Temperature & Energy Demand Modelling

How does Air Temperature affect Energy Consumption in Melbourne?

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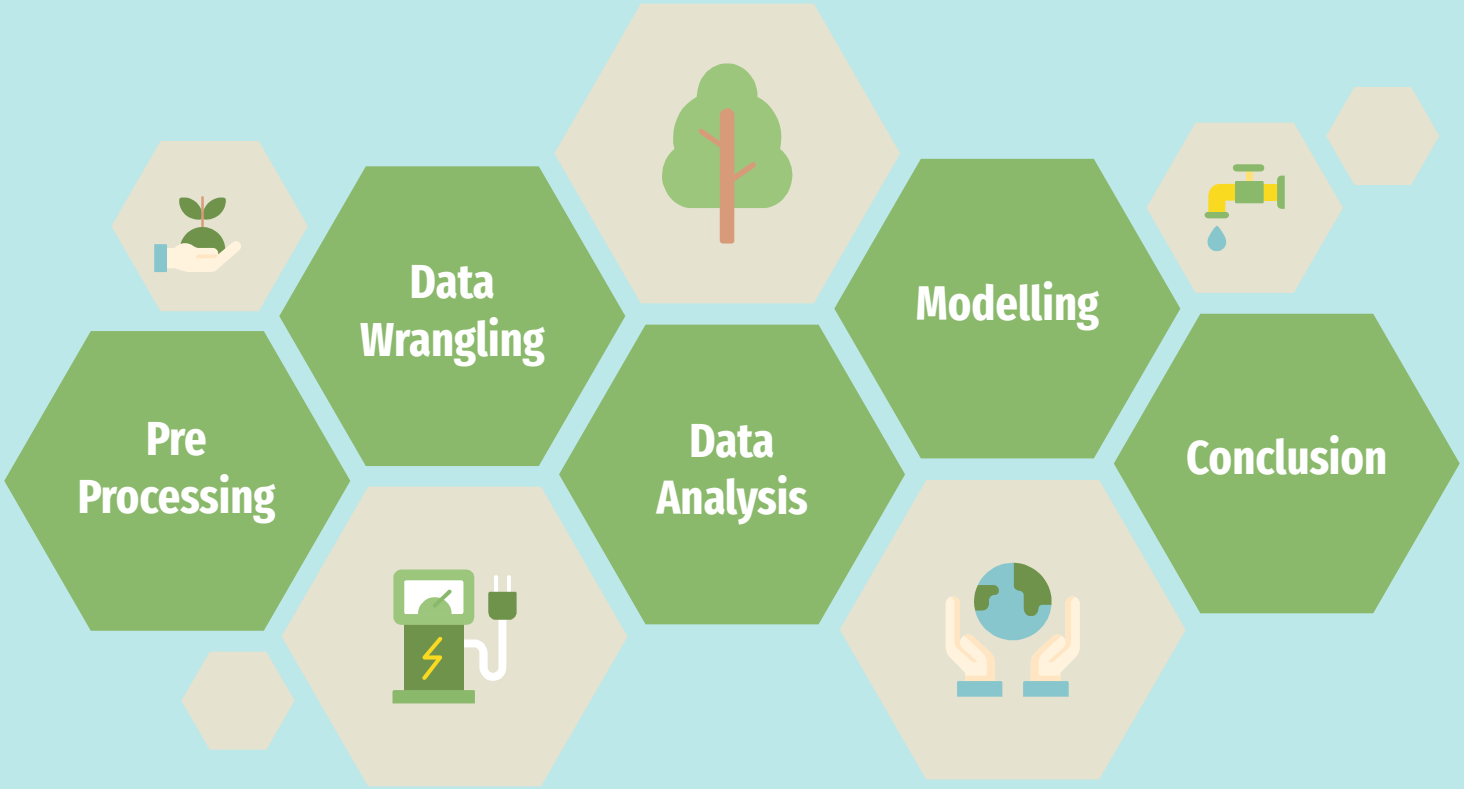
Overview


Pre Processing
Data Wrangling
Data Analysis
Modelling
Conclusion

Data Preprocessing and Wrangling

- Used Melbourne temperature (obtained from the Olympic Park weather stations) and energy demand data for years 2014 to 2019

- Cleaning the data
- Changed date-time formats so the datasets matched [used python concat to do this]
- Merged the temperature data set and the demand data set using pandas.

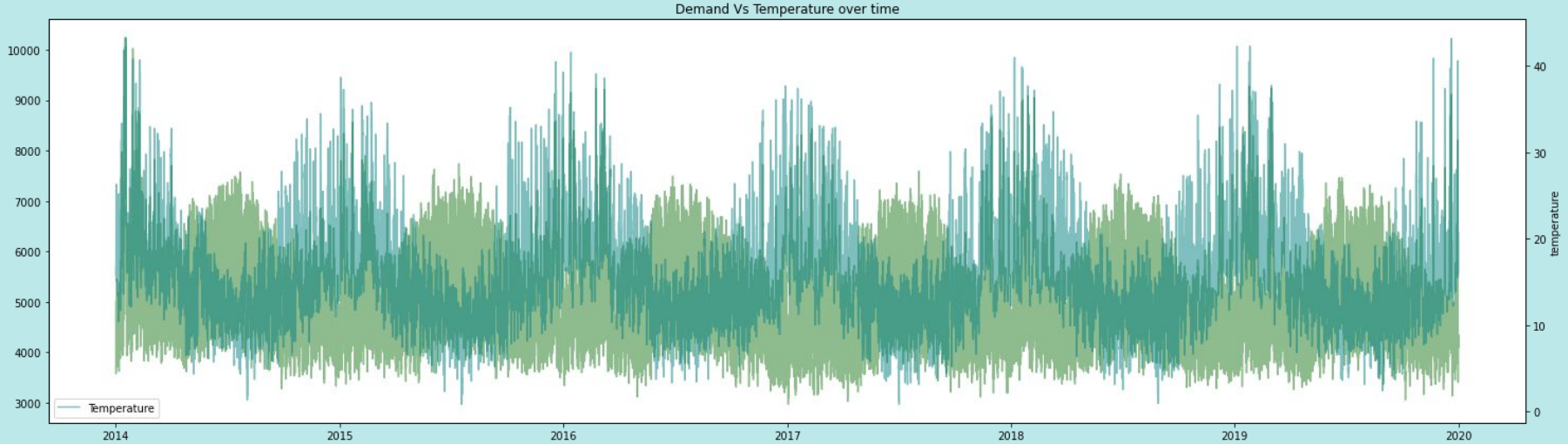
YYYY	MM	DD	HH24	MI
2013	5	31	15	0

Complications encountered:

- ★ Daylight savings
- ★ Temp data had missing values
- ★ Temp data includes temp for random timestamps (e.g. 12:33pm 5/1/14)

Data Visualisation

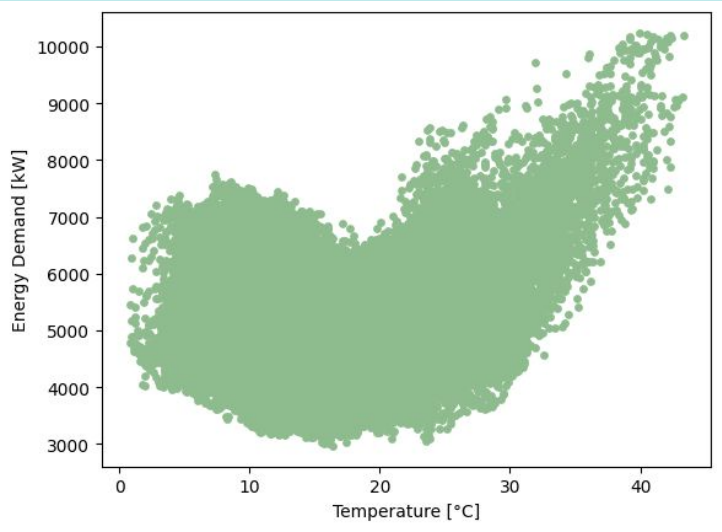
Dark green → Temperature
Light green → Energy demand



Energy demands increase during the colder months and warmer months. The biggest source of this is the usage of heaters and air conditioners by people.

Data Analysis

Energy demands are higher when temperature is relatively higher or lower than the moderate range



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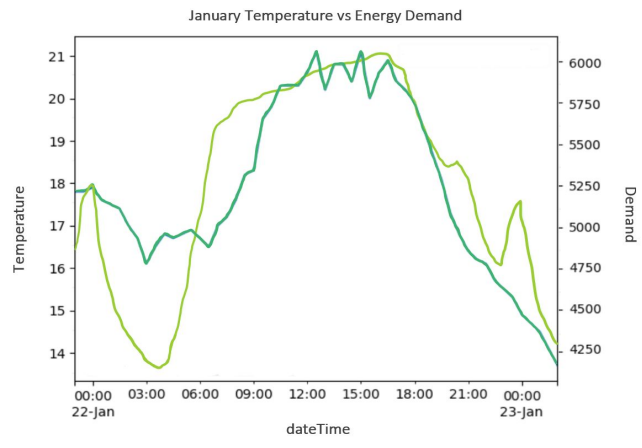
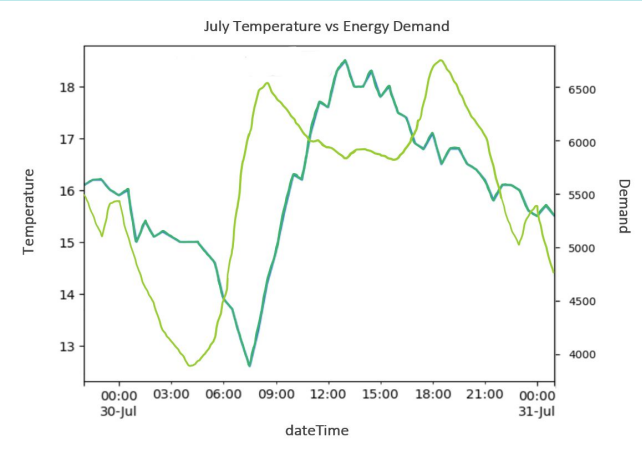




Predictive Modelling

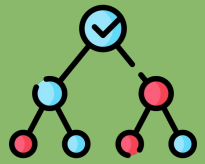
1

Linear Regression

2

Polynomial Regression

3

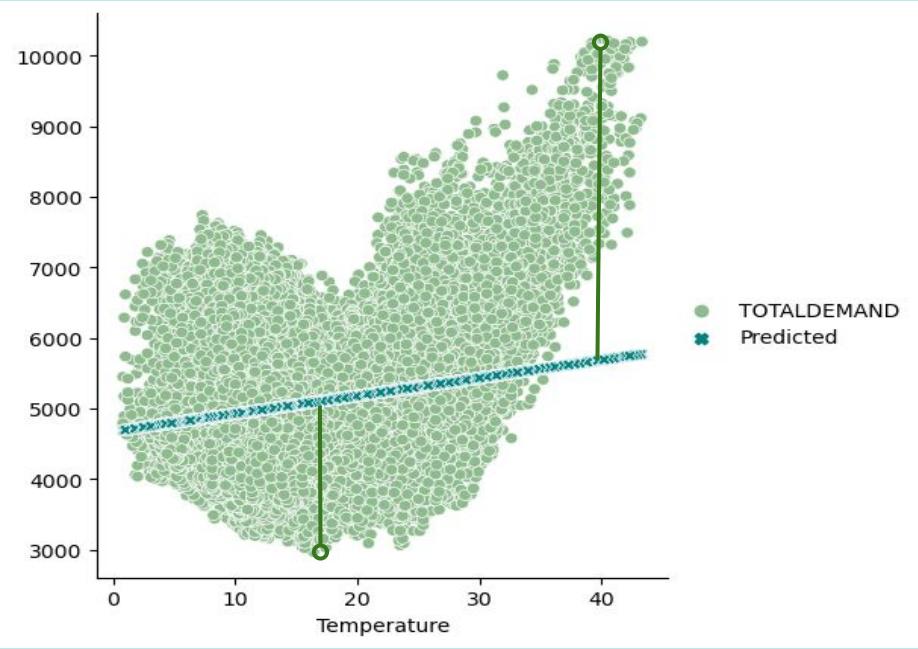


Random Forest

4

Neural Prophet

1 Linear Regression Model



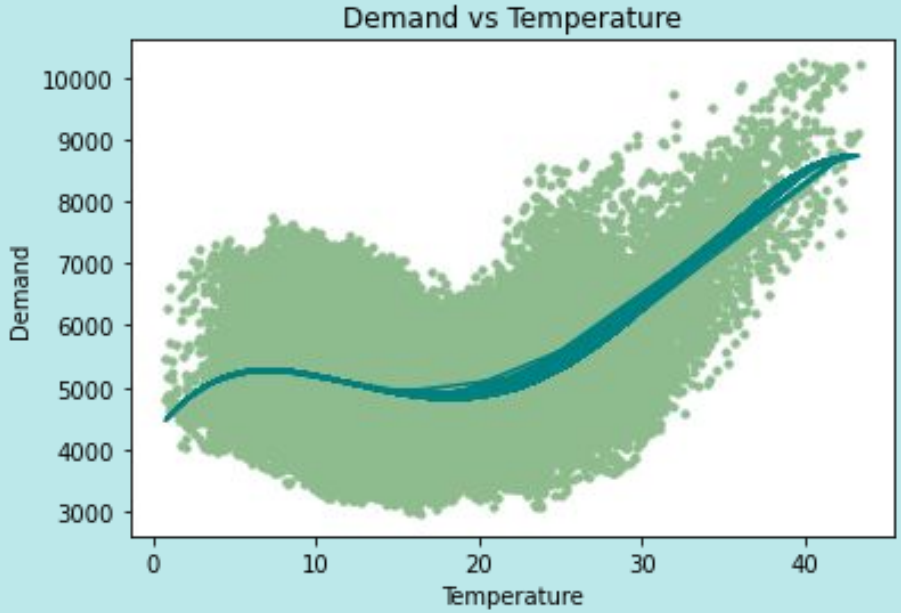
Total Demand = M * Temperature + C

Intercept: 4669.37
Coefficient: [25.38]
Training score: 0.027
Testing score: 0.025

RMSE score is 875.5192475930534
R2 score is 0.026199141681438776

This model is not a viable option

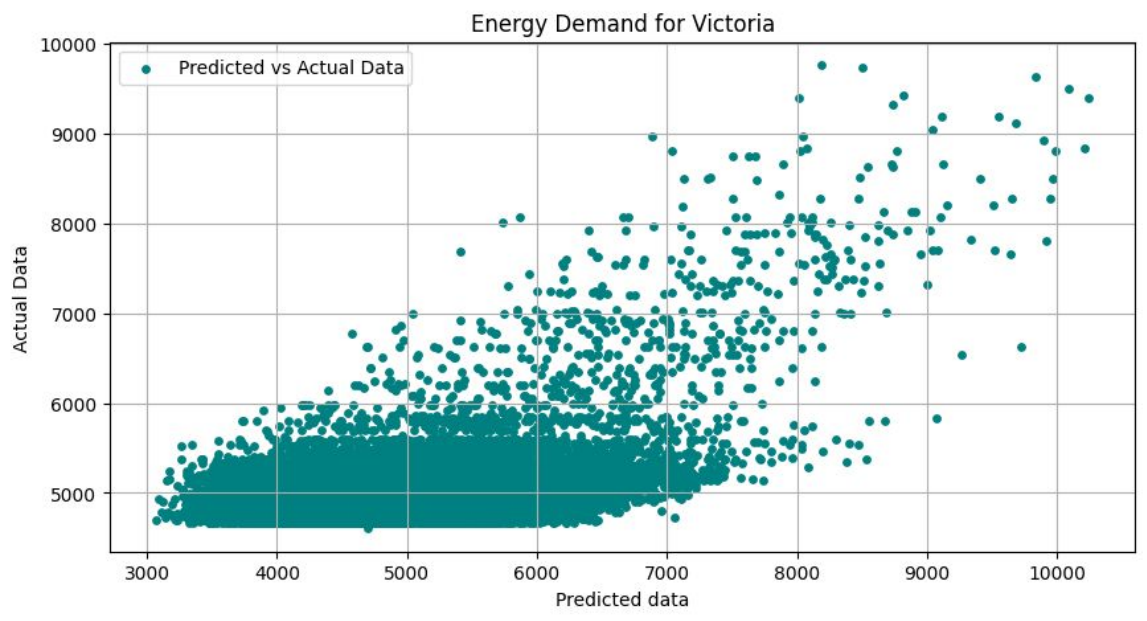
2 Polynomial Regression Model

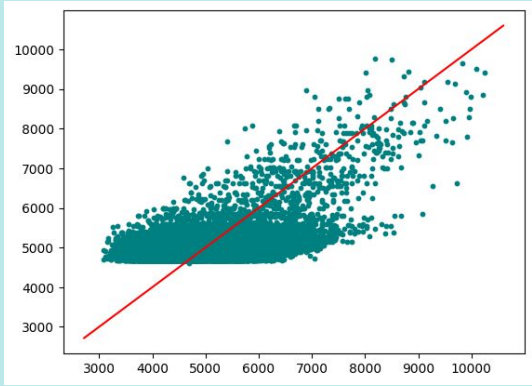


RMSE score is 804.8587071462244
R2 score is 0.18321616146167807

Bias	Variance
↑	↓
↓	↑

3 Random Forest Regression Model



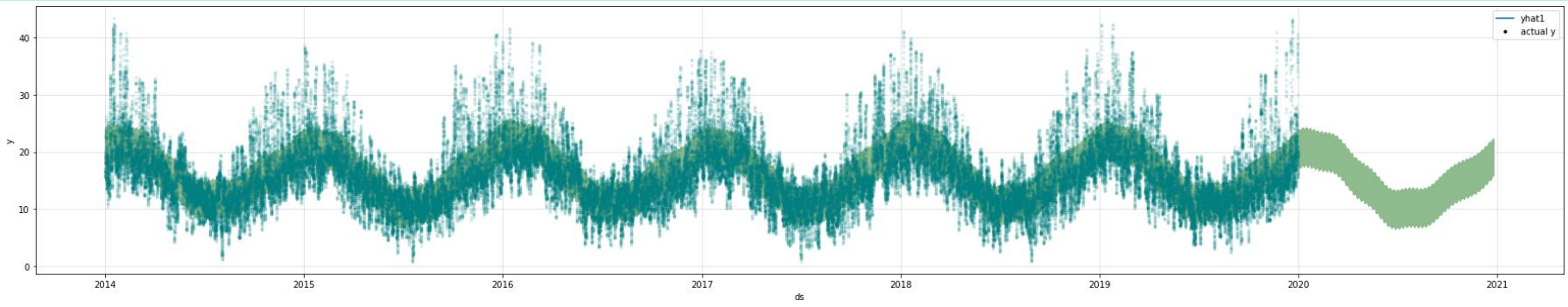


MSE = 635873.1820699641
RMSE = 797.4165674664429
(0.75% of values)

R2 = 0.19091718720056794

4 Neural Prophet Time-Series Forecasting Model

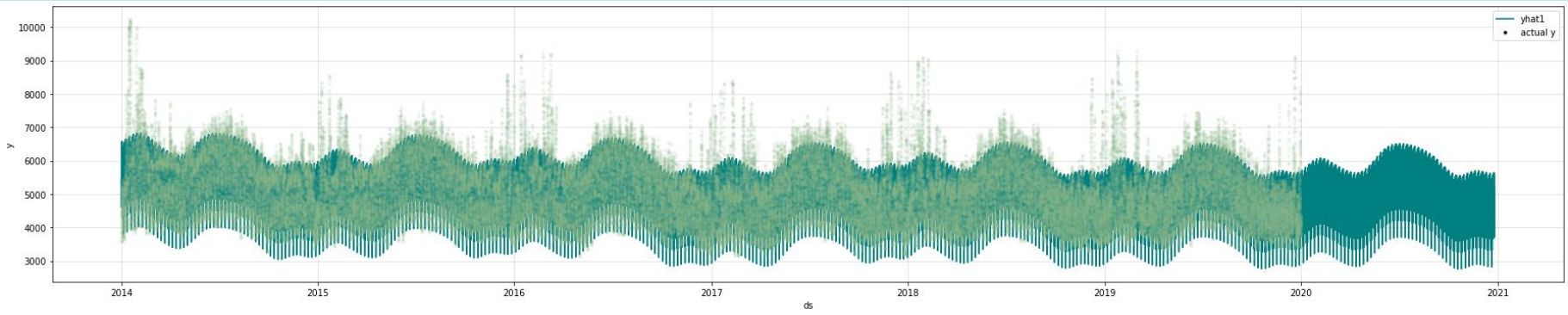
Forecasting temperature for 2020 based off previous years



RMSE score is 3.66
MAE score is 2.76

4 Neural Prophet Time-Series Forecasting Model

Forecasting energy demand for 2020 based off previous years



RMSE score is 529
MAE score is 383

Conclusion

Air Temperature and Energy Demand

Have high correlation but model accuracy has room for improvement

Best Forecasting Model

Neural Prophet time-series forecast was the best at forecasting energy demand