

CESI310 Final Project

By Andrew Mewrin, Nov 2023

Introduction

In this project we are prompted with a scenario and it is us to figure out how to resolve the issue. This project will introduce the scenario and walk through the development process to figure out and find a resolution to this problem.

Scenario

- You are the manager of a small pizza restaurant with a dining area and local and online delivery.
 - Identify one process that is not working well and could use improvement.
 - Process Identified: Delivery times are longer than expected.
 - Use ML Tools to gather information about this process.
 - Design a method to generate your own data set.
 - Design a method to improve the process. Use linear regression or poly regression ML tools to do prediction.
 - Use train/test procedure to estimate the performance of machine learning algorithms used to make predictions on your dataset.

Define (DMAIC)

In this step we need to clearly define the issue and scope of this project.

Define (DMAIC)

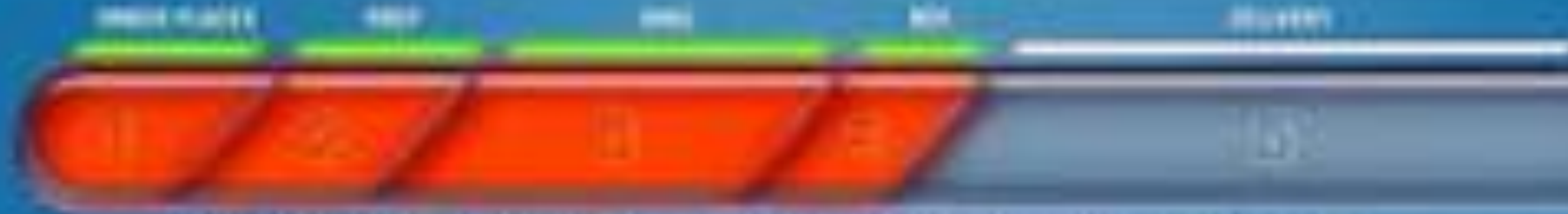
In this scenario, I am the manager of a small pizza restaurant with a dining area and local and online delivery.

- The identified process that is not working well and could use improvement is the:
 - Delivery Process:
 - Alleged Problem: Delivery times are longer than expected.

We will use our delivery tracker to measure the last leg when the Pizza is handed off to the delivery driver and measure the distance traveled and the time it takes for the delivery driver to get there.

PIZZA TRACKER

Not yet 20 minutes into the 90-minute People's Climate movement rally, the speakers were enthusiastically welcomed. The first speaker was David Ford, an old-time Marxist in that, under the leadership of his mentor, he's committed to the notion of social and class struggle. The 1960s hippie, whose youthful hair became grayer over



YOU GOT ORDER ASSEMBLY—your order was built for delivery at 12:17 PM.

PHOTON LEGAL STORAGE

Connect your members with any website.

YELLOW-CROWNED CORMORANTS

WASTE YOUR SAVING?



www.elsevier.com/locate/jmb

Pizza Tracker app

Measure (DMAIC)

In this step we need to measure our system based on the defined criteria.

Measure (DMAIC)

While using our delivery tracker to measure the last leg when the Pizza is handed off to the delivery driver. We measured the distance traveled and the time it takes for the delivery driver to get there.

Raw data has been acquired and cleaned using python.

	A	B	C	D	E
1	EmployeeID	EmployeeName	DistanceTraveled	DeliveryTime	
2	933dccf7-6d4e-4f88-8cd1-533fe44037b8	Roger Maynard	1.5047365609290382	31.64149702648497	
3	933dccf7-6d4e-4f88-8cd1-533fe44037b8	Roger Maynard	4.848488147702144	43.69761010556523	
4	933dccf7-6d4e-4f88-8cd1-533fe44037b8	Roger Maynard	1.4597954954586687	33.20527878430515	
5	933dccf7-6d4e-4f88-8cd1-533fe44037b8	Roger Maynard	6.320560289173169	28.46249573004317	
6	933dccf7-6d4e-4f88-8cd1-533fe44037b8	Roger Maynard	4.900297941919144	31.70764686678451	
7	933dccf7-6d4e-4f88-8cd1-533fe44037b8	Roger Maynard	7.291752811342407	23.150562264922755	
8	933dccf7-6d4e-4f88-8cd1-533fe44037b8	Roger Maynard	9.732364622842427	16.30410466685103	
9	933dccf7-6d4e-4f88-8cd1-533fe44037b8	Roger Maynard	4.698719947533325	34.37013879579042	
10	933dccf7-6d4e-4f88-8cd1-533fe44037b8	Roger Maynard	3.890088605	32.29357222406779	
11	933dccf7-6d4e-4f88-8cd1-533fe44037b8	Roger Maynard	6.942943188515978	42.90682277318069	
12	933dccf7-6d4e-4f88-8cd1-533fe44037b8	Roger Maynard	2.6328678888894075	12.486047780329063	
13	933dccf7-6d4e-4f88-8cd1-533fe44037b8	Roger Maynard	2.9923882171068987	31.89065152733751	

Pizza Tracker app dataset

Analyze (DMAIC)

In this step we need to Analyze the data obtained to find any root causes of defects we can.

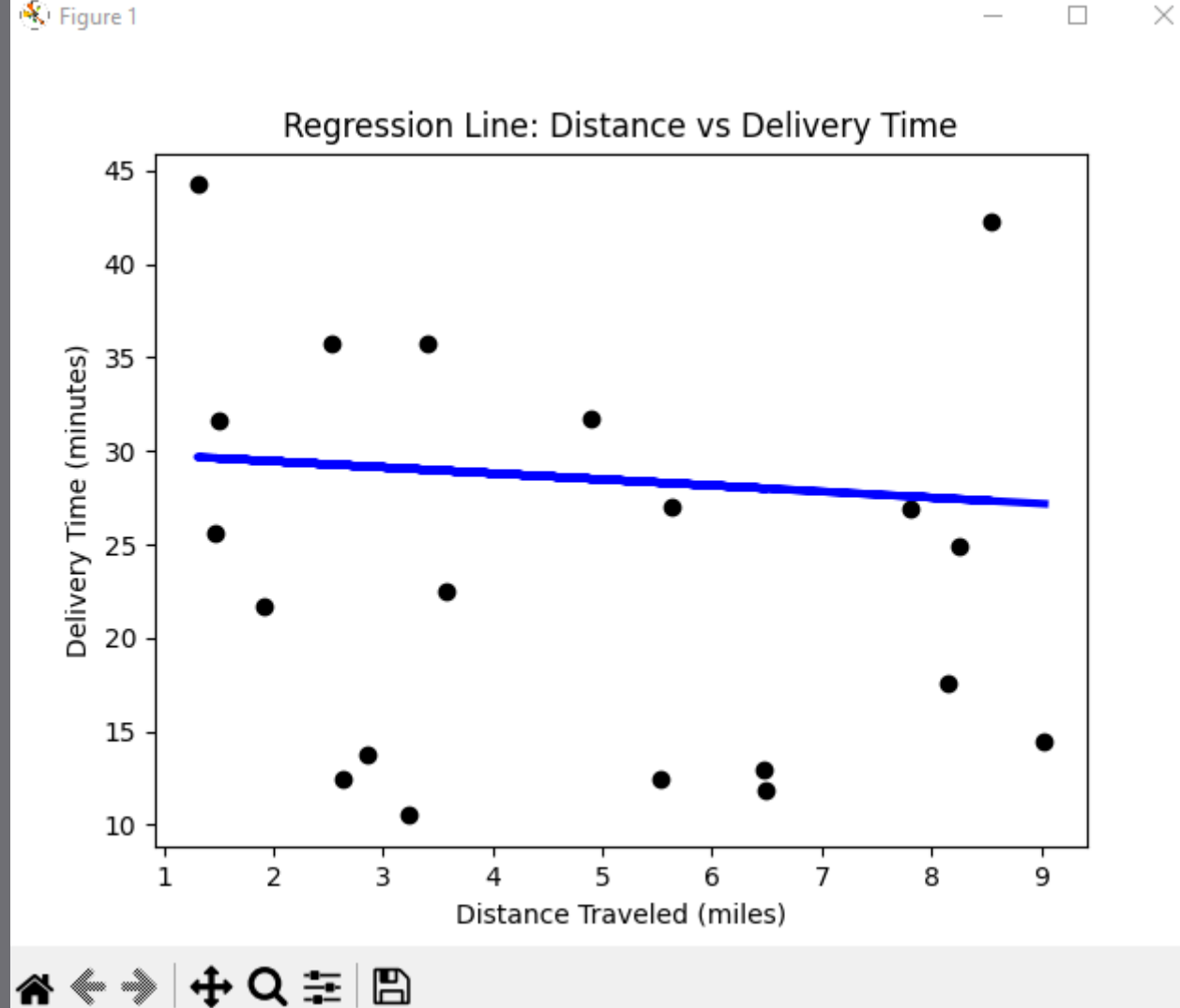
Analyze (DMAIC)

Here we have all our data, we will now put it through Machine learning algorithms to interrogate the data and find places for improvement.

```
24 # Make predictions on the test set
25 y_pred = model.predict(X_test)
26
27 # Evaluate the model
28 mse = mean_squared_error(y_test, y_pred)
29 print(f'Mean Squared Error: {mse}')
30
31 # Plot the regression line
32 plt.scatter(X_test, y_test, color='black')
33 plt.plot(X_test, y_pred, color='blue', linewidth=3)
34 plt.title('Regression Line: Distance vs Delivery Time ,')
35 plt.xlabel('Distance Traveled (miles)')
36 plt.ylabel('Delivery Time (minutes)')
37 plt.show()
```

```
Interrogate_Dataset.py > ...
1 #Created by Andrew Merwin, CEIS310, Nov 2023
2 import pandas as pd
3 from sklearn.model_selection import train_test_split
4 from sklearn.linear_model import LinearRegression
5 from sklearn.metrics import mean_squared_error
6 import matplotlib.pyplot as plt
7
8 # Load the dataset
9 df = pd.read_csv('pizza_delivery_dataset.csv')
10
11 # Split the dataset into features (X) and target variable (y)
12 X = df[['DistanceTraveled']]
13 y = df['DeliveryTime']
14
15 # Split the data into training and testing sets
16 X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)
17
18 # Create a linear regression model
19 model = LinearRegression()
20
21 # Train the model
22 model.fit(X_train, y_train)
23
```

Python program to interrogate the dataset



Python program to interrogate the dataset

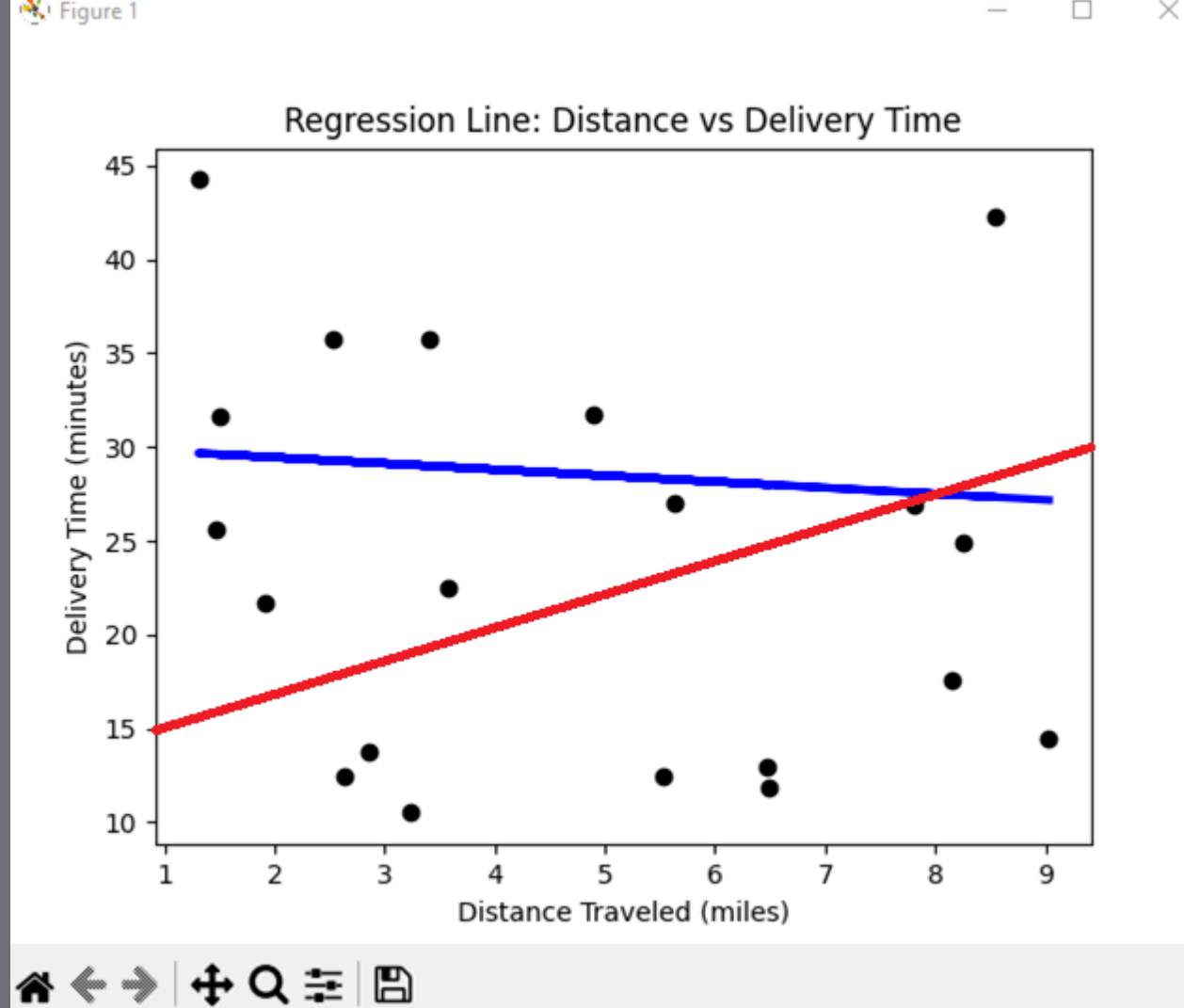
Improve (DMAIC)

Here we determine opportunities for improvement and implement the improvements.

Improve (DMAIC)

By comparing the analyzed data to company standards we can see that all data points above one standard deviation beyond the standard is WAY outside of the expected range.

Improvement implemented is to discuss these occurrences with the team and individual contributors.



Comparing linear regression model to company standards

Control (DMAIC)

This step involves implementing steps to control the process to ensure continuous improvement.

Control (DMAIC)

After discussing these findings with the team, they were able to identify routes through town that were very slow due to increased population foot traffic.

Employees were coached in avoiding these paths. Further corrections will be made if data doesn't improve next cycle.

Define, Measure, Analyze, Improve, Control

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Project Challenges

- This project forced me to dive deeper into Python than ever before and utilized machine learning algorithms I never before knew about.
- I had to read the source documents of scikit-learn to find the right methods of calling the regression tools used.

Career Skills

- Python Programming
- Machine Learning
- Industrial Problem Solving

Conculsion

In conclusion, we were able to use a systematic approach to problem solving by using Six Sigma principles and machine learning to find solutions to a perceived problem that became known through the use of data collection and interpretation.

This will be an exponentially valuable skill going forward.