Madhav Parthasarathy
Understanding Covid-19's Effect on Commerce through Machine Learning
Mr. P Gopakumar
Menerva Software
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Executive Summary

During these trying times, the novel virus has taken its toll on the economy. As a result, there must be a method to prevent any further loss in revenue for grocers especially. I started this project off, by researching the topic and its previous applications. As the virus is quite new, I was made to improvise a solution using machine learning. After finding a certain amount of data, I was able to utilize machine learning in order to predict the sales through certain periods of time. Due to Covid-19, there had been an extreme disparity in the sales of grocery stores, and being able to predict these sales, will help prevent any further trouble.

Business Context

Menerva Software is a company surrounding the information technology industry, with heavy use of Artificial Intelligence. As Covid-19 has reached the global stage, its effect on commerce has been quite a large one. Menerva Software has been helping their clients automate certain services, which serves as an even larger boon during these trying times. Information technology is a service to those who are performing manual tasks that can possibly be automated.

Specifically, Menerva Software doesn't focus on certain issues with manual tasks; it focuses on a multitude of tasks such as centralizing data or productizing workflows through unique, automated solutions.

In my internship experience, I was mainly focused on the effect of the novel virus on grocery sales, and the returns possibilities of certain products during these times. Using Machine Learning, I was tasked with predicting grocery sales during these times and post-virus, and I was tasked with understanding the amount of possible returns by customers. For these certain projects, I was forced to perform my own research into understanding possible factors for changes in sales or returns, with certain websites explaining the issues people are going through during these times (Becdach 2). Additionally, I had to perform the same research for returns management, to understand the planning for certain goods in stores (Nunnery 1).

Business Project Description

There has been a huge hit in the economy due to the novel virus, and in order to understand which products are lacking in terms of sales, there must be some sort of analysis provided. As there hasn't been a situation similar to this previously, there was a level of mystery towards this phenomenon. In order to better understand my project, I had to investigate the factors surrounding the change in grocery sales, and after researching, I was able to begin formulating a plan for the code. The general format of my work for my business project, had been to spend the beginning researching heavily on the topic to be able to answer questions directed and posed towards me. Next, I would plan out the code I would be writing, and write pseudo-code. Finally, I write the code in python, and I would write up a description document of the projects I had been completing, in order for the audience of the code to be able to understand each line.

A small section of the first part of the project (predicting sales):

```
from sklearn.model_selection import train_test_split
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size = 0.3)
```

```
from sklearn.linear_model import LinearRegression
regressor_P1 = LinearRegression()
regressor_P1.fit(X_train, y_train)
```

```
LinearRegression(copy_X=True, fit_intercept=True, n_jobs=None, normalize=False)
```

```
X_test
```

	Week Number	Unemployment Rate	P1 CPI	Hyperbolic
14	15	14.7	122.610	1.747476
12	13	14.7	122.610	1.775904
0	1	4.3	120.977	1.000000
5	6	4.2	120.154	1.000391
6	7	4.2	120.154	1.003123

```
y_test
```

```
14    6.044469
12    6.237220
0     1.030000
5     1.030000
6     1.050000
Name: P1, dtype: float64
```

```
y_pred = regressor_P1.predict(X_test)
np.set_printoptions(precision=2)
y_pred
```

```
array([6.04, 6.24, 1.02, 1.03, 1.04])
```

A small section of the second part of the project (returns management):

```
df.shape
```

```
df['Total Return Sales'].unique()
```

```
:
```

```
:
```

```
: X = df[['Week Number','Sales Growth By Week']]
```

y = df['Total Return Sales'] y

```
: from sklearn.model_selection import train_test_split
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size = 0.3)
```

```
from sklearn.linear_model import LinearRegression
regressor_P1 = LinearRegression()
regressor_P1.fit(X_train, y_train)
```

```
X_test
```

```
y_test
```

```
y_pred = regressor_P1.predict(X_test)
np.set_printoptions(precision=2)
y_pred
```

Business Project Research

The main question I followed in my research project was “What is the general trend of grocery sales through the months in which the virus reaches its peak and after?” Using this question, there were multiple different branches I could venture into, as with sales, there is also analysis of returns, and understanding the possible factors that may affect these given quantities.

In order to properly research, I first began by asking my manager for introductory articles that may serve as beneficial for my later research. Using these articles, I would be able to understand where I should be looking, and what I should be looking for. After answering these questions posed, I was able to quickly find the best articles for my purpose, yielding significantly helpful information to use.

My manager has served as a really helpful resource for my project, as I would always be asking questions about my project, and from his years of experience in these fields of work, he was able to give me in depth answers, which I would record to later understand. I spent quite a bit of time understanding my mentor’s words, and I would also research on my own to gain an even further level of knowledge. I gained a new level of patience, and researching skills, as there were many articles that didn’t serve my purpose, and only a few that sufficed.

Generally, the limitations placed on me, were more coming from myself. This was the first time I had been in a work environment, and I had to essentially fight my way to a solution, as there were hard deadlines, and explanations I had to give in meetings. I was “thrown into the fire,” and I was finally able to get out of it through a lot of work. The only limitation I had was my lack of work experience. However, the other limitation was in the form of lack of data. This limitation could not have been controlled by the company, as the company is a startup.

Business Project Key Learnings & Recommendations

From this internship, I not only learned the technical skills necessary for pursuit of a future career in data analytics and machine learning, but I also learned how to stay determined in a real life scenario as an intern of a start-up company, with limited resources. From my business project, I was able to learn machine learning at a more applicable scale, with a unique problem in the coronavirus, and I was able to develop necessary researching skills.

As Menerva Software is a startup, the only recommendation I can make is to acquire more data to work with for projects. While this is extremely tough, as the company is a startup, I had seen some difficulties in my project for creating machine learning models with minimal data. However, this company has heralded an incredible internship experience for me, and I loved every part of it!

Annotated Bibliography

Becdach, Camilo, et al. “Rapidly Forecasting Demand and Adapting Commercial Plans in a Pandemic.” *McKinsey & Company*, McKinsey & Company, 7 May 2020,

www.mckinsey.com/industries/consumer-packaged-goods/our-insights/rapidly-forecasting-demand-and-adapting-commercial-plans-in-a-pandemic.

- I read upon this among many other articles to attack the issue of predicting sales post-covid. I used articles like these, to help me create ideas for my own code. I had to brush up on python and I had to learn machine learning for this.

“How To Forecast The Unforecastable: Demand Planning In The Time Of COVID-19.” *Retail TouchPoints*, 16 Apr. 2020, retailtouchpoints.com/topics/data-analytics/predictive-analytics/how-to-forecast-the-unforecastable-demand-planning-in-the-time-of-covid-19.

- I used this article for returns management, in order to predict the rate of returns in the future. I was able to understand the dynamics of grocers and consumers at a higher level, in order to help me with my pursuit of better returns management.

Appendices

ADMINISTRATION

Student Name:	**Madhav Parthasarathy**	**Student No:**	**121145**
Organization:	**Menerva Software**	**Mentor:**	**P. Gopakumar**

ATTENDANCE LOG

Date	Time Arrival Each Day	Mentor Signature	Time Departure Each Day	Mentor Signature	Hours On-Site Each Day
July 15th - July 17th	9:00		4:00		7 hours remote
July 18th- July 19th	9:00		12:00		3 hours remote
July 20th- July 24th	9:00		4:00		7 hours remote
July 25th- July 26th	9:00		12:00		3 hours remote

July 27th- July 31st	9:00		4:00		7 hours remote
August 1st- August 2nd	9:00		12:00		3 hours remote
August 3rd- August 7th	9:00		4:00		7 hours remote
August 8th- August 9th	9:00		12:00		3 hours remote
August 10th- August 14th	9:00		4:00		7 hours remote
August 15th	9:00		12:00		3 hours remote

Total hours: 188 hours

Predictions of sales in a specific time period:

```
: y_pred = regressor_P1.predict(X_test)
np.set_printoptions(precision=2)
y_pred
```

```
: array([6.04, 6.24, 1.02, 1.03, 1.04])
```

Infographic:

GROCERY SALES DURING COVID-19

Madhav Parthasarathy

PURPOSE

During these trying times, the novel virus has taken its toll on the economy. As a result, there must be a method to prevent any further loss in revenue for grocers especially.

METHOD

I started this project off, by researching the topic and its previous applications. As the virus is quite new, I was made to improvise a solution using machine learning.,

USING MACHINE LEARNING

After finding a certain amount of data, I was able to utilize machine learning in order to predict the sales through certain periods of time.

CONCLUSION

Due to Covid-19, there had been an extreme disparity in the sales of grocery stores, and being able to predict these sales, will help prevent any further trouble.

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