

# TENNESSEE FUEL QUALITY ANALYSIS

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# OVERVIEW

- I. Our Question
- II. The Dataset
- III. Key Volatility Metrics
- IV. Time Series Analysis
- V. Logistic Regression Analysis
- VI. Conclusion & Next Steps

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# OUR QUESTION

Can we use data collected by fuel inspectors to better predict gas station fuel test failures in the state of Tennessee?





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# THE DATASET

*Five year fuel quality inspection records  
for the state of Tennessee*

- **Source:** State of Tennessee  
Department of Agriculture
- **Time Period:** Mid 2014 to early  
2019
- **Number of Fuel Products:** 11
- **Number of Test Types:** 72

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# KEY VOLATILITY METRICS

01

Distillation 50% - The temperature at which 50% of a sample is evaporated. Relates to the driveability and idling characteristics for the fuel.

02

Vapor Pressure - is a measure of the amount of vapor that is produced by a gasoline sample at 37.8°C (100°F). Vapor pressure most affects an engine's ease of starting.

03

Vapor-liquid ratio is the ratio of the volume of vapor to the volume of liquid at atmospheric pressure. Used to evaluate a gasoline sample's tolerance to changes in temperature.



3

AVOID SPILLAGE

DO NOT TOP OFF

Regular

\$ 0.99  
Price per gallon  
All taxes included



MINIMUM OCTANE RATING  
87-AVI / 2 METHOD

OUT OF ORDER

Mid Grade

\$ 1.19  
Price per gallon  
All taxes included



MINIMUM OCTANE RATING

OUT OF ORDER

Premium

\$ 1.49  
Price per gallon  
All taxes included



MINIMUM OCTANE RATING

OUT OF ORDER

Diesel

\$ 1.79  
Price per gallon  
All taxes included



ULTRA-LOW SULFUR  
HIGHWAY DIESEL FUEL  
(15 ppm Sulfur Maximum)

Required for use in all model year  
2007 and later highway diesel  
vehicles and engines.

Recommended for use in all diesel  
vehicles and engines.

DIESEL  
FUEL  
PRESS

# TIME SERIES ANALYSIS

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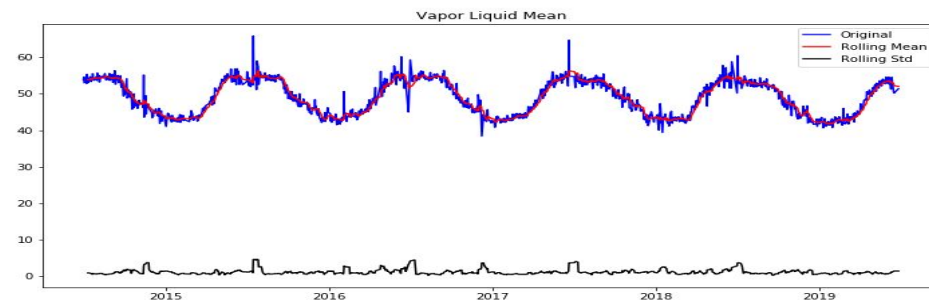
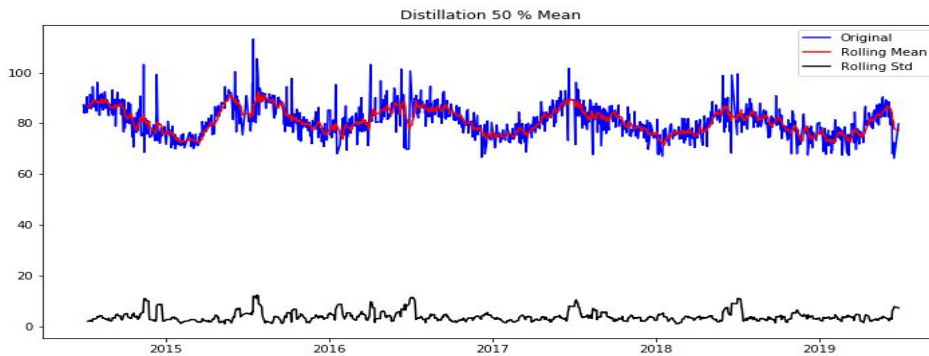
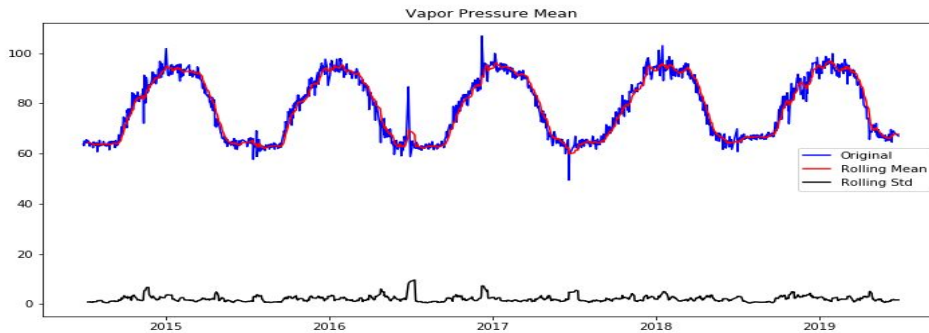


# Dicky Fuller Test of The Mean

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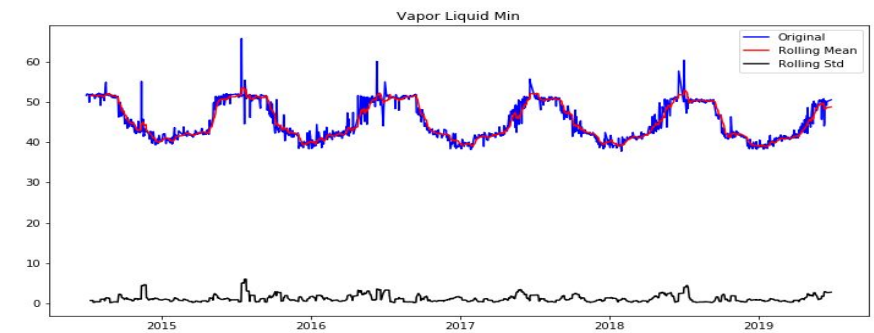
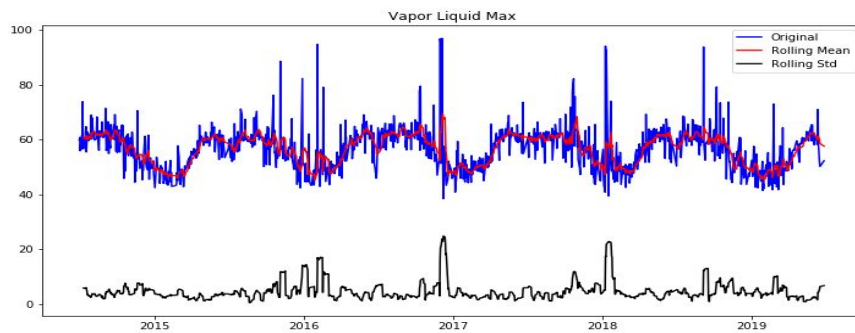
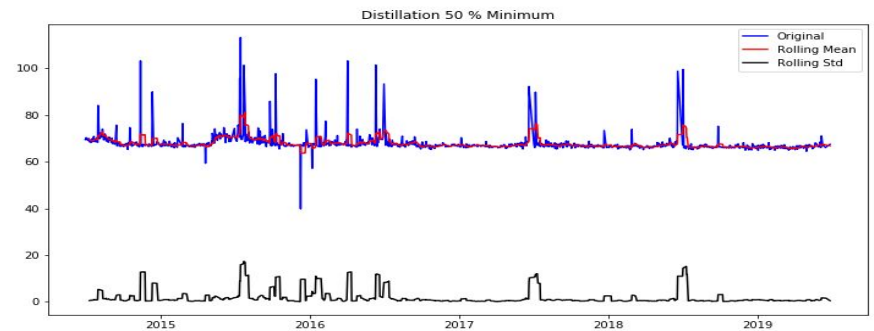
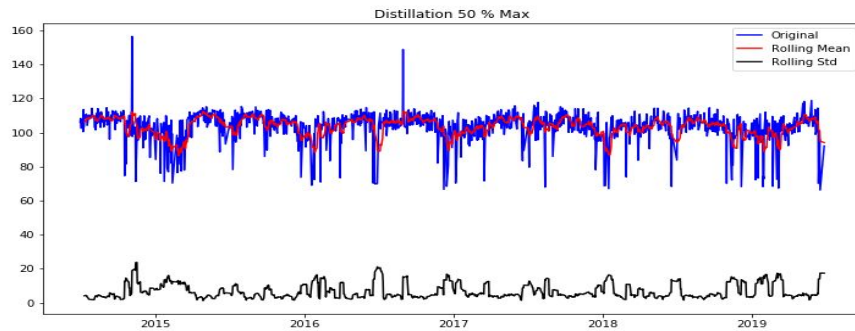
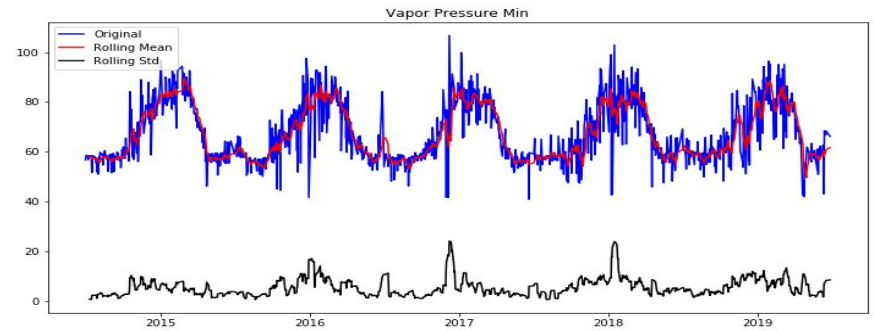
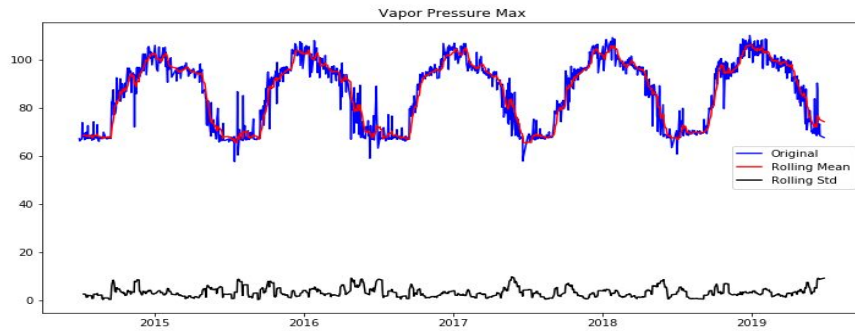
## Dicky Fuller Test

- Distillation 50% average is stationary above the 1% critical value
- Vapor Pressure and vapor liquid are stationary at all critical values



# Dicky Fuller

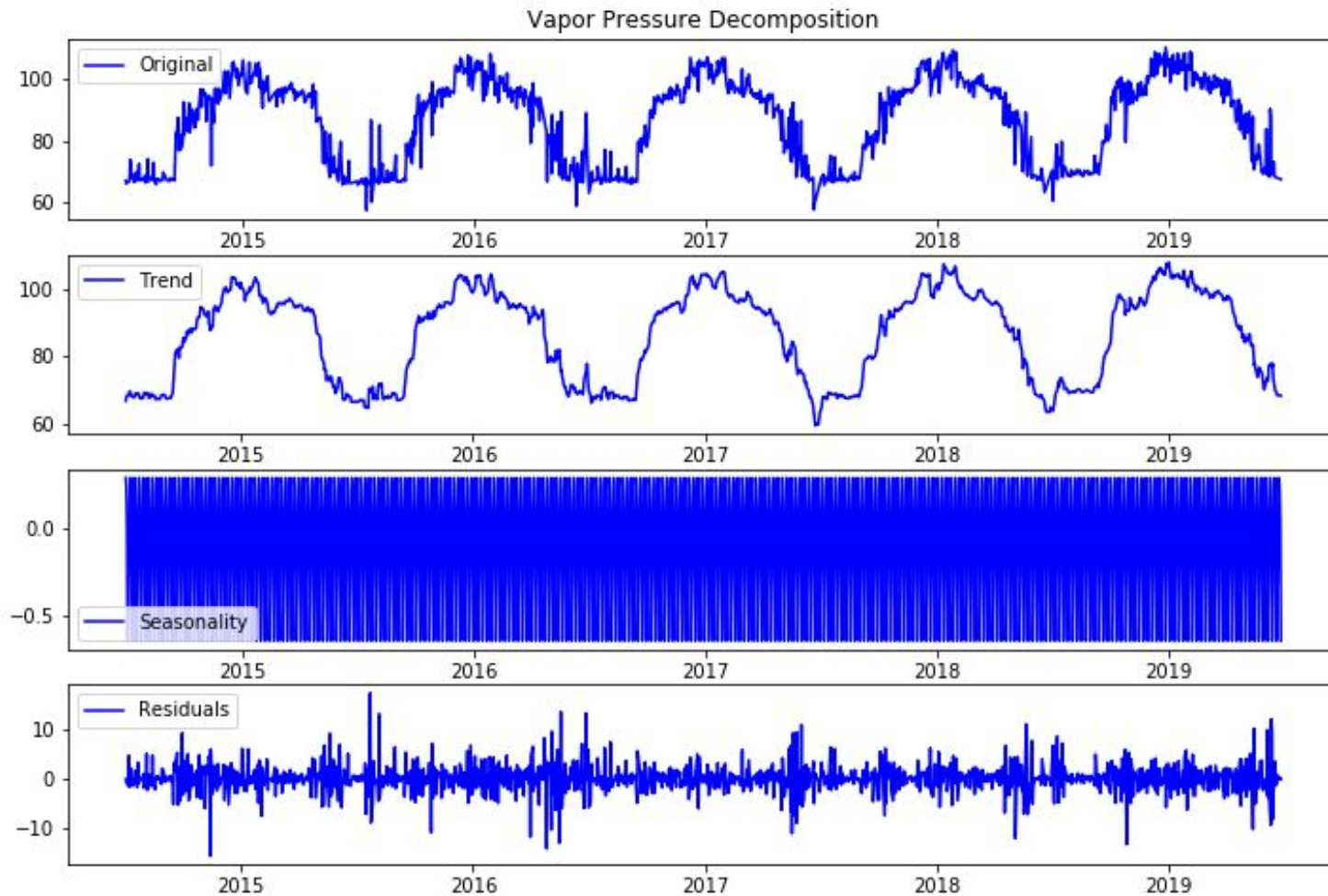
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# Seasonal Decomposition

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# LOGISTIC REGRESSION ANALYSIS

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# MODEL SELECTION

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## Chosen Model:

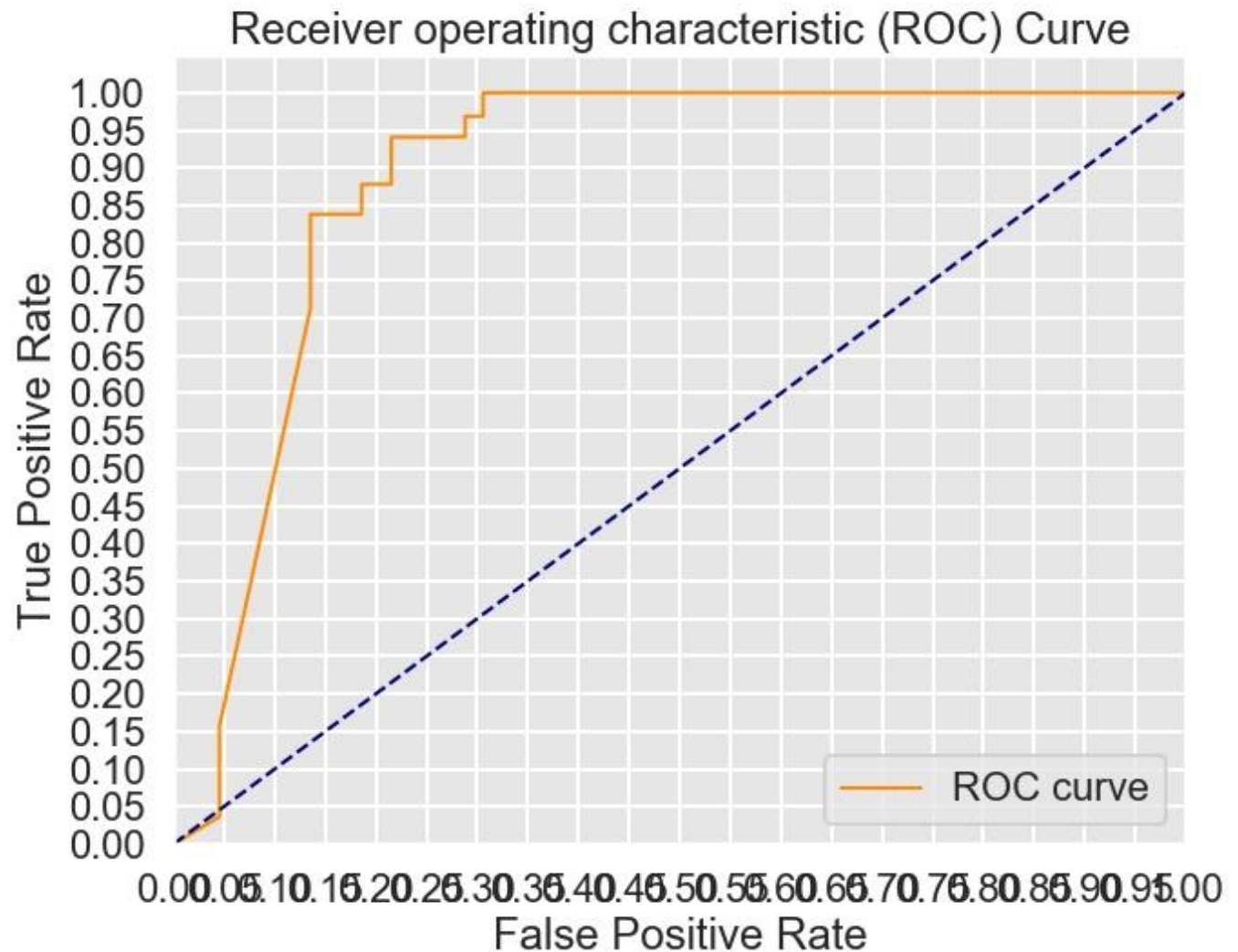
- Target Variable: Vapor Liquid-Ratio Test Outcome
- Predictor Variables: Tennessee Retailers Season & Grade

## Model Accuracy:

	PRECISION	RECALL	ACCURACY	F1-SCORE
TRAIN	0.88755	0.74867	0.79480	0.81221
TEST	0.94850	0.76702	0.83020	0.84816

# ROC CURVE

Vapor  
Liquid-Ratio Test  
Outcome ~  
Tennessee  
Retailers Season  
& Grade



# CONCLUSION & NEXT STEPS

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- There is obvious seasonal trends due to the nature of the regulations.
- Further analysis is required in order to interpret the logistic regression.

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- Do tests that pass but barely pass lead to more complaints?
  - Do certain regions of Tennessee have more failures in certain seasons
  - Do certain brands of gas stations or distributors deliver more failures or have more complaints against them?



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**THANK YOU!**

**QUESTIONS?**