

Intro to Stochastic Processes 426/626: End of Semester Project

Overview

Stochastic processes are an essential component of modern data analysis and simulation. They are used to describe real-world phenomena that involve uncertainty and variability, from stock market movements to weather patterns. The goal of the course project is to give you an opportunity to explore an application of stochastic processes that is of particular interest to you!

There are two different routes you can take for this project:

- (1) Find an article in a peer-reviewed journal in your area of interest that uses a stochastic process as a model for some “real-life” behavior or uses it to implement and/or analyze an algorithm.
- (2) Develop an *original* model using a stochastic process from this course of your choice and calibrate it to real-world data that you find or collect yourself.

You will submit (1) a **written report** giving a summary of the application and the model, including some related analysis and/or numerical experiments; and (2) give a 10-minute **in-class presentation** about your project during the final week of classes.

Timeline

- Choose a topic by **5pm Friday April 4** and email me a proposal of what you want to do (a few sentence description and/or outline describing your proposed project).
- In-class 10-minute presentations start on Tuesday, April 22. *Please let me know if there is a day this week that you cannot give a presentation and I will try to accommodate this. I will assign presentation days/times to the class as soon as all project topics are chosen.*
- Final report due by **11:59pm Tuesday April 29**.

Project Guidelines

General guidelines

- The written report should be no longer than 5 pages plus references.

- You are encouraged to type your written report using LaTeX, but you may also use Microsoft Word, Pages, etc.
- This is an individual project. You are welcome to discuss the project with classmates, friends, professors, or others, but the work you submit must be your own.
- Provide a references section with full citations of all sources used. (This means at least: article title, authors' names, journal title and year of publication.)

Content Guidelines

Your written report should include an introduction with history/background of the application, a section describing the model, and a section that provides some type of analysis related to what we learned in class and/or numerical experiments performed (i.e., an implementation of the algorithm you are considering with a dataset found online), and a discussion/conclusion section. Through the report, you should address the following questions:

- What real-life behavior (or computational task) are you/the authors of the article trying to study?
- Describe the mathematical model/algorithm that the authors/you propose and why this stochastic process was chosen to model this phenomenon.
- If the model is similar to something we have studied in class, discuss how some of the things we learned about it might be relevant to the application.
- Do the authors/you compare the predictions of their model (from theory or from simulations) with data from real-life observations or experiments? If so, what did they/you find?
- In what ways is the model unrealistic and how might the model be improved?

Your in-class presentation should provide an overview of the application and the model, and provide highlights from any analysis/experiments you performed.

Grading Breakdown

The project is worth 35% of your final grade, broken down as follows:

- (5%): Submitting proposal for the project by 5pm Friday April 4
- (35%): In-class 10-minute presentation (shows a good understanding of the stochastic process and application; describes the stochastic process and application in way your classmates may understand)
- (60%): Written report (showing a good understanding of the stochastic process and application; includes sections described above; addresses the questions listed above; clear, concise, well-organized writing style)