Introduction

The Problem

The problem that I will be trying to solve is how to optimize the Netflix homepage by minimizing the browsing time needed for users before they find a show to watch.

Although there are numerous possible factors that influence browsing time, I will be considering 3 specific factors, tile size, match score and preview length. The tile size is the ratio of a show's tile height to the overall screen height. The match score is a prediction of how much a user will enjoy that particular show or movie. The preview length is the duration of a show or movie's preview when a user hovers over its tile.

In order to minimize the browsing time, I will need to find an optimal configuration of these 3 factors that minimize the expected browsing time.

The metric of interest for this problem is *average browsing time*, and the response variable is a continuous measurement for browsing time of a user.

The data for my experiments are simulated from uploading a design matrix to an online response surface simulator that replicates the random assignment of 100 users to each condition and the observation of their response variable.

The region of operability for tile size is (0.1, 0.5). The region of operability for match score is (0, 100). The region of operability for preview length is (30, 120).

I will begin with factor screening in order to determine which factors significantly influence the response variable. I will then use the method of steepest descent as well as conduct a central composite design and use a second order response surface model to find the optimal configuration of the factor levels. I will go over these steps in detail in the following sections. I will be using a 0.01% significance threshold throughout this project since a p-value lower than 0.01 would present significant evidence against the null.

Goals of Response Surface Methodology

Response Surface Methodology aims to conduct a sequence of experiments to obtain an optimal response variable, utilizing information from prior experiments to aid in future ones.

This goal can be achieved by characterizing the relationship between the expected response and a subset of the design factors. The set of possible values that this subset of the factors can take is called the region of operability. This region is where we explore and run our experiments to find the optimal condition.

The function characterizing the relationship between the expected response and a subset of the design factors is unknown, so we fit models to approximate it. We typically use Taylor's Theorem and low order polynomials, especially in small localized regions of experiments, where low order polynomials should well approximate the function. However, second order models are used for response surface optimization since they are capable of modeling concavity/convexity.

An example of response surface methodology is using factor screening to identify factors that significantly influence the response variable, and then following up by optimizing that response with the method of steepest ascent/descent and response surface designs. Each experiment conducted uses information from previous ones and the goal is to find the optimal operating condition.