ISE 490-A
Data-Mining and Applied Machine Learning

School of Systems & Enterprises
Spring 2022

Instructor: Dr. Sang Won (Grace) Bae (Faculty website: link)
Canvas Course Address: https://sit.instructure.com/courses/57391
Course Schedule: Tuesday, Thursday 8:00am-9:15am at McLean 218A
Contact Info: sbae4@stevens.edu
Virtual Office Hours: Wednesday 1pm – 2pm: https://stevens.zoom.us/my/StevensHCI

Virtual Session URL: https://stevens.zoom.us/j/95316905509
Prerequisite(s): Probability, Statistics, Python
Corequisite(s): N/A
Cross-listed with: N/A

COURSE DESCRIPTION

This course will use tools and techniques which have proven to be of value in recognizing patterns, making predictions, and developing machine learning approaches from both large data sets (using data-mining techniques), and small data sets (using networks constructed from problem definition and discovery). Both approaches are critical to today's engineers and managers, because they span a rangeof possible data availability and reliability. Using these tools and techniques, the student will survey applications, and have hands-on experimentation with both data mining and network construction, using real-world examples and situations.

STUDENT LEARNING OUTCOMES

After successful completion of this course, student will be able to:

- Understand the conceptual underpinnings of methods in data-mining by the introduction of principalideas in statistical learning
- Be familiar with the industry-standard approaches to data-mining
- Translate real world problems into mathematical models, using computational methods to set-up andevaluate engineering management alternatives via the use of data-mining techniques
- Judge the suitability of models and solutions and adapt data-mining models based on the assessment ofperformance and usability and use available software analysis tools, selecting appropriate tools for various analyses and situations

COURSE FORMAT AND STRUCTURE

This course is in-person. For more information about course access or support, contact the Technology Resource and AssistanceCenter (TRAC) by calling 201-216-5500.

Course Logistics

- Information will be posted (online activities, discussion starters, etc.) for the upcoming week by Monday evening, so that you can access the course materials (e.g., presentation slides).
- When assignments are due, they're due by 8pm EST on the due date listed in the course schedule.
- Deadlines are an unavoidable part of being a professional and this course is no exception. Course requirements must be completed and posted or submitted on or before specified due date. Due dates are defined as Eastern Standard Time (as used in Hoboken, NJ).
  Please note: students living in distance time zones or overseas must comply with this course time and time and due date deadline policy. Avoid any inclination to procrastinate. To encourage you to stay on schedule, due dates will be established for each assignment.
- An assignment file should be appended by your username, such as "assignment1_kim53.doc". This may make it easier to manage assignment files you download to my computer.

Instructor's Online Hours

See heading on the first page of this syllabus.
I'll be available via email and will respond as soon as possible (generally within 24-48 hours). For any online discussions, I check in at least 3 times per week. Keep in mind that it is not possible for me to respond to every single posting every week (nor is it pedagogically appropriate), but will respond to a variety of postings and students each week and attempt to assure equality in terms of responses to students, when applicable.

If there is a specific discussion you'd like to introduce, please send an email to my Stevens account. If you feel you are being neglected in any way, please contact me. When emailing, please place in the subject line the course number/section and the topic of the email. This will help tremendously in locating your emails more quickly.

Virtual Office Hours

See heading on the first page of this syllabus.
Virtual Office Hours are a synchronous session through Zoom to discuss questions related to weekly readings and/or assignments.

Online Etiquette Guidelines

Your instructor and fellow students wish to foster a safe online learning environment. All opinions and experiences, no matter how different or controversial they may be perceived, must be respected in the tolerant spirit of academic discourse. You are encouraged to comment, question, or critique an idea but you are not to attack an individual. Our differences, some of which are outlined in the University's inclusion statement below, will add richness to this learning experience. Please consider that sarcasm and humor can be misconstrued in online interactions and generate unintended disruptions. Working as a community of learners, we can build a polite and respectful course ambience.

The Netiquette rules for this course:

- Do not dominate any discussion. Give other students the opportunity to join in the discussion.
- Do not use offensive language. Present ideas appropriately.
- Be cautious in using Internet language. For example, do not capitalize all letters since this suggests shouting.
- Avoid using vernacular and/or slang language. This could possibly lead to misinterpretation.
- Keep an open-mind and be willing to express even your minority opinion.
- Think and edit before you push the "Send" button.
- Do not hesitate to ask for feedback.

TENTATIVE COURSE SCHEDULE

Week Starting	Topic(s)	Assignment
1 & 2	**Introduction**: Machine Learning, Data Mining Data and data mining life cycle, definitions, and case studies	Configuration of laptops and simple exercises in data manipulation
3	**Data pre-processing**: understanding, cleaning and transforming	Exercises in pinpointing goals, sampling, transforming
4	**Data Modeling Tools**: R with Rattle	Demonstration and work-along problems in class
5	**Supervised and un-supervised learning** –theory and examples	Final Project Initial assessment due
6	**Clustering** and association analysis using kMeans and basket analysis	Exercises in kMeans
7	**Midterm Exam** **Review of final teams and projects**	Midterm Exam
8	**Decision Trees**: definitions, algorithms, applications, optimizations	Exercises in decision trees
9	**Decision Trees case studies**	Exercises and case studies using R/Rattle/maptree
10	**Neural Networks** – theory, examples	Exercises using R/Rattle/nnet/Python
11	**Text mining**	Exercises using Gephi/Python
12	Introduction and examples of **Applied Machine Learning**: Anomaly Detection and Matching platforms	Exercises in basic machine learning
13	**Applied Machine Learning examples**	Extended exercises
14	**Final Project Due**	

COURSE MATERIALS

Recommended Textbook(s):

Data Mining with Rattle and R: The Art of Excavating Data for Knowledge Discovery, GrahamWilliams, Spring, 2011
Modeling and Reasoning with Bayesian Networks, Adnan Darwiche, Cambridge University Press,2013

Other Readings: As noted in class

TECHNOLOGY REQUIREMENTS

Baseline technical skills necessary for online courses

- Basic computer and web-browsing skills
- Navigating Canvas

Technology skills necessary for this specific course

- Live web conferencing using Zoom
- Recording a slide presentation with audio narration
- Possible recording, editing, and uploading video via Kaltura

Required Equipment

- Computer: current Mac (OS X) or PC (Windows 7+) with high-speed internet connection
- Webcam: built-in or external webcam, fully installed
- Microphone: built-in laptop or tablet mic or external microphone

Required Software:

All the software specified for this class are either free or ubiquitous for undergraduates at Stevens. *You will be expected to use the tools specified in this class. It is your responsibility to make sure your machines are configured properly and are in good working order.*

- Microsoft Word/Excel/PowerPoint

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- **MS-Excel** 2016 (or later)
- **R** version
- **R Studio** version
- **Rattle** version
- **maptree R library**
- **nnet R library**
- **bnlearn R libraries**

} Will verify versions at start of semester

GRADING PROCEDURES

Grades will be based on:

Class Participation	(10%)
Assignment	(20%)
Midterm Exam	(30%)
Final Project	(40%)

Late Policy
Late submittals will be allowed only on a case-by-base basis, unless on-time submissions are not possible due to utility outages, pandemic issues, or work/family emergencies (which must be documented to the professor).

ACADEMIC INTEGRITY

Undergraduate Honor System

Enrollment into the undergraduate class of Stevens Institute of Technology signifies a student's commitment to the Honor System. Accordingly, the provisions of the Stevens Honor System apply to all undergraduate students in coursework and Honor Board proceedings. It is the responsibility of each student to become acquainted with and to uphold the ideals set forth in the Honor System Constitution. More information about the Honor System including the constitution, bylaws, investigative procedures, and the penalty matrix can be found online at http://web.stevens.edu/honor/

The following pledge shall be written in full and signed by every student on all submitted work (including, but not limited to, homework, projects, lab reports, code, quizzes and exams) that is assigned by the course instructor. No work shall be graded unless the pledge is written in full and signed.

"*I pledge my honor that I have abided by the Stevens Honor System*."

Reporting Honor System Violations
Students who believe a violation of the Honor System has been committed should report it within ten business days of the suspected violation. Students have the option to remain anonymous and can report violations online at www.stevens.edu/honor.

EXAM CONDITIONS

The following procedures apply to quizzes and exams for this course. As the instructor, I reserve the right to modify any conditions set forth below by printing revised Exam Room Conditions on the quiz or exam.

1. Students may use the following devices during quizzes and/or exams. Any electronic devices that are not mentioned in the list below are not permitted.

Device	**Permitted?**	
	Yes	No
Laptops	x	
Cell Phones		x
Tablets		x
Smart Watches		x
Google Glass		x
Other		x

2. Students may use the following materials during quizzes and/or exams. Any materials that are not mentioned in the list below are not permitted.

Material	Permitted?	
	Yes	No
Handwritten Notes		x
Typed Notes		x
Textbooks		x
Readings		x
Other		x

3. Students are allowed to work with or talk to other students during quizzes and/or exams.

LEARNING ACCOMODATIONS

Stevens Institute of Technology is dedicated to providing appropriate accommodations to students with documented disabilities. The Office of Disability Services (ODS) works with undergraduate and graduate students with learning disabilities, attention deficit-hyperactivity disorders, physical disabilities, sensory impairments, psychiatric disorders, and other such disabilities in order to help students achieve their academic and personal potential. They facilitate equal access to the educational programs and opportunities offered at Stevens and coordinate reasonable accommodations for eligible students. These services are designed to encourage independence and self-advocacy with support from the ODS staff. The ODS staff will facilitate the provision of accommodations on a case-by-case basis.

For more information about Disability Services and the process to receive accommodations, visit https://www.stevens.edu/office-disability-services. If you have any questions please contact: Phillip Gehman, the Director of Disability Services Coordinator at Stevens Institute of Technology at pgehman@stevens.edu or by phone 201-216-3748.

Disability Services Confidentiality Policy

Student Disability Files are kept separate from academic files and are stored in a secure location within the Office of Disability Services. The Family Educational Rights Privacy Act (FERPA, 20 U.S.C. 1232g; 34CFR, Part 99) regulates disclosure of disability documentation and records maintained by Stevens Disability Services. According to this act, prior written consent by the student is required before our Disability Services office may release disability documentation or records to anyone. An exception is made in unusual circumstances, such as the case of health and safety emergencies.

INCLUSIVITY

Name and Pronoun Usage

As this course includes group work and class discussion, it is vitally important for us to create an educational environment of inclusion and mutual respect. This includes the ability for all students to

have their chosen gender pronoun(s) and chosen name affirmed. If the class roster does not align with your name and/or pronouns, please inform the instructor of the necessary changes.

Inclusion Statement

Stevens Institute of Technology believes that diversity and inclusiveness are essential to excellence in academic discourse and innovation. In this class, the perspective of people of all races, ethnicities, gender expressions and gender identities, religions, sexual orientations, disabilities, socioeconomic backgrounds, and nationalities will be respected and viewed as a resource and benefit throughout the semester. Suggestions to further diversify class materials and assignments are encouraged. If any course meetings conflict with your religious events, please do not hesitate to reach out to your instructor to make alternative arrangements.

You are expected to treat your instructor and all other participants in the course with courtesy and respect. Disrespectful conduct and harassing statements will not be tolerated and may result in disciplinary actions.

MENTAL HEALTH RESOURCES

Part of being successful in the classroom involves a focus on your whole self, including your mental health. While you are at Stevens, there are many resources to promote and support mental health. The Office of Counseling and Psychological Services (CAPS) offers free and confidential servicesto all enrolled students who are struggling to cope with personal issues (e.g., difficulty adjusting to college or trouble managing stress) or psychological difficulties (e.g., anxiety and depression). CAPS is open daily from 9:00 am – 5:00 pm M-F. Evening hours are available by appointment in the Fall / Springsemesters and up-to-date information regarding the availability of evening appointments can be found by visiting www.stevens.edu/CAPS. To schedule an appointment, call 201-216-5177.

Due to the pandemic, in-person appointments may be limited until further notice. Up-to-date information about the availability of in-person services can be found at www.stevens.edu/CAPS. Teletherapy (therapy via secure video platform) is available to registered students physically located in the states of New York or New Jersey. Students located outside of NY / NJ are encouraged to pursue local treatment through their personal health insurance. To learn more about the process of finding a therapist please visit the CAPS webpage on Seeking Help Off-Campus.

EMERGENCY INFORMATION

In the event of an urgent or emergent concern about the safety of yourself or someone else in the Stevens community, please immediately call the Stevens Campus Police at 201-216-5105 or on their emergency line at 201-216-3911. These phone lines are staffed 24/7, year round. For students who do not reside near the campus and require emergency support, please contact your local emergency response providers at 911 or via your local police precinct. Other 24/7 national resources for students dealing with mental health crises include the National Suicide Prevention Lifeline (1-800-273-8255) and the Crisis Text Line (text “Home” to 741-741). If you are concerned about the wellbeing of another Stevens student, and the matter is *not* urgent or time sensitive, please email the CARE Team at care@stevens.edu. A member of the CARE Team will respond to your concern as soon as possible.