Final Project Report: Adding Sequential Analysis to the House Elevation Problem

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# 1. Introduction

## 1.1 Problem Statement

Clearly define the problem statement that your chosen feature aims to address. Explain the significance of this problem in the context of climate risk management.

With the recent federal infrastructure bill, American cities are set to spend billions to improve their water and flood systems among many others. However, with the growing concern on climate change’s impact on infrastructure, climate risk management is coming into the spotlight for future urban planning. However, the question of how to approach climate change forecasts remains in the minds of many researchers.

In the case of a property elevation problem, we have a property owner that is threatened by sea level rise and wants to elevate their property. Ideally, they would like to minimize costs and maximize benefits (e.g., flood protection, human safety, etc.). A simple model could take the current state(s) of the world and a possible decision (i.e., how high to elevate the property) to generate a potential solution for the owner.

However, in the real world, most decisions made by regular people are not static, but rather sequential. In other words, people can hold off from making a decision once they have more information about the world and/or have enough resources to perform an action (e.g., elevating a building). In this case, at each time step, a property owner can make a decision based on the state of the system (e.g., current sea level, current flood distribution, cureent building elevation, etc.) which can change at each time step. Additionally, in the real world, the property owner would also get some immediate feedback or reward like the cost of flood insurane and the cost of elevating.

By applying sequential analysis, we can utilize an adaptive policy that allows the property owner to make more accurate decisions based on the current state of the world, which can reduce costs while maintain or improve overall benefits. From this, researchers can possibly scale this model up to perform over neighborhoods, cities, and regions which can help property owners make informed decisions on elevating and advice future construction to consider adaptive structures that allows for future modifications and/or elevations.

## 1.2 Selected Feature

Describe the feature you have selected to add to the existing decision-support tool. Discuss how this feature relates to the problem statement and its potential to improve climate risk assessment.

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# 2. Literature Review

Provide a brief overview of the theoretical background related to your chosen feature. Cite at least two relevant journal articles to support your approach (see [Quarto docs](https://quarto.org/docs/authoring/footnotes-and-citations.html) for help with citations). Explain how these articles contribute to the justification of your selected feature.

## 2.1 [Using direct policy search to identify robust strategies in adapting to uncertain sea-level rise and storm surge](https://doi.org/10.1016/j.envsoft.2018.05.006)

This is from (**haasnootDynamicAdaptivePolicy2013a?**) which is amazing

# 3. Methodology

## 3.1 Implementation

You should make your modifications in either the HouseElevation or ParkingGarage module. Detail the steps taken to implement the selected feature and integrate it into the decision-support tool. Include code snippets and explanations where necessary to clarify the implementation process.

## 3.2 Validation

As we have seen in labs, mistakes are inevitable and can lead to misleading results. To minimize the risk of errors making their way into final results, it is essential to validate the implemented feature. Describe the validation techniques used to ensure the accuracy and reliability of your implemented feature. Discuss any challenges faced during the validation process and how they were addressed.

# 4. Results

Present the results obtained from the enhanced decision-support tool. Use tables, figures, and visualizations to clearly communicate the outcomes. Provide sufficient detail to demonstrate how the implemented feature addresses the problem statement. Use the #| output: false and/or #| echo: false tags to hide code output and code cells in the final report except where showing the output (e.g.g, a plot) or the code (e.g., how you are sampling SOWs) adds value to the discussion. You may have multiple subsections of results, which you can create using ##.

# 5. Conclusions

## 5.1 Discussion

Analyze the implications of your results for climate risk management. Consider the context of the class themes and discuss how your findings contribute to the understanding of climate risk assessment. Identify any limitations of your approach and suggest potential improvements for future work.

## 5.2 Conclusions

Summarize the key findings of your project and reiterate the significance of your implemented feature in addressing the problem statement. Discuss the broader implications of your work for climate risk management and the potential for further research in this area.

# 6. References