

# **COSC480 PYTHON PROJECT REPORT**

## **ANALYSIS OF CRIME PATTERNS IN THE BOROUGH OF CHRISTCHURCH**

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### **Abstract**

**Background:** Crime analysis involves analysing the trends and pattern of crimes. Data - driven analysis has become a crucial part in law enforcement agencies with the involvement of advance data analytics and computer power. The outcome and benefits from crime analysis would allow for strategic planning in crime prevention and manpower resources.

**Aim :** This report seeks to analyse the trends and patterns of burglary crimes reported in the borough of Christchurch which is fully based on a data set of the reported crime from Police NZ force with the use of python programming. The report also attempts to analyse whether there is any relationship between the crime and weather.

**Purpose:** This paper tends to examine the patterns of “Unlawful Entry with Intent/Burglary, Break and Enter” crime reported by the NZ Police in the borough of Christchurch, Canterbury for the year 2018 to 2019.

**Conclusions:** The report suggest a decrease in crime related to “Unlawful Entry with Intent/Burglary, Break and Enter” cases in the borough of Christchurch from the year 2018 to 2019. The findings also suggest that there is a very weak relationship between the level of crime cases and the temperature for the data observed.

## **Section 1: Main Purpose**

This paper tends to examine the patterns of “Unlawful Entry with Intent/Burglary, Break and Enter” crime reported by the NZ Police in the borough of Christchurch, Canterbury for the year 2018 to 2019. The patterns studied in this report includes the crime growth, month to month comparison and observing area units the crime most frequently occur within Christchurch. Statistics regarding these cases have a major impact on the reputation of an area. In the case of Christchurch, this study may be useful for potential international students and locals that are planning to buy a house. The reference to these types of statistics could help them in deciding safe areas to live.

The second objective of this paper is to explore whether the change of temperature in Christchurch may play a role in effecting the number of burglary cases.

## **Section 2: Data Description**

There are two main datasets analysed in this paper. The main data sets used are .txt format data set of 24 months period (January 2018 – December 2019) for Christchurch attained from the New Zealand Police website. According to the data, a total of 13,581 burglary crimes were reported in Christchurch occurred within those 24 months of period. The data are then pre-processed by filtering only useful variables such as Month, Year, Area Unit, location, Crime Type (of “Unlawful Entry with Intent/Burglary, Break and Enter”) by using python.

The second data consists of the average monthly temperature data that was obtained from the Weather Underground website. The original data includes monthly mean , maximum and minimum temperature. For analysis purposes, only data regarding the mean monthly temperature for both the years 2018 and 2019 were used.

## **Section 3: Analysis Techniques**

Techniques used in this analysis involved statistical analyses of statistical summary for extracting main statistical information and correlation analysis to explore the effect of weather on crime occurrence. In this analysis the Matplot and Numpy was used for comparing and visualizing crime growth over time period. Among the visualisation and techniques involved in this analysis are listed as the following:

1. Statistical Summary
2. Boxplots
3. Line Graph
4. Bar Chart
5. Area Unit Analysis
6. WordCloud Analysis

## Section 4: Results and Discussion

### 4.1 Statistical Summary and Box Plot

Figure 1 shows the statistical summary of the data observed. The statistical summary is considered an important part of an analysis as it demonstrates the key statistical information such as the Central Tendency, including the mean and the median of the data.

Statistical Summary for Burglary Cases 2018

	Year	Month	Burglary Cases	Mean Temperature
count	1.0	11.000000	11.000000	11.000000
mean	2018.0	6.000000	571.000000	11.241818
std	NaN	3.316625	77.313647	3.551613
min	2018.0	1.000000	490.000000	7.090000
25%	2018.0	3.500000	514.000000	8.420000
50%	2018.0	6.000000	539.000000	10.800000
75%	2018.0	8.500000	616.500000	14.150000
max	2018.0	11.000000	718.000000	17.020000

Statistical Summary for Burglary Cases 2019

	Year	Month	Burglary Cases	Mean Temperature
count	1.0	11.000000	11.000000	11.000000
mean	2019.0	6.000000	551.727273	11.558182
std	NaN	3.316625	48.891903	4.085748
min	2019.0	1.000000	488.000000	5.940000
25%	2019.0	3.500000	528.500000	8.460000
50%	2019.0	6.000000	547.000000	10.540000
75%	2019.0	8.500000	567.000000	15.710000
max	2019.0	11.000000	661.000000	17.270000

Figure 1: Statistical summary for Christchurch burglary cases

With the help of using the python software library, pandas, significant information regarding the data observed were able to be retrieved as shown in Figure 1. Since there was no data for the number of burglary cases in the January 2018, therefore, we excluded the data for both months in year 2018 and 2019 for a fair comparison between the two years. Based on the summary, the minimum number of burglary cases in 2018 is reported as low as 490 while in 2019 it was 488. The mean for 2018 is 571 while in 2019 is has a mean of 551.7. To visualize these statistical outcomes, boxplots were plotted as shown below.

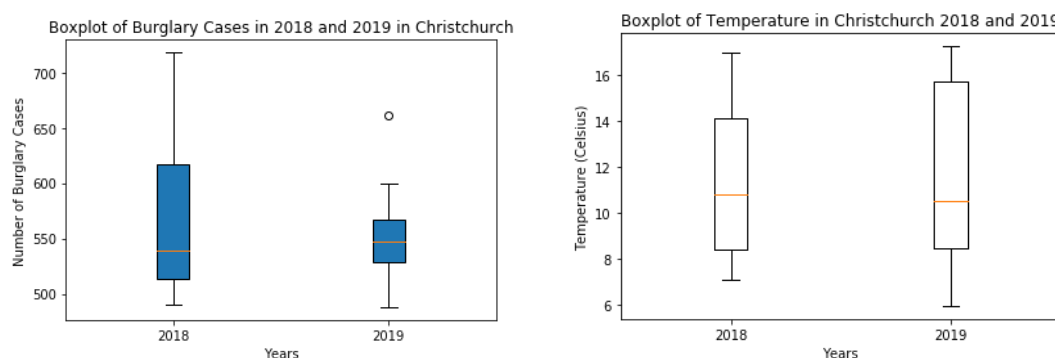


Figure 2: Boxplots

## 4.2 Monthly Comparison for Number of Burglary Cases

	Year 2018	Monthly Burglary cases
0	February	490
1	March	503
2	April	496
3	May	574
4	June	539
5	July	527
6	August	525
7	September	593
8	October	640
9	November	718
10	December	676

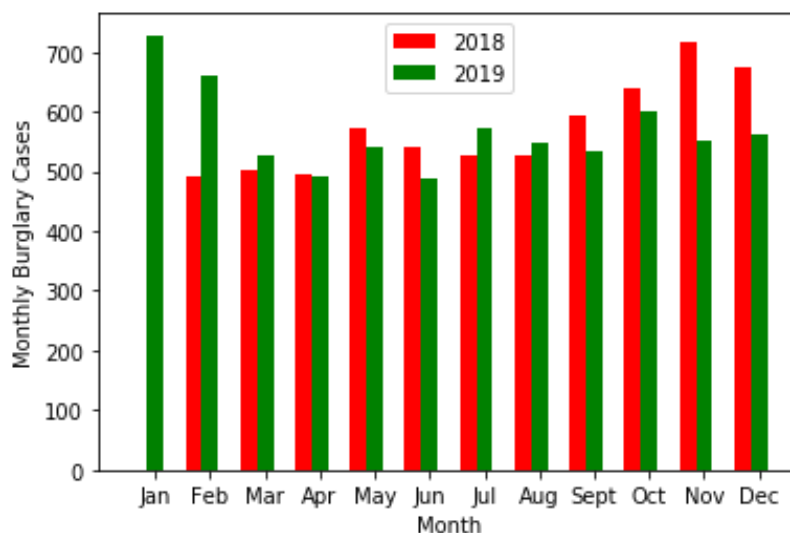
Total Burglary crime cases in 2018 is 6281 cases.

	Year 2019	Monthly Burglary cases
0	February	661
1	March	525
2	April	490
3	May	542
4	June	488
5	July	573
6	August	547
7	September	532
8	October	600
9	November	550
10	December	561

Total Burglary crime cases in 2019 is 6069 cases.

*Figure 3: Total burglary cases for 2018 and 2019*

Based on Figure 3, it is recorded that starting from the month February till end of the year in Christchurch had a total of 6281 burglary crime cases whereas the total decrease by 3% to 6069 cases.



*Figure 4: Month to Month Comparison*

Figure 4 was generated by using the library of numpy and matplotlib in Python. The graph demonstrates the number of burglary cases that had been reported in the year 2018 and 2019 on a monthly basis comparison. It reflects an overall decrease in the number of case reported in the year 2019 as compared to in year 2018. The lowest number of cases recorded is in February 2018 while in 2019, the lowest number of cases recorded was in June. January in 2019 was recorded the highest in 2019 while in 2018, November was recorded as the highest. It is observed that there is a continuous steep decline in 2019 from January till April from 728 to 490 with a decrease of 33%.

### 4.3 Area Units in Christchurch



Figure 5: Christchurch area unit burglary cases reported 2018 and 2019

Figure 5 shows a wordcloud that was developed by using the library Matplot in Python. A wordcloud was used to visualise the top 10 areas with the highest burglary cases out of 88 area units in Christchurch for both the year 2018 and 2019. Words seen most obvious are considered to have the highest number of case reports within both the years. Based on Figure 5, we can observe and estimate that the top 10 areas would be St Albans, Avon Loop, Cthedral Square, Barrington North, St Martins, Albans East, Upper Riccarton, North Beach, Woolston South and Shirley West.

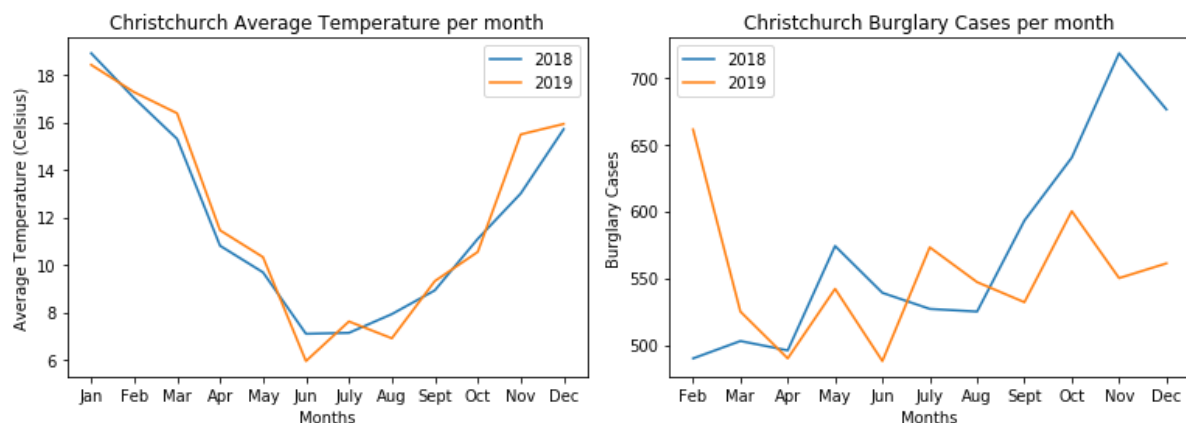


Figure 6: Left: Monthly Average Temperature, Right: Monthly Burglary Cases

Based on Figure 6, it is observed in September and October that there is a pattern of constant increase in both the average temperature and burglary cases in both year 2018 and 2019. Within the the months of May and June, it is seen that there is a pattern of continuos decrease in both the average temperature and number of burglary cases in both the years. Between April and May, the number of burglary cases both increased when during that time there was a slight decrease in the average temperature for both years.

For in the early months of the year in Feburary and March, as the temperature goes down, the lines representing number of burglary cases are not moving the same direction. In 2018 the pattern shows an increase while in 2019 there is a decrease. Another contradicting pattern is shown between the month of October and December in the number of cases whereby when in 2018 the

number of cases decreased in contrast, the number of cases increase in 2019. In November to December, the pattern in number of burglary cases moved in opposite directions . From both graph shown in Figure 6, we can conclude that the temperature may have some influence to the number of burglary cases occurred in Christchurch.

#### 4.4 Scatter Plot of Temperature & Number of Burglary Cases

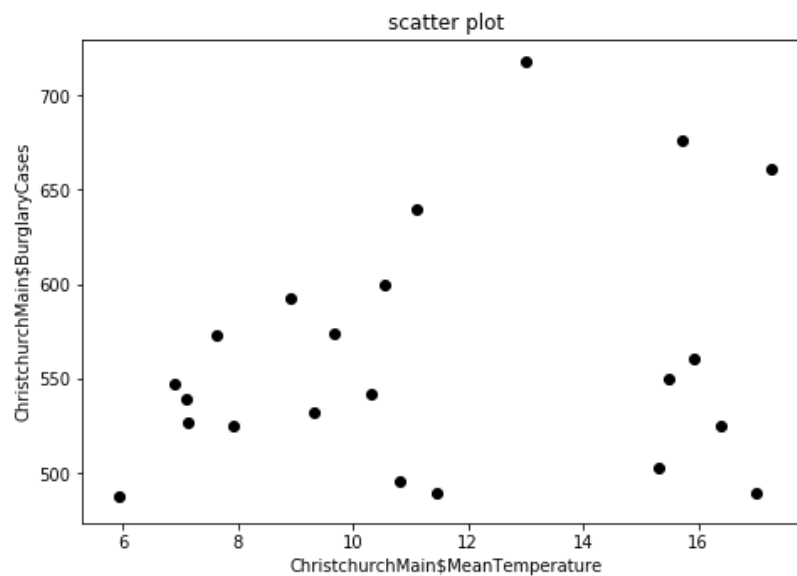


Figure 7: Scatter Plot of Temperature & Number of Burglary Cases

Further investigations by using a scatter plot using Python were made to further our analysis in identifying possible relationships between the weather and burglary cases in Christchurch. The calculation of the correlation coefficient was also been done to measure the statistical relationship between the two variables. The scatterplot in Figure 6 illustrates that the points are randomly scattered which suggests a weak relationship between the two variables. Based on the calculation of the coefficient correlation based on the scatterplot above, the results showed that the strength of the correlation for the above analysis is 0.24 which is considered to be quite small. As stated by Cohen (1988), the strength of the correlation that is considered small is between 0.10 to 0.29. Therefore, based on the results shown, it suggests that either a very weak relationship or probably no relationship between the increase in temperature in contributing to the increase in the number of burglary cases in Christchurch. However, since the data collected in this paper is considered small regarding the information of burglary cases and the temperature within two years only, therefore, further analysis in extended period of time is recommended.

## Conclusion

Overall based on the analysis been made, it is seen that there has been a decrease in the number of burglary cases in Christchurch from the year 2018 to 2019. An important thing to highlight here is that the number of burglary cases reported however does not portray the actual data of the number of cases that has occurred within Christchurch as the data collected here are just based on the number of “reports”. Therefore in order to increase the accuracy in collecting data regarding the report of a certain crime case, it is suggested that improvements in terms of data reporting should be made to reduce the number of unreported cases for the benefit and awareness of the society.

The analysis between the two years in this paper also shows us that there is a weak relationship between the temperature in Christchurch and the number of reported burglary cases. Analysis of the area unit in Christchurch in visualizing the top 10 area units most frequently burglary cases have occurred within the years between 2018 and 2019 was included also in this analysis because it is believed that the visualization of this part of information could be helpful to residents and international students in making choices of which area is safe to live in identifying the safety of their surrounding living area based on previous reports of cases that have occurred. Therefore, if the area they are living has been listed as one of the top 10 most risky areas for the crime to occur, extra safety should be taken by them.

Overall, it is very crucial to carry out a systematic analysis of crime for the law enforcement agencies such as the police here in Christchurch. With deeper techniques available in data analytic, the police could lay out strategies such as focusing manpower on identified crime areas and time (Matthies, C., Chiu, T., 2016). Further future studies regarding this topic by gathering more data for instance by including more years, involving the economic data , and more detail of weather variables are recommended as this could help improve the study of this topic research by helping to give a clearer picture on the effects that weather may have on the crime rate.

## REFERENCES

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