IEOR 4404 Simulation

Fall 2020 Project Description

1. Group members

Each group should have 2-4 group members. You can decide the members of your group. When working on your project, you are very likely to benefit from a group with diversity in terms of background and skillsets.

Please finalize your group before **Nov 15** and fill in your group information here.

2. Project Deliverables

a. Project proposal (Deadline: **Nov 29, 2020**)

Submit a one-page proposal on Courseworks. In this report, you should briefly describe

- The problem(s) you aim to tackle
- The value proposition of the project(s)
- The initial structure of the system
- If you will be using any data, describe the data
- Provide a general plan going forward.

The person in the group whose last name is first in alphabetic order will submit this under their name. The purpose of the proposal is for us to provide some feedback and will not count towards the final grades.

b. Final Report and Video (Deadline: **Dec 23, 2020**)

Written report: Submit a 3-5 page report on CourseWorks (with additional pages for appendices to present graphs and tables if needed).

In the report, please include the following

- The content of your report. Content of the project can include not limited to
    - Project background
    - The value proposition of the project
    - A detailed description of your model
    - Presentation of the results of your simulation.
        - Analyze the system output

        - Perform policy experiment for policy recommendation and optimization
        - Any variance reduction technique used
    - Discussion and conclusion
        - Contributions and Limitation of your model/result
    - List the role and contribution of each member to the project (Required)
- Links
    - Link to the Jupyter Notebook on your LionDrive (Required)
    - Link to the dataset stored on your LionDrive, if you used any (Required)
    - Link to the video presentation (Required)

Video: Record a 5-minute video presenting your project. Think about this as a video that a person would be able to know the whole pipeline of your project. A viewer should be able to get a good idea of what your project is without reading your report. The format can be as simple as you narrate a deck of slides. You are encouraged to be creative. Please upload the video to Panopto (link). Share the link in your report.

The person in the group whose last name is last in alphabetic order will submit this under their name.

3. Project Details

The goal of this project is to identify a business/policy problem and answer it using the simulation techniques learned from this course and/or other related courses. Based on the simulation model with reasonable assumptions, back up based on your experience, the literature, or actual data, you should be able to generate insights that help facilitate important business decision. Projects will be evaluated mainly on whether you managed to generate value for a potential stakeholder (director at a company, government official, industry reporter, etc.). In other words, someone should be willing to pay to see your presentation! We encourage you to be creative in finding interesting and relevant questions and constructing the simulation model (make sure that the model assumptions reflect the real-world). Be creative with your simulation problem and your methodologies.

You are expected to work closely as a group in defining their project, constructing the system, implement the system, collecting data when necessary, doing the analytics, developing the project presentation, and writing the report. In explaining your project, be concise and clear. Keep in mind that plots, tables, and other visual representations can be effective in conveying your ideas and findings. You will be assessed along with the following three criteria, with roughly equal weight.

(1) Value opportunity

What benefit can be achieved in terms of added value and/or cost reductions from this project? What is this project meaning to the targeted audience? The ideal project setting would be one in which there is a value opportunity, using the simulation model in a novel setting, if necessary, that

can be leveraged to capture this value. For the targeted audience, it can range from a small business owner to society as a whole.

(2) Analytics Rigor

Do the proposed simulation model and methodology capture the value identified above? That is is the simulation model do a good job describing the real-world setting? Are methodologies used appropriately? Are the models and methods implemented correctly in Python? Are the key assumptions well supported and validated? Is the model performance good enough to deliver the anticipated benefits?

(3) Clarity and Interpretability

Can you explain the landscape you are working in and how your problem fits into this landscape? Is the problem clearly defined? Are your final outputs easily interpretable? Is it easy to understand what you worked on and how it was done? Can someone reproduce your results based on your presentation and report? Can someone use your results to capture value?

We encourage you to find a topic that will be personally relevant to you. You can base your project idea on current or previous work experience. You may want to think of various topics you encountered as a student at Columbia. Your project could be based on an idea you have for a new business venture based on analytics. **Using the project that you have done from a different course is strictly prohibited. Avoid a project that has very little simulation components.**

In all cases, we are not looking for a fully functioning system. Rather, think of your project as a proof-of-concept prototype. Specifically, we are looking for a good problem idea, and then use simulation and assumptions (or data) that are sufficient to validate the potential of your idea. View your project and presentation as something you might use to demonstrate your idea to potential investors, consulting clients, policymakers, or senior executives. Ask an interesting question(s), construct well thought out simulation models, do proper analytics, and communicate them all effectively!

4. Data Sets References

Groups are encouraged to collect data by themselves. Some references of notable sources of data are listed below. These are just examples, and groups are encouraged to search beyond this list, as there many sources.

a. Fairness: http://fairness-measures.org/Pages/Datasets

b. Gapminder: https://www.gapminder.org/data/

c. Human Rights Data Analysis Group: https://hrdag.org/data-publication/

d. New York City open data: https://nycopendata.socrata.com/

e. U.S. open government data: http://www.data.gov/

f. World Bank: http://data.worldbank.org/

g. US Census Bureau: http://www.census.gov/main/www/access.html

h. Google trends: http://www.google.com/trends

i. Google finance: https://www.google.com/finance

j. Million song dataset: http://aws.amazon.com/datasets/6468931156960467

k. Data from academic papers, for example see data links in Esther Duflo's website: http://economics.mit.edu/faculty/eduflo/papers

l. USA Facts by Steve Ballmer: http://usafacts.org