BUAD 493 - Marshall Honors Research Seminar [*Spring 2020*]

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Course Description

The prevalence of Big Data nowadays not only provides us with unique opportunities for business innovations and scientific breakthroughs, but also poses unprecedented challenges to the developments of new algorithms, methods, and theory for the foundations of Data Science and to the practices of Business Analytics. Traditional analytical tools that work efficiently on relatively smaller-scale structured data may no longer perform well or even become inapplicable in the contemporary unstructured Big Data. To prepare students with the skills to excel in this new environment, this course will provide students with a research project where they can gain experience with some of the state-of-the-art skills in this field and understand how they relate to business processes.

The class intends to achieve a number of foals in that regard.

➢ Provide students with an overview of research methods and strategies for tackling the "messy" and "uncertain" problems that exist in many modern companies.

➢ To learn and apply many modern statistical techniques, in order to solve those problems. This involves learning to read, present and apply insights from research papers, with the hope that students will be able to go out and seek the tools they, themselves need when they go to the workforce.

➢ To understand the application and relevance of these big data tools for business, and find a way to relate their research efforts to real world problems that companies are struggling with.

This course is the first in a two-semester sequence running Spring 2019 and Fall 2019. The goal of the first course is to prepare students to conduct independent research in Data Sciences and Operations (DSO) for Business Analytics and Data Analytics; in the second course students conduct independent research and produce a written study (a complete research paper). The first course focuses on the research process, research design, modern methods of big data analytics and AI for business applications, and identification of research questions. The second class focuses on executing the project and writing up the results for presentation and dissemination. During both courses, students will work closely the instructor on all phases of the project.

The course will benefit Marshall undergraduate students who are interested in a future career in Business Analytics or Big Data Analytics, or a future graduate program in Business Analytics or Data Science.

Learning Objectives

- ➢ Students will develop abilities to read and understand scholarly research studies, and assess the credibility of the findings.

- ➢ Students will develop abilities to design a research strategy to answer a question of interest.

- ➢ Students will gain familiarity with the main contemporary research methods of big data analytics and AI for business applications.

- ➢ Students will develop abilities to employ widely used statistical and machine learning software such as R and Python.

- ➢ Students will develop abilities to effectively present research findings.

- ➢ Students will develop abilities to effectively write up research findings in the format of a complete research paper.

These skills are useful for a variety of careers and are also useful for being an informed citizen in general given the importance of research and the rise of Big Data and AI in the world today.

Textbook Materials

We will use the following textbooks at various stages throughout the course.

- ➢ James, G., Witten, D., Hastie, T., & Tibshirani, R. (2013). *An introduction to statistical learning*. Springer. [e-book in PDF available at http://faculty.marshall.usc.edu/gareth-james/ISL/]
- ➢ Hastie, T., Tibshirani, R. and Friedman, J. (2009). *The Elements of Statistical Learning: Data Mining, Inference, and Prediction (2nd edition)*. Springer. [e-book in the PDF format available at https://web.stanford.edu/~hastie/ElemStatLearn]
- ➢ Goodfellow, I., Bengio, Y. and Courville, A. (2016). *Deep Learning*. MIT Press. [e-book in the HTML format available at http://www.deeplearningbook.org]

Additional course materials are prewritten lecture notes and reading materials consisting of research papers.

Grading Policies:

Your final course grade, which will be curved, will be assessed as follows:

- ➢ Homework assignments 20%
- ➢ Paper presentation 20%
- ➢ Proposal presentation 20%
- ➢ Research proposal 40%

There will be approximately three homework assignments, each carrying the same weight toward the final grade. The lowest homework score will be dropped. Each student is required to give a short in-class presentation based on a selected research paper. Each student will also briefly discuss his or her research ideas as they develop, and make a formal presentation of his or her research proposal at the end of the semester. The in-class presentations will be evaluated by the quality of slides, presentation, and discussions.

Research proposal. The research proposal is due on the date of the final exam. Each student will propose a research project and describe the data and methods to be used in executing the study. A detailed explanation of the contents of the research proposal will be provided as the semester progresses. The proposal will be graded based on its meeting the deadline, its completeness, its creativity and insight, its connection to the literature (where relevant), its feasibility, the quality of the research design, and its overall effectiveness and consistency with scholarly norms of communication (e.g., the writing is clear and grammatical, the material is well organized).

Grading Detail

Class Attendance: This is a small class so it is important for students to be present. Please do not schedule other activities such as interviews, case competitions, and consulting projects that conflict with the class meeting times. If you expect a conflict with an existing commitment, please let me know as soon as possible.

Assignment Submission Policy: Assignments must be turned in on the due date/time. Any assignment turned in late will receive a grade deduction.

Evaluation of Your Work: You may regard each of your submissions as an "exam" in which you apply what you've learned according to the assignment. I will do my best to make my expectations for the various assignments clear and to evaluate them as fairly and objectively as I can. If you feel that an error has occurred in the grading of any assignment, you may, within one week of the date the assignment is returned to you, write me a memo in which you request that I re-evaluate the assignment. Attach the original assignment to the memo and explain fully and carefully why you think the assignment should be re-graded. Be aware that the re-evaluation process can result in three types of grade adjustments: positive, none, or negative.

Course Calendar

Week	Date	Topic
1	Jan 8	Introduction and Research Overview
2	Jan 15	Research: Adding Structure to Unstructured Problems
3	Jan 22	Overview of Statistical Techniques and Hypothesis Testing
4	Jan 29	Statistical Analysis with Python *[Workshop #1]*
5	Feb 5	Causal Inference and Research Design
6	Feb 12	Modern Statistical Tools for Prediction, Variable Selection and Classification
7	Feb 19	Statistical Analysis with Python *[Workshop #2]*
8	Feb 26	Students Present Research Papers (1)
9	March 4	Students Present Research Papers (2)
10	March 11	Statistical Analysis with Python *[Workshop #3]*
Spring Break		
11	March 25	Discuss student research ideas
12	April 1	Deep Learning
13	April 8	Blockchain
14	April 15	Students Present Research Proposals (1)
15	April 29	Students Present Research Proposals (2)
	Summer 2020	*Collect and Clean Data*
	Fall 2020	*Analyze Data and Write Research Paper*