**Data:** University of Michigan Consumer Sentiment – The data is available from the St. Louis Federal Reserve FRED Economic Data site and represents a well known and commonly referenced representation of U.S. consumer sentiment. The source data is monthly and covers the time range from January 1, 1952 to January 1, 2022. Only data from January 1, 2002 to January 1, 2022 is used for the analysis. The resulting dataset contains the date and the relative sentiment score using the first quarter end measurement of 1966 as a baseline value of 100. No values are missing. The data is not seasonally adjusted. The data is converted from monthly scores to monthly percentage change. Because monthly percentage change is used, the December 1, 2001 sentiment score is used as the basis to calculate the initial percentage change.

**Input filename:** MI\_Consumer\_Sentiment\_2002\_2022

**Tools:** The code is written in R. The application is a Shiny web application using the standard ui and server components. The ‘cerulean’ theme from the shinythemes library is used for the interface color scheme. The R code was converted to a Shiny application and published to the deployment URL on shinyapps.io. The underlying model to fit and forecast the data is the Prophet model. The input data, described below, is a local csv file packed with app.R and published to shinyapps.io

**Project Overview:**

The monthly percentage change in U.S. consumer sentiment is fitted using an optimized Prophet model, and the application allows the application user (“Researcher”) to forecast 12 months of data. The Research will be allowed to change the flexibility of the growth and season specials, set one of the forecast periods to be a negative event, and determine the confidence level for the forecast. By setting the flexibility of the growth and season specials, the Researcher can include her expectations of month to month volatility and annual seasonality into the forecast. The exogenous variable allows the Researcher to determine the impact of a future negative geopolitical or economic event over the next 12 months. Note that these events are significant but unusual, so only one negative event is allowed for the forecast period. By determining the confidence level of the forecast, the Researcher can interactively review the possible ranges of monthly percentage change in U.S. consumer sentiment for the forecast period.

**URL to the Deployed Application:** <http://aesommers.shinyapps.io/Sentiment_Forecast>

**URL to GitHub repository:** <https://github.com/aesommersX999/D590Project>

**Team:** Team 7 - Andrew Sommers **Date:** April 30, 2022

**Final Project Document:** Application Details

**Title:** Forecasting U.S. Consumer Sentiment; Can a Sufficiently Robust Forecasting Model Be Developed?

**Details of the Forecasting Functionality:**

An optimized Prophet model, based on the evaluation of several models using different parameter settings, is initially selected for fitting the monthly percentage change in U.S. consumer sentiment. The exogenous variable is set to 0 for each month in the forecast period: No substantial negative geopolitical or economic events are expected. The confidence level is set to 85%. The defaults can be accepted, or the Research can change parameters as follows:

Growth Special – the initial value of the changepoint\_prior\_scale is set to .20 which allows a material amount of flexibility in the changes in trend and provides a good fit to the short-term trend in the data. The Researcher will be allowed to increase or decrease trend flexibility using a range of .10 to .30. The change will represent the Researcher’s expectation of future month to month volatility of consumer sentiment.

Season Special – the initial value of order is set to 10 Fourier terms which allows for a material amount of flexibility in the seasonal impact. The Research will be allowed to increase or decrease the seasonal impact using the range of 5 to 15 terms. The change will represent the Researcher’s expectation of the future seasonal impact on consumer sentiment.

Exogenous Variable – The Research can either except the default that no substantial negative geopolitical or economic event will occur or select a single month in the forecast period for a negative event. Again, these events are unusual, so only one negative event is allowed for the forecast period.

Confidence Level – The Researcher can select a confidence level and view the mean for the forecasted monthly percentage change for U.S. consumer sentiment with expected lower and upper values. The default value is 85%, and the application will allow the Researcher to select the confidence level in the range of 75% to 95%.

After the Researcher has selected the parameters for the forecast, the monthly percentage change for U.S. consumer data, using the historical data from January, 2002 to January, 2022, will be fitted with the Prophet model, a 12 month forecast will be generated and plotted, and the resulting forecasted mean values with the lower and upper range, based on the confidence level, will be displayed. The Research can reset the parameters and generate a new forecast.

Graphical user interface, application

Description automatically generatedGraphical user interface, application, Word

Description automatically generated

**Tab 2 – Interactive Forecasting**

**Tab 1 – Introduction to the Application**

**Details of Application User Interaction:**

Overview: The user interface will provide an explanation of the application’s functionality, allow for the Researcher to set parameters for the Prophet model, and generate the forecast. Visuals for the interface tabs follow.

**Breakdown of Work:**

The project team has a single member, Andrew Sommers.

**Interface Details:**

The Research is presented with an initial screen, Tab 1, that provides an overview of the application and the historical data used to generate the forecast.

Tab 2 provides a description of the forecasting functionality including the output and user definable parameters. All interactive functionality is provided on Tab 2:

The growth special flexibility can be set using a slidebar. The default value of .20. The flexibility can be set to any value in the range of .10 to .30. The default value provides the better fit of the historical data, however, the Researcher is allowed to adjust her expectations of the flexibility of the trend.

The season special flexibility can be set using a slidebar. The default value is 10 Fourier terms. The number of terms, order, can be set to any value in the range of 10 to 20 terms. The default value provides the better fit of the historical data, however, the Researcher is allowed to adjust her expectations of seasonality for the forecast.

The Researcher can input one negative event by entering the forecast month, from 1 to 12, for that event. The default value is 0 representing no significant negative event during the forecast period.

The Researcher can input the confidence level, from 75% to 95%, for the forecast. The default value is 85%.

The Forecast Button will generate the 12 month forecast, plot the historical data and the forecast with the selected confidence level, and display an output table of the forecasted values including the month and the lower bound, mean, and upper bound values. Lower and upper bound values are based on the selected confidence level.

The Reset Button will reset all values to the defaults.