15.076 Analytics for a Better World

Place-Time: E51-315, MW: 11:30-1:00PM

Instructors:

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Teaching Assistants:

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Recitation:

Fridays 11:30am-12:30pm, E51-315

Course Content and Objectives:

The purpose of the class is to introduce predictive and prescriptive analytics methods to solve problems that contribute to the welfare of society. The goal is to use analytics to address problem areas depicted in Figure 1 that outlines to the Sustainable Development Goals of the United Nations. The emphasis is on using machine learning and optimization methods in innovative ways using real world data. Specifically, methods that will be used include: linear and discrete optimization, linear and logistic regression, optimal classification and regression trees, deep learning, random forests and boosted trees. Projects will utilize Julia, Jump, Python and TensorFlow.

Text: Dimitris Bertsimas and Dick den Hertog, class notes and Dimitris Bertsimas, Allison O'Hair and WIlliam Pulleyblank, The Analytics Edge, Dynamic Ideas, 2016.

Recitations: The recitations will be an integral part of the class. They cover software implementations in Julia, Jump, Python and TensorFlow for both optimization and machine learning.

Figure 1: The Sustainable Development Goals of the United Nations.

Course Requirements: Problem sets, and a final team project. A project will need to involve up to two students per project. Grades will be determined by performance on the above requirements weighted approximately as 50% problem sets, and 50% final team project.

Project Information The project is on a topic of the student's choice. It is expected that it involves two students. It is possible to do it alone or in teams of three, but you need to talk with the instructors. The requirements involve:

- Submit a project proposal, due on 3/30.

- Submit a presentation on 5/2.

- Submit an 8 Page report due on 5/9.

Policy on Individual Work: Students can discuss problem sets with other students, but their answers must be their own. Students should list people they have talked to about each problem at top of each problem set. Copying a solution in a problem set or in the project violates the policy on individual work. Violations on this policy will result in lowering one's grade, taking an F in the class among others.

Lecture	Time	Topic	Lecturer
1	M, 1/31	Introduction to the class	DB, DH
2	W, 2/2	Linear Optimization	DH
3	M, 2/7	The World Food Program	DH
4	W, 2/9	Integer Optimization	DH
5	M, 2/14	Optimizing cattle feed in Africa	DH
6	W, 2/16	Optimizing brachytherapy treatment for cancer	DH
7	M, 2/21	Optimizing locations of the UN Humanitarian Response Depots	DH
8	W, 2/23	Dike height optimization and Shortest Path	DH
9	M, 2/28	Two videos Finalists Edelman Award 2021	DH & DB
10	W, 3/2	Optimal locations of hospitals in Timor Leste	DH
11	M, 3/7	World Food Program revisited: palatability constraint	DH
12	W, 3/9	Framingham heart study	DB
13	M, 3/14	Covid Analytics	DB
14	W, 3/16	Predicting mortality and morbidity for emergency care	DB
	M, 3/21	Spring break	
	W, 3/23	Spring break	
15	M, 3/28	Personalized medicine	DB
16	W, 3/30	Deep Learning	DB
17	M, 4/4	Ensemble models for hurricanes	DB
18	W, 4/6	Holistic AI for Medicine	DB
19	M, 4/11	Efficiency in organ transplantation	DB
20	W, 4/13	Fairness in organ transplantation	DB
	M, 4/18	Holiday	
21	W. 4/20	Personalized agriculture	DB
22	M, 4/25	Design of vaccines	DB
23	W, 4/27	Length of stay at Hartford Hospital	DB
24	M, 5/2	Boston public schools	DB
25	W, 5/4	Project presentations	
26	M, 5/9	Project presentations	