**Reducing Restaurant Food Waste**

Luke Newman

**Project Design**

About 115,00 tons of food gets wasted in the United States alone each day. That is one-fifth of the total food supply in the US. 15% of this food is estimated to be wasted by convenient stores, 50% by consumers, and 35% by restaurants. In this project I forecast the number of customers several restaurants in Japan can expect each day in order to manage food prep and inventory more efficiently.

My first steps were to perform exploratory data analysis on each restaurant looking for feature relations, holiday impacts, and weather impacts. By doing this I found which holidays had a positive impact on customers and which holidays had a negative impact. Also, out of all the weather data I had it seemed only precipitation and average temperature had a correlation. With this knowledge I began feature engineering. For example, I made features out of the date like the year, month, day, weekday, weekend. Which holidays had a positive impact and which holidays had a negative impact. If the holiday was on the weekend or weekday. If the previous or next day was a holiday because one-day holidays had little impact on customers. After feature engineering I used SARIMAX to forecast. SARIMAX is a combination of simpler models making a more complex model and includes seasonality (For me this was the weekly cycle where restaurants are busiest on Fri-Sat and least busy Sun-Mon) and external features (All the features I engineered and weather data). After obtaining my MVP I tried two other models, Facebook’s Prophet and LSTM neural networks. SARIMAX gave me the lowest RMSE and hence chose it to be my final model. I repeated this process for five restaurants and created a tableau dashboard with each of their forecasts in a table and on a line graph as well as their location on a map. This dashboard is designed to make it easy for restaurants to see their past number of customers and their forecasted number 2 weeks into the future.

Now back to how forecasting restaurant’s customers can be used to reduce food waste. With a customer forecast, restaurants can prep food more accurately to match how many customers they expect. One example is on holidays. Some restaurants have their busiest days on holidays while others do not. If your restaurant does not bring in many customers on certain holidays, even if you think it might be different this year, don’t prep food according to your hunch because it will result in more food being wasted and a loss of money.

**Tools**

* Python
  + Pandas, NumPy, Sci-Kit learn, matplotlib, keras, SciPy, FbProphet
* Powerpoint

**Data**

I obtained data on over 200 restaurants in Japan from a dataset on kaggle. My dataset consisted of the number of customers per day, reservations, food genre, location, and Japanese holidays. After obtaining my MVP, I included weather data to see if it would improve predictive forecasting.

**Future Work**

I would like to collect data over a longer time period. This would help models see trends and seasonality over years. Also, data collected in shorter intervals (By hour). We can then make a model to predict customers during lunch time and dinner time respectively. My current models only work for restaurants who serve dinner. My model also can be used to help restaurants staff. Knowing exactly how many workers they need throughout the day can save money.