious and final.
>
> Such action will be initiated by the instructor if it is determined that any written assignment is copied or falsified or inappropriately referenced.

Any good writer's handbook as well as reputable online resources will offer help on matters of plagiarism and instruct you on how to acknowledge source material. If you need more help understanding when to cite something or how to indicate your references, PLEASE ASK.

Please note: Students are responsible for being familiar with and adhering to the published **"Community Standards of Behavior: University Policies and Regulations"** which can be accessed in the **University Student Handbook.**

ACADEMIC SUPPORT SERVICES

Office of Disability Services

Americans With Disabilities Act Statement

Any personal learning accommodations that may be needed by a student covered by the "Americans with Disabilities Act" must be made known to the university as soon as possible. This is the student's responsibility. Information about services, academic modifications and documentation requirements can be obtained from the The Office of Affirmative Action, Equal Opportunity and Diversity (AAEOD).
https://web.uri.edu/affirmativeaction/

Any student with a documented disability is welcome to contact me early in the semester so that we may work out reasonable accommodations to support your success in this course. Students should also contact Disability Services for Students, Office of Student Life, 330 Memorial Union, 401-874-2098.

From the University Manual: 6.40.10 and 6.40.11 Accommodations for Qualified Students With Disabilities.

Students are expected to notify faculty at the onset of the semester if any special considerations are required in the classroom. If any special considerations are required for examinations, it is expected the student will notify the faculty a week before the examination with the appropriate paperwork.

Uri Online Library Resources

https://web.uri.edu/library/

COURSE SCHEDULE

Week	Topics	Notes/Assignments
1	Introduction to AI, Data Science, and Machine Learning; Getting Started with Python Tools Python Environment Setup: Anaconda, Spyder, Google Colab	**Install Python tools, run first ML program**

2	Python Essentials for Data Analysis and Machine Learning (NumPy, pandas, matplotlib)	**Assignment 1**
3	Exploratory Data Analysis (EDA) Summary statistics, data visualization, handling missing values, outliers	**Assignment 2**
4	Feature Engineering and Feature Selection Exploring and Understanding Data	**Assignment 3: House Price Prediction Part I**
5	Using Regression to Make Predictions in Business	**Assignment 4: House Price Prediction Part II**
6	How to Test and Improve Your Models: Train-test split, cross-validation, performance metrics (MSE, R^2)	**Assignment 5: House Price Prediction Part III**
7	Avoiding Overfitting and Improving Model Performance: Regularization Techniques Lasso, Ridge, and Elastic Net regression	**Midterm Project Assigned**
8	Classification I: Logistic and Softmax Regression	**Midterm Project Due**
9	Classification II: Decision Trees and Random Forests Gini index, entropy, overfitting, ensemble methods	**Assignment 6: Ethical use of AI in Human Resources Management Project Part I**
10	Classification II: Decision Trees and Random Forests Gini index, entropy, overfitting, ensemble methods	**Assignment 7: Ethical Use of AI in Human Resources Management Project Part II**
11	Clustering and Unsupervised Learning	**Assignment 8: Customer Behavior Analysis**

	K-Means, DBSCAN, Hierarchical Clustering	
12	Association Rules and Market Basket Analysis	**Assignment 9: Market Basket Analysis**
13	Choosing the Best Model and Connecting Results to Business DecisionsPutting it all together: pipeline, model comparison, business insights	**Final Project Assigned**
14	Review Session and Final Project Presentation	**Final Project Due**