DBA4711: Applied Analytics

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General Information and Syllabus
Spring 2023

Description
Big data and analytics have climbed to the top of the corporate agenda—with ample reason. Together, they promise to transform the way many companies do business, delivering performance improvements not seen since the redesign of core processes in the 1990s. In this class we examine how data analytics is used to transform businesses and industries, using examples and case studies in e-commerce, healthcare, social media, fintech, pharma and beyond. Through these examples and many more, we teach and demonstrate the use of predictive and prescriptive analytics methods such as linear regression, logistic regression, classification trees, random forests, social network analysis, time series modeling, clustering, optimization, and machine learning.

Prerequisites:
Introduction to Optimisation, or a basic statistics and a basic optimization course. Please contact the course instructors with questions about appropriate prerequisites.

Readings/Resources
There is no required textbook for the course. However, we have some suggested readings from *The Analytics Edge* by Dimitris Bertsimas, Allison O'Hair and William Pulleyblank, Dynamic Ideas LLC, 2016. We refer to the book below as the AE book.

Grading
Your course grade will be composed of the following:
1. Homework Assignments and Cases: 40%.
2. Midterm: 25%.
3. Final Project: 25%
4. Class Participation: 10%.

Final Project:
For the final project, each team needs to submit a one-page proposal that outlines a plan to apply analytical methods to a problem the team has identified using some of the concepts and tools discussed in the course. The proposal should include a description of: (1) the problem, (2) the data that you have or plan to collect to solve the problem, (3) which analytic techniques you plan to use, and (4) the impact or overall goal of the project (say, if you could build a perfect model, what would it be able to do?).

The final project submission will consist of a written report of at most 4 pages (not including appendices) that describes your analysis, as well as a 15-minute presentation (in PowerPoint or pdf format) of your project.

Tentative Syllabus for DBA4711: Applied Analytics
Spring 2021
Course Outline

I. **Introduction to Python and R:** Structuring, analyzing and solving business decision problems in Python and R. Review of basic Python, and R. Applications to Hospital Operations optimization, Public health analytics – (Covid) (2 weeks)

II. **Optimal Resource Allocation**: Constrained optimization models of problems involving allocation of limited resources – equipment, personnel, materials, time, space, capital – to optimize some measure of performance such as profit, cost, sales, return on investment. Applications to Investment management, Real time Trading, ridesharing optimization, short term rentals optimization (4 weeks)

III. **Risk Analysis by Simulation**: Monte Carlo simulation of uncertain parameters Python and R. Applications to Lending analytics in Microlending Fintech, Health insurance analytics, Gig economy (3 weeks)

IV. **Operations Analytics**:   Building models for optimizing Operations in Industry 4.0. Applications to Digital twins for manufacturing and IOT example application to Smart Agriculture (2 weeks)

IV. **Machine Learning in Industry:** We will introduce latest tools and techniques used in Industry such as Deep Learning, Topological learning with examples from Industry. We will have industry speakers for certain sessions. Applications will include Fraud Analytics in payments, Social network analytics, Healthcare diagnostic analytics (4 weeks)