Georgia Tech

Course Syllabus

ISYE 6501

Introduction to Analytics Modeling

Professor: Dr. Joel Sokol

Course Description

An introduction to important and commonly used models in Analytics, as well as aspects of the modeling process.

Prerequisites

- Probability and statistics
- Basic programming proficiency
- Linear algebra
- Basic calculus
- A little background in R can be useful, but isn't necessary if you're willing to learn on the fly.

Course Goals

The most important thing you can learn from this course is not the memorization of any specific bit of material. Instead, I would like you to learn these skills:

- Given a business (or other) question, select an appropriate analytics model to answer it, specify the data you will need to solve it, and understand what the model's solution will and will not provide as an answer.
- Given someone else's use of analytics to address a specific business (or other) question, evaluate whether they have used an appropriate model (and appropriate data) and whether their conclusion is reasonable.

Another goal of this course is for you to learn how to think though descriptions and usage of new models, so you can continue to learn throughout your career; new techniques will certainly be developed after you graduate, and we want you to be able to pick them up quickly.

We will not cover the mathematics and algorithms under the hood, or deeper mastery of the modeling needed to set up the use of the technique. You can acquire those deeper levels of knowledge in elective courses. (In fact, we could spend an entire semester on many of the topics you'll see in the course.)

Grading Policy

1. There will be two midterm quizzes and one final quiz that will be graded by faculty. Each will be worth 25% of the course grade.
2. There will be homework assignments most weeks of the semester. Your two lowest homework grades will be dropped, and the remaining ones will add up to 15% of the course grade. These will be peer-graded (based on the median score assigned by your peer graders). You will also need to peer-grade others' homeworks; you will not receive credit for your homework submission if you do not complete your peer assessments.

   > NOTE: I know that everyone has other obligations – family, work, etc. – that sometimes make it hard or impossible to meet weekly homework deadlines. That is why you are allowed to drop your lowest two homework grades: the drops allow you to not turn in the homework in whatever two week(s) the other obligations in your life might be too time-consuming. (Of course, I hope that you do the homework later to make sure you learn what you're supposed to know that week, but you can do it on your own time without the pressure of a deadline.)

3. There will be one course project worth 8% of the course grade. The project will be peer-graded (your score will be the median score assigned by your peer graders). You will also need to peer-grade others' projects; you will receive a grade of zero for your project submission if you do not complete your peer assessments.
4. There will be one quiz on the syllabus, worth 2% of the course grade.
5. For Georgia Tech degree and certificate students, quizzes will be scaled to letter grades based on their difficulty, and combined with the homeworks and project to determine an overall letter grade scale at the end of the semester. Audit and Verified/MicroMasters learners must achieve an overall weighted average of 60% to pass the course.

Homework and Quiz Due Dates

All homework and quizzes will be due at the times in the table at the end of this syllabus. These times are subject to change so please check back often. Please convert from UTC to your local time zone using a Time Zone Converter. Only Georgia Tech degree and certificate students and Verified/MicroMasters learners will have access to quizzes; quizzes are not available to Audit learners.

Timing Policy

- The Modules follow a logical sequence that includes knowledge-building and experience-building.
- Assignments should be completed by their due dates, in order for timely peer assessment. Peer assessments should also be completed by their due dates, to give timely feedback.
- Quizzes must be completed during the time allotted on the schedule.
- You will have access to the course content for the scheduled duration of the course.

Quiz Policy

(Georgia Tech degree and certificate students and Verified/MicroMasters learners only; quizzes are not available to Audit learners.)

- For Midterm Quiz 1 and Midterm Quiz 2, you are allowed to use one sheet of paper, either 8.5"x11" or A4, with handwritten notes (both sides of the sheet, 2 sides total).
- For Final Quiz, you are allowed to use two sheets of paper, either 8.5"x11" or A4, with handwritten notes (both sides of each sheet, 4 sides total).
- For all quizzes, you are allowed blank sheets of paper for scratch work (you will have to show the front and back of the blank sheet(s) while you are being proctored).
- Any student who misses a quiz for any reason will not be allowed to take it after the deadline; however, in appropriate situations the instructor may impute a score for the missed quiz, based on the student's other quiz scores.
- Calculators may not be used (you won't need them for any calculations).

Onboarding Process (Onboarding Quiz, Syllabus Quiz, Piazza Registration, etc.)

(Georgia Tech degree and certificate students and Verified/MicroMasters learners only; quizzes are not available to Audit learners.)

- All Georgia Tech degree and certificate students and Verified/MicroMasters students are required to complete the Onboarding Process by the deadlines shown in the table at the end of this syllabus. That includes the Onboarding Quiz, the Syllabus Quiz, and Piazza registration.
- The Onboarding Quiz is needed to help make sure that your identity is verified and that your system is set up to work with online proctoring. This is an ungraded quiz; it is just to make sure you're set up for the rest of the semester. You are required to complete this quiz early in the semester to avoid problems when taking the midterm quizzes.
- The Syllabus Quiz helps make sure everyone understands some key things (how to get help, what to do if something goes wrong, etc.) that will make the semester go more smoothly. Because the emphasis is on knowing what to do, you can keep submitting this quiz until you have all the correct answers – so everyone should be able to get the full 2% (as long as you take it before the deadline, of course). You are required to complete this quiz early in the semester to ensure that everyone understands how to navigate this course and its requirements.
- Every Georgia Tech degree and certificate student, and every Verified/MicroMasters student, is required to register for the Piazza message board associated with this course. Registration is part of the onboarding process, and it is important because all official communications in this course are done via Piazza (see the "Communication" section of the syllabus).

Attendance Policy

- This is a fully online course.
- Log in on a regular basis to complete your work, so that you do not have to spend a lot of time reviewing and refreshing yourself regarding the content.

Plagiarism Policy

- Plagiarism is considered a serious offense. You are not allowed to copy and paste or submit materials created or published by others, as if you created the materials. All materials submitted and posted must be your own. Any background materials you use should be cited.

Student Honor Code

All Audit and Verified/MicroMasters learners are expected and required to abide by the letter and the spirit of the edX honor code. All Georgia Tech degree and certificate students are expected and required to abide by the letter and spirit of the Georgia Tech honor code. The teaching assistants and I will also abide by these honor codes. Please feel free to contact me if there is any way that I can help you in complying with the honor code.

- I'm very serious about this. Ethical behavior is extremely important in all facets of life.
- Review the honor code that is relevant to you: Georgia Tech degree and certificate students should review the Georgia Tech Student Honor Code www.honor.gatech.edu and Audit and Verified/MicroMasters learners should review the edX Honor Code https://www.edx.org/edx-terms-service and.
- You are responsible for completing your own work.
- Any Georgia Tech degree or certificate student suspected of behavior in violation of the Georgia Tech Honor Code will be referred to Georgia Tech's Office of Student Integrity. Any Audit or Verified/MicroMasters learner found in violation of the edX Honor Code will be subject to any/all of the actions listed in the edX Honor Code.

Communication

- All Georgia Tech degree and certificate students and Verified/MicroMasters learners are responsible for knowing the content of all pinned Piazza posts. This is where instructors will be letting students know about important announcements, changes (if any), etc., so all students are required to read and know the content of all such posts. It is expected that students will check these posts at least once every 24 hours (with exceptions for national and religious holidays, emergencies, etc.).
- All learners should ask questions, and answer their fellow learners' questions, on the course discussion forums. Often, discussions with fellow learners are the sources of key pieces of learning.
- Georgia Tech degree and certificate students and Verified/MicroMasters learners can also ask questions of the instructor and teaching assistants via Piazza. For special cases such as failed submissions due to system errors, missing grades, failed file uploads, emergencies that prevent you from submitting, personal issues, etc., the Piazza discussion forum also allows you to send private messages to the entire team of instructors (professors and TAs).
- Audit learners will be able to ask questions of each other and answer each other questions, but the instructor and teaching assistants will not answer questions in the Audit learner forums.

Students with Disabilities, Unexpected Medical/Personal Issues, Etc. (Georgia Tech degree and certificate students only; edX MicroMasters students should contact edX)

- If you wish to request an accommodation due to a documented disability, please contact the Office of Disability Services (ODS) (**dsinfo@gatech.edu** or 404-894-2563 (voice) or 404-894-1664 (TDD)) as soon as possible. ODS helps students get accommodations prospectively (before the accommodation is needed), but not retroactively (i.e., they will not help if you knew you might need the accommodation beforehand but waited until after the situation arose to request it). We (professor and TAs) <u>cannot</u> give these accommodations ourselves; they must be requested through ODS.
- If you encounter an unexpected personal issue, medical issue, etc. you can contact the Dean of Students' office, or post on Piazza to all instructors. Depending on the situation, we might be able to handle it, or we might need you to contact the Dean of Students' office, but you are always welcome to contact the Dean of Students' office if you are not comfortable revealing the details of your situation to the professor and TAs.

Netiquette

- Netiquette refers to etiquette that is used when communicating on the Internet. When you are communicating via email, discussion forums or synchronously (real-time), please use correct spelling, punctuation and grammar consistent with the academic environment and scholarship.

- *In Georgia Tech's Master of Science in Analytics program, which this course is a part of, we expect all participants (learners, faculty, teaching assistants, staff) to interact respectfully. Learners who do not adhere to this guideline may be removed from the course.*

Course Topics and Sample Pacing Schedule

- The tables below contain a course topic outline and assessment due dates.

Weeks	Course Topics	Release Dates
Week 1	Introduction, Classification, Validation	May 16 @13:00 UTC May 16 @ 9am ET May 16 @ 6am PT
Week 2	Clustering, Basic Data Preparation, Change Detection *NOTE: Registration for the course Piazza forum is required to access the material for Weeks 2 and beyond.*	May 21 @13:00 UTC May 21 @ 9am ET May 21 @ 6am PT
Week 3	Time Series Models, Basic Regression	May 28 @13:00 UTC May 28 @ 9am ET May 28 @ 6am PT
Week 4	Advanced Data Preparation, Advanced Regression, Tree-based Models	Jun 4 @13:00 UTC Jun 4 @ 9am ET

		Jun 4 @ 6am PT
Week 5	Variable Selection, Design of Experiments, Probability-based Models	Jun 11 @13:00 UTC Jun 11 @ 9am ET Jun 11 @ 6am PT
Week 6	Probability-based Models, Missing Data, Optimization	Jun 18 @13:00 UTC Jun 18 @ 9am ET Jun 18 @ 6am PT
Week 7	Optimization, Advanced Models	Jun 25 @13:00 UTC Jun 25 @ 9am ET Jun 25 @ 6am PT
Week 8	Discussion Cases – Case Format, Power Company Case	Jul 2 @13:00 UTC Jul 2 @ 9am ET Jul 2 @ 6am PT
Week 9	Discussion Cases – Retailer Case	Jul 9 @13:00 UTC Jul 9 @ 9am ET Jul 9 @ 6am PT
Week 10	Discussion Cases – Monetization Case	Jul 16 @13:00 UTC Jul 16 @ 9am ET Jul 16 @ 6am PT
Week 11	Course Summary	Jul 23 @13:00 UTC Jul 23 @ 9am ET Jul 23 @ 6am PT
Week 12	Final Quiz	See below

	Assignment		Peer Assessments	
	Release Date	Due Date	Release Date	Due Date
Onboarding Quiz	May 16 @ 13:00 UTC May 16 @ 9am ET May 16 @ 6am PT	May 30@ 06:00 UTC May 30 @ 2am ET May 29 @ 11pm PT		
Syllabus Quiz	May 16 @ 13:00 UTC May 16 @ 9am ET May 16 @ 6am PT	May 30 @06:00 UTC May 30 @ 2am ET May 29 @ 11pm PT		
Week 1 Homework	May 16 @ 13:00 UTC May 16 @ 9am ET May 16 @ 6am PT	May 26 @06:00 UTC May 26 @ 2am ET May 25 @11pm PT	May 26 @06:00 UTC May 26 @ 2am ET May 25 @11pm PT	May 30@ 06:00 UTC May 30 @ 2am ET May 29@ 11pm PT
Week 2 Homework	May 26 @ 06:00 UTC May 26 @ 2am ET May 25 @ 11pm PT	Jun 2 @ 06:00 UTC Jun 2 @ 2am ET Jun 1 @ 11pm PT	Jun 2 @ 06:00 UTC Jun 2 @ 2am ET Jun 1 @ 11pm PT	Jun 6 @ 06:00 UTC Jun 6 @ 2am ET Jun 5 @ 11pm PT
Week 3 Homework	Jun 2 @ 06:00 UTC Jun 2 @ 2am ET Jun 1 @ 11pm PT	Jun 9 @ 06:00 UTC Jun 9 @ 2am ET Jun 8 @ 11pm PT	Jun 9 @ 06:00 UTC Jun 9 @ 2am ET Jun 8 @ 11pm PT	Jun 13 @ 06:00 UTC Jun 13 @ 2am ET Jun 12 @ 11pm PT
Week 4 Homework	Jun 9 @ 06:00 UTC Jun 9 @ 2am ET Jun 8 @ 11pm PT	Jun 16 @ 06:00 UTC Jun 16 @ 2am ET Jun 15 @ 11pm PT	Jun 16 @ 06:00 UTC Jun 16 @ 2am ET Jun 15 @ 11pm PT	Jun 20 @ 06:00 UTC Jun 20 @ 2am ET Jun 19 @ 11pm PT

	Assignment		Peer Assessments	
	Release Date	**Due Date**	**Release Date**	**Due Date**
Week 5 Homework	Jun 16 @ 06:00 UTC Jun 16 @ 2am ET Jun 15 @ 11pm PT	Jun 23 @ 06:00 UTC Jun 23 @ 2am ET Jun 22 @ 11pm PT	Jun 23 @ 06:00 UTC Jun 23 @ 2am ET Jun 22 @ 11pm PT	Jun 27 @ 06:00 UTC Jun 27 @ 2am ET Jun 26 @ 11pm PT
Week 6 Homework	Jun 23 @ 06:00 UTC Jun 23 @ 2am ET Jun 22 @ 11pm PT	Jun 30 @ 06:00 UTC Jun 30 @ 2am ET Jun 29 @ 11pm PT	Jun 30 @ 06:00 UTC Jun 30 @ 2am ET Jun 29 @ 11pm PT	Jul 6 @ 06:00 UTC Jul 6 @ 2am ET Jul 5 @ 11pm PT
Week 7 Homework	Jun 30 @ 06:00 UTC Jun 30 @ 2am ET Jun 29 @ 11pm PT	Jul 7 @ 06:00 UTC Jul 7 @ 2am ET Jul 6 @ 11pm PT	Jul 7 @ 06:00 UTC Jul 7 @ 2am ET Jul 6 @ 11pm PT	Jul 11 @ 06:00 UTC Jul 11 @ 2am ET Jul 10 @ 11pm PT
Week 8 Homework	Jul 7 @ 06:00 UTC Jul 7 @ 2am ET Jul 6 @ 11pm PT	Jul 14 @ 06:00 UTC Jul 14 @ 2am ET Jul 13 @ 11pm PT	Jul 14 @ 06:00 UTC Jul 14 @ 2am ET Jul 13 @ 11pm PT	Jul 18 @ 06:00 UTC Jul 18 @ 2am ET Jul 17 @ 11pm PT
Week 9 Homework	Jul 14 @ 06:00 UTC Jul 14 @ 2am ET Jul 13 @ 11pm PT	Jul 21 @ 06:00 UTC Jul 21 @ 2am ET Jul 20 @ 11pm PT	Jul 21 @ 06:00 UTC Jul 21 @ 2am ET Jul 20 @ 11pm PT	Jul 25 @ 06:00 UTC Jul 25 @ 2am ET Jul 24 @ 11pm PT
Week 10 Homework	Jul 21 @ 06:00 UTC Jul 21 @ 2am ET Jul 20 @ 11pm PT	NOT DUE – USE FOR	GROUP DISCUSSION	AND LEARNING
Course Project	Jun 25 @ 06:00 UTC Jun 25 @ 2am ET Jun 24 @ 11pm PT	Jul 21 @ 06:00 UTC Jul 21 @ 2am ET Jul 20 @ 11pm PT	Jul 21 @ 06:00 UTC Jul 21 @ 2am ET Jul 20 @ 11pm PT	Jul 25 @ 06:00 UTC Jul 25 @ 2am ET Jul 24 @ 11pm PT
Midterm Quiz 1	Jun 9 @ 06:00 UTC Jun 9 @ 2am ET Jun 8 @ 11pm PT	Jun 20 @ 06:00 UTC Jun 20 @ 2am ET Jun 19 @ 11pm PT		
Midterm Quiz 2	Jun 30 @ 06:00 UTC Jun 30 @ 2am ET Jun 29 @ 11pm PT	Jul 11 @ 06:00 UTC Jul 11 @ 2am ET Jul 10 @ 11pm PT		
Final Quiz	Jul 21 @ 06:00 UTC Jul 21 @ 2am ET Jul 20 @ 11pm PT	Aug 1 @ 06:00 UTC Aug 1 @ 2am ET Jul 30 @ 11pm PT		

Course Materials

- All content and course materials can be accessed online
- There is no textbook for this course

Technology/Software Requirements

- Internet connection (DSL, LAN, or cable connection desirable)
- R statistical software (free download; see cran.r-project.org) and R Studio (free download; see https://rstudio.com/products/rstudio/download/)

- Arena simulation software (free student download; see www.arenasimulation.com/academic/students) for Windows, *or* SimPy (free download; see https://pypi.python.org/pypi/simpy) for Windows/Mac)
- PuLP optimization software (free download; see www.coin-or.org/PuLP/ -- Windows version and (for Mac users) a Linux version)
- Python (required for PuLP and SimPy) programming language (free download; see www.python.org/)
- Adobe Acrobat PDF reader (free download; see https://get.adobe.com/reader/