**Georgia State University**
**J. Mack Robinson College of Business**
**Master of Science in Finance**


**IFI 8420 –BUSINESS MACHINE LEARNING**
**CRN:** 22314


**Course Syllabus**
**Spring Semester 2025**


**Instructor: Rasha Ashraf**


**Contact Information:**
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**Class Meetings:**
RCB Buckhead Executive Education Center, Room #1216
Time: Thursday (weekly), 6:00 pm – 8:30 pm
Office Hours: By appointment


**Course Description:**
This course introduces machine learning techniques specifically tailored for business applications. The focus is on understanding how machine learning can be used to solve business problems, improve decision-making, and deliver value. This course covers a set of topics in machine learning. The topics covered include both supervised and unsupervised learning, linear and nonlinear regression/classification and boosting techniques. After taking this course, the students are expected to have a good understanding of machine learning basics and able to use the learning tools for real-world business applications.

**Prerequisite**

Students should be familiar with the basics of calculus and linear algebra and have some level of exposure to basic probability. Students should have Python programming skills in order to take this course.

**Learning Objectives**
By the end of the semester, students will be able to:
•        Understand the principles and techniques of machine learning as they apply to business problems
•        Implement and apply machine learning algorithms to enhance business decision-making
•        Evaluate and select appropriate models based on business objectives
•        Understand the ethical considerations of using machine learning in a business context

**Textbook**

- James, G., Witten, D., Hastie, T., Tibshirani, R., "An Introduction to Statistical Learning: with Applications in Python", Springer, 2023 (main text).
https://www.statlearning.com/

  Video lectures from the authors:
  https://www.youtube.com/playlist?list=PLoROMvodv4rNHU1-iPeDRH-J0cL-CrIda

  Github resources:
  https://intro-stat-learning.github.io/ISLP/


- Shmueli, G., Bruce, P., Gedeck, P., and Patel, N., "Data Mining for Business Analytics – Concepts, Techniques, and Applications in Python," WILEY

**Software**

- Python

**Pedagogy Statement**

This course will be instructed using a combination of instructional pedagogies. This is not a class where you only come daily, listen, watch, and take notes! The primary methods for learning new concepts and methods will be by implementing codes, participating in class activities and discussions, and working through the assignments. It is essential to show up prepared and have completed the projects. Internalizing a discipline's way of thinking about and solving problems is a time-consuming process, with the keyword being "process". It requires active participation and questioning both in and out of the classroom. Please note that class lectures, assignments, and projects are all dependent subjects towards the ultimate goal of learning in this class.

**Download Python - Anaconda**

**URL: https://www.anaconda.com/products/individual**

**Some useful links:**

**Learn Python: https://realpython.com/**

**https://www.coursera.org/specializations/data-science-python**

**Machine Learning:**
**https://developers.google.com/machine-learning/crash-course**

**Additional Class Materials:**
Class lectures, reading assignments, instructor's notes, data related to projects and other related materials will be available at iCollege. Students are responsible for reading the materials that are required for each class.

The course uses a building block design. Each day we will learn new techniques that will be useful for future classes as well as the current class. Make sure that you have studied all designated readings prior to class. Success in the course depends on being fully prepared for each class.

**Communication:**
There will be times during the term that I will want to communicate with you either individually or as a class. I will do this via your GSU email. I will be using the list of e-mail addresses as indicated on the Gosolar class roster.

**Grading:**

Your overall grade heavily depends on the numerical weights listed below as well as various factors including class participation, attitude, and timeliness.

Your grade will be determined by the following.

| | |
|---|---|
| Assignments | 20 % |
| Quizzes | 30% |
| Midterm Exam | 30% |
| Final Project | 18 % |
| Attendance | 2% |

**Letter Grade Breakdown**

| Grade | Numeric Score |
|---|---|
| A+ | 97- 100+ |
| A | 93–96.9 |
| A− | 90–92.9 |
| B+ | 87–89.9 |
| B | 83–86.9 |
| B− | 80 –82.9 |
| C+ | 77–79.9 |
| C | 73–76.9 |
| C− | 70–72.9 |
| D | 60–69.9 |
| F | 0–59.9 |

**Class Attendance**
Students are expected to attend the class regularly (in-class or virtually), be on time and stay in the class for the entire duration of the class. An attendance will be taken by the professor in every class.

**Professionalism**
Students are expected to behave in a professional manner.

**Quiz**
There will be total 4 online quizzes. Quizzes are individually assigned. All quizzes will be based on the topics covered in the class when the quiz is assigned. You are not allowed to collaborate with others or take any outside help while taking quizzes.  The quizzes will be opened on a designated date and time. There is a time limit on taking the quiz and students are not permitted to make any changes after the time limit. No late submission is accepted. Only one attempt is allowed for each quiz.

Note that all quizzes are equally weighted. That means each quiz grade is converted to 100 and then the sum of all seven quizzes are divided by 4. Ignore "Sub Total" quiz grade posted in iCollege which is automatically generated by adding all the grades without considering equal weights.

**Homework Assignments**
Students will be assigned 5 homework assignments. The requirements of the assignments will be discussed during the class. The assignments pertain to the development of Python programs related to topics discussed in the class and will involve analyzing financial data using various data analytics methods taught in class.

The assignment submission due date will be provided with the assignment. No late submission is accepted and failure to submit the assignments on time will result a score of zero.

Assignments will be performed by groups. For each group assignment, each group should submit the Python program electronically in iCollege.

*You are not allowed to assist other student in providing explanations related to the conceptual development of models and/or providing clarifications related to the analysis or programs with other group members. Any student violating this policy will receive the appropriate University disciplinary action.*

**There are several sections in each assignments. Each team member must actively participate in writing part of the code of a particular section. Other group members can validate the code to make sure that part is working. Team members must decide how to distribute the code assignments across the team members. Group members must NOT provide any help to members of the team for quizzes related to the assignments or any other quizzes and exam.**
**Team assignments will be done by the professor. Be respectful to all the team members as you work. Maintain professionalism at all times.**

**Final Project**
Students will complete a group final project at the end of the semester. Each group will identify a decision problem related to business and perform an analysis using the Python programming environment using real business decision data. Each group must receive prior approval of the project topic from the professor. The last date to receive approval is indicated in the course outline. The final project is due at the beginning of the last class. The final project is group assignment and each group is expected to work on it completely independently without any help from others. Each group need to submit Python codes and program output related to the project electronically. Additionally, each group will present the final project in front of the class on the day of last class.

**Working in groups:**
Submit your group name (your start-up company) by the end of the first class. You are responsible to coordinate with your group members regarding how you will accomplish tasks of the group assignments and final project. You will be required to submit an evaluation of your group members, indicating the extent of their contribution along with your own involvement. You should maintain professionalism in working with others at all times.

**Grading Policy for Team Assignments:**
Please make sure that you correspond with your team members on a timely manner.
Your grade will be affected if I receive complaints from your team members regarding difficulty in communication and unprofessional and disrespectful behavior. Respond to emails on a timely manner (must be within 24 hours). One Complaint will be subject to 20% penalty of the assignment grade. Two Complaints will be subject to 50% penalty of the assignment grade. Three complaints: You will get 0 in the assignment.

**In addition, you will be required to complete team evaluations for assignments and the project (5% of the overall assignment and project grade will be based on peer reviews) during the semester:** In the evaluation: each group member will be asked to evaluate other members' contributions to the group in different aspects of team contributions. You will also be required to reflect on the overall evaluation. Please read the evaluation items in iCollege carefully at the beginning of the semester so you are aware of the expectations.

**Note that if all members say that one person did not contribute at all, skipped meetings or consistently missed deadlines, that student will receive a 0 for the overall assignments grade.**

**Data files:**
Many of the assignments require downloading data from online. For other assignments data are provided at the GSU iCollege.

**Academic honesty:**
It is your responsibility to read the University Policy on Academic Honesty. It can be found in "GSU Student Code of Conduct" (http://codeofconduct.gsu.edu/). This document establishes clear standards for academic honesty and it will be enforced in this course. My policy is completely consistent with that document.

Anyone violating the academic honesty standards will receive the appropriate University disciplinary action. If at any time you are not sure whether something is a violation of the academic honesty policy please contact me for clarification.

To give you an idea of the types of actions that I consider to be violations of academic honesty, here is a non-exhaustive list.
- You may not look at another student/group's project solution, copy from another student/group's Python program or output, communicate in any way with others about the solution methods, or get help from people not in the class. A person who allows someone else to look, copy, or share information is equally guilty of a violation.
- You may not use other people's work that are available online and claim that as yours. If you do use any online resources for coding purposes, you have to provide list of references.
- You may not sign someone else's name to the attendance sheet.

You will be required to sign and submit a Statement of Academic Honesty for all submitted projects.

**Disability Services:**
Students who wish to request accommodation for a disability may do so by registering with the Office of Disability Services in Suite 230 or the Student Center. Students may only be accommodated upon issuance by the Office of Disability Services of a signed Accommodation Plan and are responsible for providing a copy of that plan to instructors of all classes in which an accommodation is sought.

**GSU Policy Prohibiting Students from Posting Instructor-Generated Materials on External Sites**
The selling, sharing, publishing, presenting, or distributing of instructor-prepared course lecture notes, videos, audio recordings, or any other instructor-produced materials from any course for any commercial purpose is strictly prohibited unless explicit written permission is granted in advance by the course instructor. This includes posting any materials on websites such as Chegg, Course Hero, OneClass, Stuvia, StuDocu and other similar sites. Unauthorized sale or commercial distribution of such material is a violation of the instructor's intellectual property and the privacy rights of students attending the class, and is prohibited.

**Courtesy Rules**
1. Turn off your cell phones.
2. Be respectful to others
3. Do not engage in any discussions non-related to the course during the duration of the class.
4. Students in this class are encouraged to speak up and participate during class meetings and online class discussions. The students on our class represent a diversity of individual beliefs, backgrounds, and experiences, and therefore, every member of this class must show respect for every other member of this class.

**Student Evaluation of Instructor:**
Your constructive assessment of this course plays an indispensable role in shaping education at Georgia State. Upon completing the course, please take the time to fill out the online course evaluation.

**Course Outline:**

This course outline provides a general plan for the course; deviation may be necessary. Any schedule change will be announced in class or transmitted via email, and you are responsible for the announced change regardless of whether you are in class at the time of the announcement or have read your email. This includes announcements made the first night of class.

| Class Day | Topics | Read |
|---|---|---|
| **Class 1**<br><br>**(01/16)** | **Introduction to Data Analytics (Reading Material)**<br><br>• What is statistical learning?<br>• Difference between prediction and inference<br>• Parametric methods vs. Non-parametric methods.<br>• Supervised versus unsupervised learning<br><br>**Overview of Data Mining Process**<br><br>• WestRoxbury housing data analysis<br><br>**Data Visualization**<br>• Basic Plots<br>• Distribution Plots | JWHTT CH-2, and SBGP CH-2 and 3, Instructors' notes |
| **Class 2**<br><br>**(01/23)** | **Data Exploration**<br>• Summary Statistics<br>• Correlation Matrix<br>• Pivot Table<br>• Reducing Catagories<br>•<br>**Homework 1 assigned: Group Submission** | SBGP CH-4 and<br><br>Instructor's notes |
| **Class 3**<br><br>**(01/30)** | **Liner Regression Part 1: Simple Regression**<br><br>• Simple Linear Regression: Hypothesis testing, Estimating the coefficients, assessing the accuracy of the model<br>• Potential problems: non-linearity of the data, outliers, collinearity, and correlation of error terms.<br><br>**Read:** JWHT Chapter 3 and Instructor's notes<br><br>**Homework 2 assigned: Group Submission** | JWHTT CH 3 and<br><br>Instructor's notes |
| **Class 4 and 5**<br><br>**(02/06 and 02/13)** | **Liner Regression Part 2: Multiple Regression**<br><br>• Multiple Linear Regression: Deciding on important variables, model fit and predictions<br>• Qualitative predictors | JWHTT CH 3 and<br><br>Instructor's notes |
| **Class 6**<br><br>**(02/20)** | **Classification Model**<br><br>• An Overview of Classification models.<br>• Logistic Regression<br>• Model Accuracy | JWHTT CH-4 and<br><br>Instructors' notes |

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|---|---|---|
| | **Homework 3 assigned: Group Submission** | |
| **Class 7** <br> **(03/05)** | **More on Classification Models:** Discriminant Analysis (LDA), Nearest-Neighbors, Naïve Bayes, | SBGP CH-7,8 and 12, JWHTT CH 4 and Instructors' notes |
| **Class 8** <br> **(03/06)** | **Models for High Dimension Data** <br><br> • Shrinkage methods - LASSO <br><br> **Model Assessment and Selection** <br><br> • Cross validation <br> • K-fold Cross Validation <br><br> **Homework 4 assigned: Group Submission** <br><br> **Final Date to get approval for Project Proposal** | JWHTT CH 5 and 6 and Instructor's notes |
| **Class 9** <br> **(03/13)** | **Decision Tree** <br><br> • The Basics of Decision Trees: Regression and Classification Trees <br><br> **Submit Project Proposal** | JWHTT CH 8 and Instructors' notes |
| **Class 10** <br> **(03/27)** | **Midterm Exam** | |
| **Class 11** <br> **(04/03)** | **Ensemble learning (Bagging and Random Forests, Boosting)** <br><br> **Homework 5 assigned: Group Submission** | SBGP CH-9 and 13, JWHTT CH 8, and Instructors' notes |
| **Class 12** <br> **(04/10)** | **Unsupervised Learning** - Clustering (K-Means, Hierarchical Clustering) and Principal Components Analysis (PCA) | JWHTT CH 12 and Instructors' notes |
| **Class 13** <br> **(04/17)** | **Project Discussion** | |
| **Class 14** <br> **(04/24)** | **Final Project Submission and Presentation: Group Assignment: 15 mins presentation for each team. Submit the project code and presentation before 5:30 pm on 10/04 in iCollege.** | |