

II. Instructor Notes

Disciplines/courses suitable for this project: This project is appropriate for any discipline with a forecasting goal in mind by identifying the current trends and seasonalities in data.

Degree of difficulty: M (moderately complex)

This project works best for time-series data with strong seasonality effects and enough historical data available. In order to forecast future prices, we use a machine learning package called Facebook Prophet. This package is a forecasting model that uses seasonality and trend in the historical dataset and uses these as the basis of future forecasting. One of the main advantages of the model is the fact that it is robust regarding missing data. Please read the paper using the link below to learn more about the Prophet model in the forecasting dataset. We use Python as a framework for our analyses, and we run the Python using the Anaconda platform. You can watch the video using the following link to learn more about this platform.

<https://peerj.com/preprints/3190/>

Resources/background needed:

Watch the short demo on Anaconda here:

https://anaconda.cloud/tutorials/getting-started-with-anaconda-individual-edition?source=win_installer

In addition to the links provided to the students, the following resources can be helpful:

<https://facebook.github.io/prophet/>

For general information on Anaconda and a quick guide for using the platform, please look at the link below:

https://docs.anaconda.com/anaconda/user-guide/?utm_source=anaconda.com&utm_medium=individual-get-started

The first step is to install the Anaconda on your computer. We use this platform for running the Jupyter Notebook, a web-based application to run codes in a Python environment. Depending on your operating system (Windows, Mac, or Linux), you can install an appropriate version of Anaconda on your computer following the link below.

For downloading stock prices and other economic indicators such as unemployment rates, housing prices, etc., we can use the following links:

<https://finance.yahoo.com/>

<https://fred.stlouisfed.org/>

About running individual or group projects: the project can be run individually or in a group of 2-3 students. The project has two major parts, 1- installing the Anaconda and getting access to the python environment; 2- following the codes and understanding the outcomes.

Note that python codes are case sensitive, and any minor changes in codes will result in an error. Students must not make any changes to the codes. However, they can copy/paste the error codes on Google and find out the issue related to their code in case of facing errors.

Discussion on the project duration: The project can start and finish in one sitting during class time. Each project requires only one variable with historical data. It does not matter how long the historical data can go back. However, the more data we have available as input, we can fit the better model to predict the future, thereby finding a better output. On the same token, is the number of days we use in the future for forecasting. For instance, if we use the historical price of stocks last year as our input and predict the next 30 days' stock prices, we get better and more reliable results than predicting the next six months of stock prices.

Open-ended questions:

Why is it important to predict the future prices of the measures you chose for this project?

Why do you think this measure is a good fit for this model? The answer to this question lies in the seasonality of the data.

Based on your final forecast, what kind of seasonality do you see in your model? Daily, weekly, or any other effects such as holiday effect?

Special instructions and assumptions: students need to know the basic autoregressive model behind this Facebook Prophet model. The simple autoregressive model we use here has a mathematical equation of $y(t) = g(t) + s(t) + h(t) + e(t)$ which all these elements represent trend, periodic changes, holiday effects, and error term respectively. $Y(t)$ is our variable of interest which we want to predict its future changes.

Further guidelines on evaluation:

Other information for faculty not covered above:

It is essential to spend one class describing the autoregressive models and their forecasting roles using historical data. The concepts of seasonality, trends, and utilizing the past data to predict future changes are very intuitive concepts for any student with any background. Having one session describing these concepts will help students realize what the software does to predict a model with the best fitting numbers.