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 16% 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 a final grade for your homework submission if you do not complete your peer assessments.
3. There will be one course project worth 9% of the course grade. The project will be peer-graded (based on the median score assigned by your peer graders). You will also need to peer-grade others' projects; you will not receive a final grade for your project submission if you do not complete your peer assessments.
4. Audit and Verified/MicroMasters learners must achieve an overall weighted average of 60% to pass the course. For OMS Analytics degree 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.

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.

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

- 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 a blank sheet of paper for scratch work (Verified/MicroMasters learners and OMS Analytics degree students will be proctored; you will have to show the front and back of the blank sheet while you are being proctored. Audit learners will not be proctored).

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 OMS Analytics degree 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: Audit and Verified/MicroMasters learners should review the edX Honor Code https://www.edx.org/edx-terms-service and OMS Analytics degree students should review the Georgia Tech Student Honor Code www.honor.gatech.edu.
- You are responsible for completing your own work.
- Any OMS Analytics degree 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 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.
- Verified/MicroMasters learners and OMS Analytics degree students can also ask questions of the instructor and teaching assistants via the course discussion forums. 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., a special email address will be provided in a discussion forum for you to directly contact the instructor and teaching assistants.
- 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.

Netiquette

- Netiquette refers to etiquette that is used when communicating on the Internet. Review the Core Rules of Netiquette. 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[1].

- *In Georgia Tech's MS in Analytics program, 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.*

1. Conner, P. (2006-2014). Ground Rules for Online Discussions, Retrieved 4/21/2014 from http://teaching.colostate.edu/tips/tip.cfm?tipid=128

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	Jan 8 @13:00 UTC Jan 8 @ 8am EDT Jan 8 @ 5am PDT
Week 2	Validation, Clustering	Jan 14 @14:00 UTC Jan 14 @ 9am EDT Jan 14 @ 6am PDT
Week 3	Basic Data Preparation, Change Detection	Jan 21 @14:00 UTC Jan 21 @ 9am EDT Jan 21 @ 6am PDT
Week 4	Time Series Models	Jan 28 @14:00 UTC Jan 28 @ 9am EDT Jan 28 @ 6am PDT
Week 5	Basic Regression	Feb 4 @14:00 UTC Feb 4 @ 9am EDT Feb 4 @ 6am PDT
Week 6	Advanced Data Preparation	Feb 11 @14:00 UTC Feb 11 @ 9am EDT Feb 11 @ 6am PDT
Week 7	Advanced Regression, Tree-based Models	Feb 18 @14:00 UTC Feb 18 @ 9am EDT Feb 18 @ 6am PDT
Week 8	Variable Selection	Feb 25 @14:00 UTC Feb 25 @ 9am EDT Feb 25 @ 6am PDT
Week 9	Design of Experiments, Probability-based Models	Mar 4 @14:00 UTC Mar 4 @ 9am EDT Mar 4 @ 6am PDT
Week 10	Missing Data, Optimization	Mar 11 @13:00 UTC Mar 11 @ 9am EDT Mar 11 @ 6am PDT
Week 11	GEORGIA TECH SPRING BREAK	
Week 12	Optimization, Advanced Models	Mar 25 @13:00 UTC Mar 25 @ 9am EDT Mar 25 @ 6am PDT
Week 13	Discussion Cases – Case Format, Power Company Case	Apr 1 @13:00 UTC Apr 1 @ 9am EST Apr 1 @ 6am PST

Week 14	Discussion Cases – Retailer Case	April 9 @13:00 UTC April 9 @ 9am EST April 9 @ 6am PST
Week 15	Discussion Cases – Monetization Case	April 16 @13:00 UTC April 16 @ 9am EST April 16 @ 6am PST
Week 16	Course Summary	April 23 @13:00 UTC April 23 @ 9am EST April 23 @ 6am PST
Week 17	Final Quiz	See below

	Assignment		Peer Assessments	
	Release Date	Due Date	Release Date	Due Date
Week 1 Homework	Jan 8 @ 13:00 UTC Jan 8 @ 8am EDT Jan 8 @ 5am PDT	Jan 18 @ 07:00 UTC Jan 18 @ 2am EDT Jan 17 @ 11pm PDT	Jan 18 @ 07:00 UTC Jan 18 @ 2am EDT Jan 17 @ 11pm PDT	Jan 22 @ 07:00 UTC Jan 22 @ 2am EDT Jan 21 @ 11pm PDT
Week 2 Homework	Jan 18 @ 07:00 UTC Jan 18 @ 2am EDT Jan 17 @ 11pm PDT	Jan 25 @ 07:00 UTC Jan 25 @ 2am EDT Jan 24 @ 11pm PDT	Jan 25 @ 07:00 UTC Jan 25 @ 2am EDT Jan 24 @ 11pm PDT	Jan 29 @ 07:00 UTC Jan 29 @ 2am EDT Jan 28 @ 11pm PDT
Week 3 Homework	Jan 25 @ 07:00 UTC Jan 25 @ 2am EDT Jan 24 @ 11pm PDT	Feb 1 @ 07:00 UTC Feb 1 @ 2am EDT Jan 31 @ 11pm PDT	Feb 1 @ 07:00 UTC Feb 1 @ 2am EDT Jan 31 @ 11pm PDT	Feb 5 @ 07:00 UTC Feb 5 @ 2am EDT Feb 4 @ 11pm PDT
Week 4 Homework	Feb 1 @ 07:00 UTC Feb 1 @ 2am EDT Jan 31 @ 11pm PDT	Feb 8 @ 07:00 UTC Feb 8 @ 2am EDT Feb 7 @ 11pm PDT	Feb 8 @ 07:00 UTC Feb 8 @ 2am EDT Feb 7 @ 11pm PDT	Feb 12 @ 07:00 UTC Feb 12 @ 2am EDT Feb 11 @ 11pm PDT
Week 5 Homework	Feb 8 @ 07:00 UTC Feb 8 @ 2am EDT Feb 7 @ 11pm PDT	Feb 15 @ 07:00 UTC Feb 15 @ 2am EDT Feb 14 @ 11pm PDT	Feb 15 @ 07:00 UTC Feb 15 @ 2am EDT Feb 14 @ 11pm PDT	Feb 19 @ 07:00 UTC Feb 19 @ 2am EDT Feb 18 @ 11pm PDT
Week 6 Homework	Feb 15 @ 07:00 UTC Feb 15 @ 2am EDT Feb 14 @ 11pm PDT	Feb 22 @ 07:00 UTC Feb 22 @ 2am EDT Feb 21 @ 11pm PDT	Feb 22 @ 07:00 UTC Feb 22 @ 2am EDT Feb 21 @ 11pm PDT	Feb 26 @ 07:00 UTC Feb 26 @ 2am EDT Feb 25 @ 11pm PDT
Week 7 Homework	Feb 22 @ 07:00 UTC Feb 22 @ 2am EDT Feb 21 @ 11pm PDT	Mar 1 @ 07:00 UTC Mar 1 @ 2am EDT Feb 28 @ 11pm PDT	Mar 1 @ 07:00 UTC Mar 1 @ 2am EDT Feb 28 @ 11pm PDT	Mar 5 @ 07:00 UTC Mar 5 @ 2am EDT Mar 4 @ 11pm PDT
Week 8 Homework	Mar 1 @ 07:00 UTC Mar 1 @ 2am EDT Feb 28 @ 11pm PDT	Mar 8 @ 07:00 UTC Mar 8 @ 2am EDT Mar 7 @ 11pm PDT	Mar 8 @ 07:00 UTC Mar 8 @ 2am EDT Mar 7 @ 11pm PDT	Mar 12@ 06:00 UTC Mar 12 @ 2am EDT Mar 12@ 11pm PDT
Week 9 Homework	Mar 8 @ 07:00 UTC Mar 8 @ 2am EDT Mar 7 @ 11pm PDT	Mar 15@ 06:00 UTC Mar 15 @ 2am EDT Mar 14@ 11pm PDT	Mar 15 @ 06:00 UTC Mar 15 @ 2am EDT Mar 14 @ 11pm PDT	Mar 19@ 06:00 UTC Mar 19 @ 2am EDT Mar 18@ 11pm PDT
Week 10 Homework	Mar 15 @ 06:00 UTC Mar 15 @ 2am EDT Mar 14 @ 11pm PDT	Mar 29@ 06:00 UTC Mar 29 @ 2am EDT Mar 28@ 11pm PDT	Mar 29 @ 06:00 UTC Mar 29 @ 2am EDT Mar 28 @ 11pm PDT	Apr 2 @ 06:00 UTC Apr 2 @ 2am EST Apr 1 @ 11pm PST
Week 11 Homework	NO	HOMEWORK	THIS	WEEK
Week 12 Homework	NO	HOMEWORK	THIS	WEEK

Week 13 Homework	Apr 5 @ 06:00 UTC Apr 5 @ 2am EST Apr 4 @ 11pm PST	Apr 12 @ 06:00 UTC Apr 12 @ 2am EST Apr 11 @ 11pm PST	Apr 12 @ 06:00 UTC Apr 12 @ 2am EST Apr 11 @ 11pm PST	Apr 16 @ 06:00 UTC Apr 16 @ 2am EST Apr 15 @ 11pm PST
Week 14 Homework	Apr 12 @ 06:00 UTC Apr 12 @ 2am EST Apr 11 @ 11pm PST	Apr 19 @ 06:00 UTC Apr 19 @ 2am EST Apr 18 @ 11pm PST	Apr 19 @ 06:00 UTC Apr 19 @ 2am EST Apr 18 @ 11pm PST	Apr 23 @ 06:00 UTC Apr 23 @ 2am EST Apr 22 @ 11pm PST
Week 15 Homework	Apr 19 @ 06:00 UTC Apr 19 @ 2am EST Apr 18 @ 11pm PST	Apr 26 @ 06:00 UTC Apr 26 @ 2am EST Apr 25 @ 11pm PST	Apr 26 @ 06:00 UTC Apr 26 @ 2am EST Apr 25 @ 11pm PST	Apr 30 @ 06:00 UTC Apr 30 @ 2am EST Apr 29 @ 11pm PST
Week 16 Homework	NO	HOMEWORK	THIS	WEEK
Course Project	Mar 29 @ 06:00 UTC Mar 29 @ 2am EDT Mar 28 @ 11pm PDT	Apr 19 @ 06:00 UTC Apr 19 @ 2am EST Apr 18 @ 11pm PST	Apr 19 @ 06:00 UTC Apr 19 @ 2am EST Apr 18 @ 11pm PST	Apr 23 @ 07:00 UTC Apr 23 @ 2am EST Apr 22 @ 11pm PST
Midterm Quiz 1	Feb 22 @ 07:00 UTC Feb 22 @ 2am EDT Feb 21 @ 11pm PDT	Mar 1 @ 07:00 UTC Mar 1 @ 2am EDT Feb 28 @ 11pm PDT		
Midterm Quiz 2	Mar 29 @ 06:00 UTC Mar 29 @ 2am EST Mar 28 @ 11pm PST	Apr 5 @ 06:00 UTC Apr 5 @ 2am EDT Apr 4 @ 11pm PDT		
Final Quiz	Apr 26 @ 06:00 UTC Apr 26 @ 2am EST Apr 25 @ 11pm PST	May 3 @ 06:00 UTC May 3 @ 2am EST May 2 @ 11pm PST		

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)
- 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/