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**Supply Chain AI Instructor: Andrew Zhang**

22:799:641 **Email: andrew.zhang@ibm.com**

Spring 2021 **Co-Instructor: Xiaowei Xu**

**Email: xiaoweix@business.rutgers.edu**

**COURSE DESCRIPTION**

Supply chain management has become increasingly data-driven in the last several decades and traditional statistical techniques (e.g., forecasting) have been widely applied in supply chain planning. Well into the e-commerce age, there is great need for supply chain managers to understand artificial intelligence (AI) and machine learning (ML) methods, to organize/analyze “big” data and to integrate/automate data analysis into operations processes on newly emerging IT platforms (e.g., cloud computing). The main purpose of this course is to provide the most fundamental knowledge and programming skill sets to students so that they can understand the modern progress of AI/ML and how to apply AI/ML to supply chain management, glean data-oriented insights and develop actionable supply chain strategies.

The course is structured as a combination of lectures, in-class case studies, and group projects. Students will understand the philosophy and history of AI and related information technology, develop data analysis and data visualization skills, and also get a practical introduction in machine learning (e.g., via the Python *scikit-learn* library) through supply chain-related case studies. Students are then expected to apply and demonstrate knowledge of machine learning and data science with a group project involving a real-life supply chain problem. Python (https://www.python.org/) will be introduced and used as the main platform and extant Python packages will be employed as tools in these case-studies and group projects. The major learning approach of this course is through case-studies (in-class) and group projects (after-class). Case/project topics are drawn from various supply chain instances and a sample of these topics include:

1. Product recommendation using sports goods store chain data – machine learning algorithms (data source: IBM)
2. Predictive maintenance using hydraulic system senor data – time series/ machine learning algorithms (data source: UCI data repository)

**COURSE MATERIALS**

1. Since students will be asked to use Python to analyze various supply chain problems, we recommend a Python programming book as a reference: *Python Data Science Handbook*, Jake VanderPlas, O’Reilly.
2. Miscellaneous online articles and business cases/reports.
3. Lecture slides, data and Python Jupyter notebooks are available on blackboard before each class. Please check this site (<http://blackboard.rutgers.edu>) every week.

**PREQUISITES**

Operations Analysis (22:799:580)

**ACADEMIC INTEGRITY**

Academic integrity is essential to maintaining an environment that fosters excellence in teaching, research and other educational and scholarly activities. All suspected incidents of academic misconduct will be referred to an Academic Integrity Facilitator for investigation. Unfortunately, some Rutgers students are failed or suspended every year for violations of academic integrity. If you have any doubt what constitutes a violation of academic integrity, please visit the Student Judicial Affairs website <http://academicintegrity.rutgers.edu/>

Cheating is not tolerated at Rutgers University. Students are responsible for understanding the RU Academic Integrity Policy at: <https://slwordpress.rutgers.edu/academicintegrity/wp-content/uploads/sites/41/2014/11/AI_Policy_2013.pdf> This Policy is strongly enforced. On all examinations and assignments, students must sign the RU Honor Pledge, which states, “On my honor, I have neither received nor given any unauthorized assistance on this examination or assignment.” Written assignments will be screened through *SafeAssign* or *Turnitin*, plagiarism detection services that compare the work against a large database of past work. Don’t let cheating destroy your hard-earned opportunity to learn. For more details see: [business.rutgers.edu/ai](http://www.business.rutgers.edu/ai)

**ATTENDANCE AND CLASS PREPARATION POLICY**

Online attendance will be monitored selectively. Every student is expected to contribute to class discussions. Continuing, thoughtful and thorough participation in all aspects of the class will enable students to maximize their benefit from this course. Some ground rules include:

* This class requires that you use a laptop (with Python) in many sessions.
* Attend with an open mind – seek to learn.
* Engage in class discussions – focus on substance/quality.
* Please email the professor in advance, if you will be absent, late, or have to leave early.

Quantitative exercises will be left after online lectures and solutions will be discussed in a following session later. Everyone is expected to participate. If it is apparent that you have repeatedly missed class and/or are unprepared for the discussion, points will be taken off your class participation grade.

**HOMEWORK SETS**

After-class exercises will be assigned based on extensions of in-class case studies and course materials. Homework solution will be discussed in class by students and instructors.

**TEAM PROJECT**

Students are required to form a team (of three members). Each team will pick a data set (we will provide a data set list), propose several meaningful managerial questions to be answered by the data set, use Python to analyze the data set and draw managerial insights.

Each team needs to make a project proposal presentation on **Apr 3** (20 minutes). The ppt proposal should cover research questions and preliminary description/visualization of the data set.

Each team needs to present its final results on **May 1** (40 minutes). The final report (30-40 pages) is due on **May 8**.

Grade criteria – find a rich data set, propose/answer interesting managerial questions, build appropriate decision models, conduct clean data analysis via Python, and write an informative report!

In the project report, each team needs to report the effort contribution of its team members (e.g., 30%, 30% and 40%). **A student who makes less than 20% contribution will have points deducted from his/her score.**

**EXAM DATES AND POLICIES**

**Exam One:**

The in-class exam will be held on **Mar 27**. Exam questions are based on extensions of in-class case studies and course materials covered before spring break. Students are required to use Python to analyze data and draw correct managerial insights from data outputs. There will be no conceptual questions in the exam.

**Exam Two:**

The in-class exam will be held on **May 8**. Exam questions are based on extensions of in-class case studies and course materials covered after spring break. Students are required to use Python to analyze data and draw correct managerial insights from data outputs. There will be no conceptual questions in the exam.

Exams are open-book and open-notes. **NO MAKE-UP EXAMS WILL BE GIVEN EXCEPT FOR SCHOOL ALLOWED REASONS.** A brief review of the material to be covered in the exam will be part of the lecture before each exam.

If you have a disability that influences testing procedures, please provide me with an official letter from the Office of Disability Services at the start of the semester.

**GRADING POLICY**

Each component will account for a percentage weight in your numerical course grade (max 100 pts) as follows:

|  |  |
| --- | --- |
| Total | 100% |
| Homework | 2% |
| Team Project | 32% |
| Exam 1 | 33% |
| Exam 2 | 33% |

Your course numerical grade will be translated into your course letter grade as follows:

**Final Letter Grades: Letter grades will be curved! The average class GPA is targeted to be in the range 3.2-3.4**

~30% of A/A-; ~60% of B+/B/B-; ~10% C+/C/C-; optional F.

**No extra credits!** If you want to achieve a satisfactory grade, work **hard** on the team project and two exams.

**No excuses** will be accepted after the final letter grades have been assigned.

**SUPPORT SERVICES**

If you need accommodation for a *disability*, obtain a Letter of Accommodation from the Office of Disability Services. The Office of Disability Services at Rutgers, The State University of New Jersey, provides student-centered and student-inclusive programming in compliance with the Americans with Disabilities Act of 1990, the Americans with Disabilities Act Amendments of 2008, Section 504 of the Rehabilitation Act of 1973, Section 508 of the Rehabilitation Act of 1998, and the New Jersey Law Against Discrimination: <https://ods.rutgers.edu>

If you are a military *veteran* or are on active military duty, you can obtain support through the Office of Veteran and Military Programs and Services: <http://veterans.rutgers.edu/>

If you are in need of *legal services*, please use our readily available services: <http://rusls.rutgers.edu/>

**COMMUNICATION WITH YOUR INSTRUCTOR**

**Email is the best way to communicate with your instructor. When sending email to your instructor, please sign your message with your first and last name.**

**Please use your rutgers.edu email** whenever possible and put 22:799:6xx plus the section number in the subject line. Emails with no subject line or an unidentifiable name may be deleted as a protection against computer viruses.

**COURSE SCHEDULE**

***AI Course Weekly Schedule – Spring 2021***

**(This is a tentative schedule and is subject to change)**

|  |  |  |
| --- | --- | --- |
| week |  | Topics |
| 1 | 23-Jan | Course overview; AI concepts |
| 2 | 30-Jan | Python Basic: numpy |
| 3 | 6-Feb | Python Data Manipulation: pandas |
| 4 | 13-Feb | Python Data Visualization: matplotlib and seaborn |
| 5 | 20-Feb | Python Data Visualization: matplotlib and seaborn |
| 6 | 27-Feb | Case 1: Sales Data - Regression and Statistics Concepts |
| 7 | 6-Mar | Case 1: Sales Data - Machine Learning Techniques |
|  | 3/13 and 3/21 | *Spring break – no classes* |
| 8 | 27-Mar | **Exam 1** |
| 9 | 3-Apr | Project Proposal / Guest Speaker |
| 10 | 10-Apr | Python Data Visualization: plotly |
| 11 | 17-Apr | Case II: Preventive maintenance |
| 12 | 24-Apr | Case II: Preventive maintenance |
| 13 | 1-May | Project Presentation |
| 14 | 8-May | **Exam 2/Project Due** |