CRIME DATA VISUALIZATION USING R

Prepared By:
Aditya Kumar Pandey
MTech (AI & DS), 240201001
Dept. of CSE, IIIT Bhagalpur

Submitted To:
Dr. Om Prakash Singh
Assistant Professor
Dept. of CSE, IIIT Bhagalpur

INDEX

CASE STUDY
INTRODUCTION

- This case study explores crime patterns across Greater Manchester using R.
- Focused on spatial and temporal crime analysis using charts, maps, and trend lines.
- Aimed to uncover which areas and times are most affected by different crime types.
- Visualizations help inform law enforcement, city planning, and public safety policies.

PROBLEM STATEMENT

- Large crime datasets are difficult to interpret in raw form.
- Manual pattern recognition is not scalable.
- Visualizations allow quick insights into trends, hotspots, and crime severity.

DATASET INFORMATION

Source:

- Crime dataset obtained from Kaggle – focusing on Greater Manchester police reports.

Format:

- CSV file with 7 features (columns) and thousands of records.

Feature	Description
date	Date when the crime was reported
bourough	Administrative area (e.g., Manchester, Bolton)
location	Descriptive location (e.g., On or near Supermarket)
lsoa	Local geographic unit used for UK statistics
category	Type of crime (e.g., Burglary, Drugs)
lat	Latitude coordinate of the incident
long	Longitude coordinate of the incident

LIBRARIES AND PACKAGES

ggplot2

- Used for creating powerful and elegant visualizations including line plots, bar charts, heatmaps, and scatter plots.

dplyr

- Core package for data manipulation – filtering, grouping, summarizing, arranging, and mutating data.

readr

- Efficiently reads CSV files and handles data import with better performance and fewer type issues.

lubridate

- Simplifies date and time parsing and manipulation (e.g., extracting months or years from timestamps).

reshape2

- Used for reshaping data frames, especially helpful for heatmap creation (e.g., melt() function or table() + conversion).

DATA PREPROCESSING

- Dataset Loaded from CSV
- Initial Exploration
- Converted Data Types
- Checked Missing Values
- Post-Cleaning Summary

DATA PREPROCESSING

- Loaded crime data from a CSV file into a data frame.
- Displayed structure and summary of the dataset to understand the variables.
- Converted date column from character to Date format for time-based analysis.
- Converted borough and category columns from character to factor for efficient grouping and plotting.
- Checked for missing values using colSums(is.na(...)).

DATA PREPROCESSING

Initial Exploration

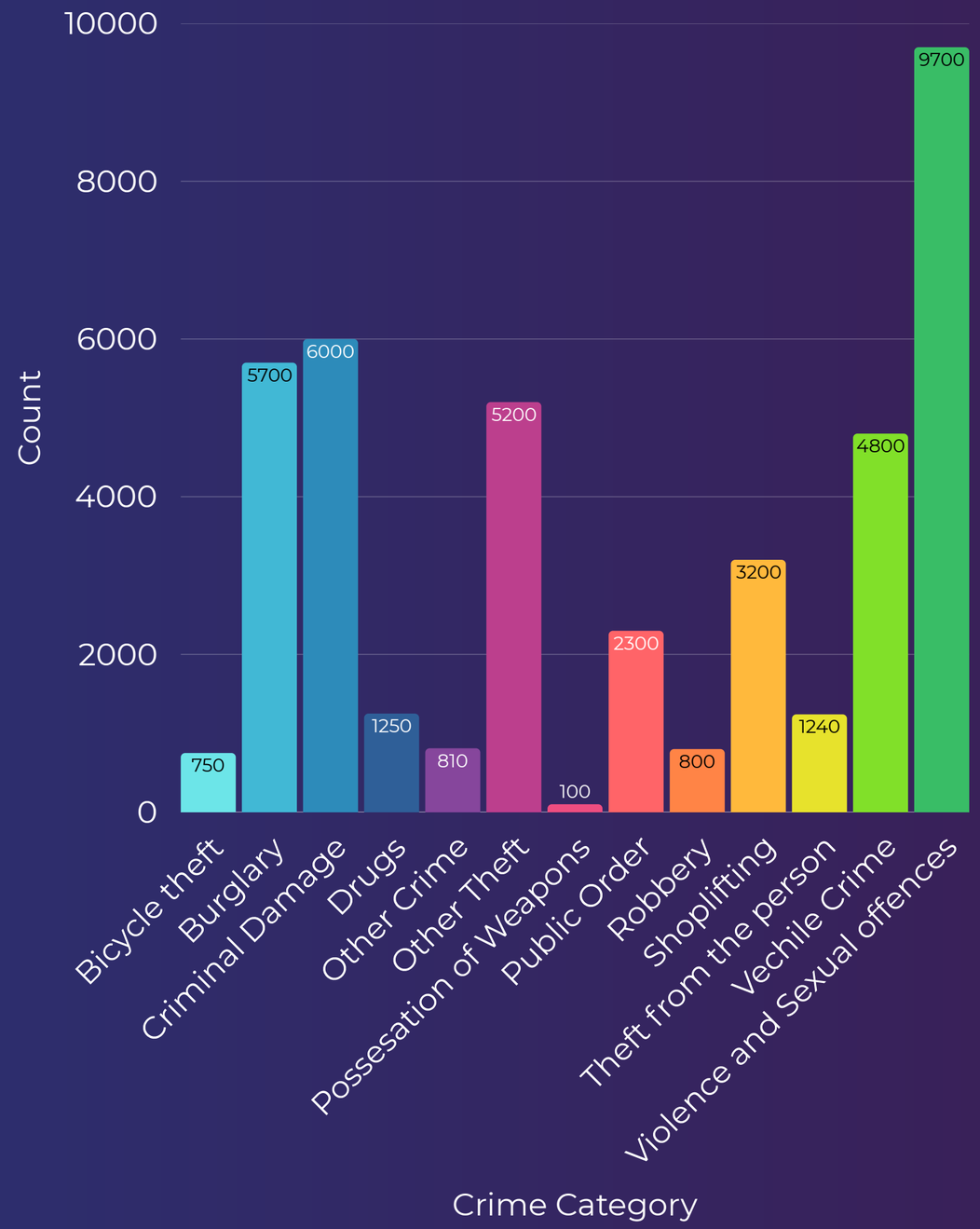
A data.frame: 6 × 7

	date	location	borough	lsoa	category	long	lat
	<chr>	<chr>	<chr>	<chr>	<chr>	<dbl>	<dbl>
1	2015-01-01	On or near Belmont Road	Bolton	E01004768	Burglary	-2.444807	53.61151
2	2015-01-01	On or near Shepton Close	Bolton	E01004768	Vehicle crime	-2.441729	53.61492
3	2015-01-01	On or near The Beeches	Bolton	E01004768	Violence and sexual offences	-2.442944	53.60966
4	2015-01-01	On or near East Walk	Bolton	E01004803	Burglary	-2.443162	53.62908
5	2015-01-01	On or near Chapel Street	Bolton	E01004803	Vehicle crime	-2.442286	53.63200
6	2015-01-01	On or near Great Stones Close	Bolton	E01004804	Other theft	-2.432463	53.62680

Data Summary

```
     date              location          borough             lsoa          
 Length:41450       Length:41450       Length:41450       Length:41450      
 Class :character   Class :character   Class :character   Class :character  
 Mode  :character   Mode  :character   Mode  :character   Mode  :character  


   category              long              lat        
 Length:41450       Min.   :-2.716   Min.   :53.34  
 Class :character   1st Qu.:-2.328   1st Qu.:53.46  
 Mode  :character   Median :-2.240   Median :53.50  
                    Mean   :-2.267   Mean   :53.50  
                    3rd Qu.:-2.173   3rd Qu.:53.55  
                    Max.   :-1.965   Max.   :53.67  
                    NA's   :1        NA's   :1      
```



CRIME COUNT BY CATEGORY

Crime is highest in:

- Anti-social behaviour
- Vehicle crime
- Burglary
- Bars show skewed distribution toward top 3 types

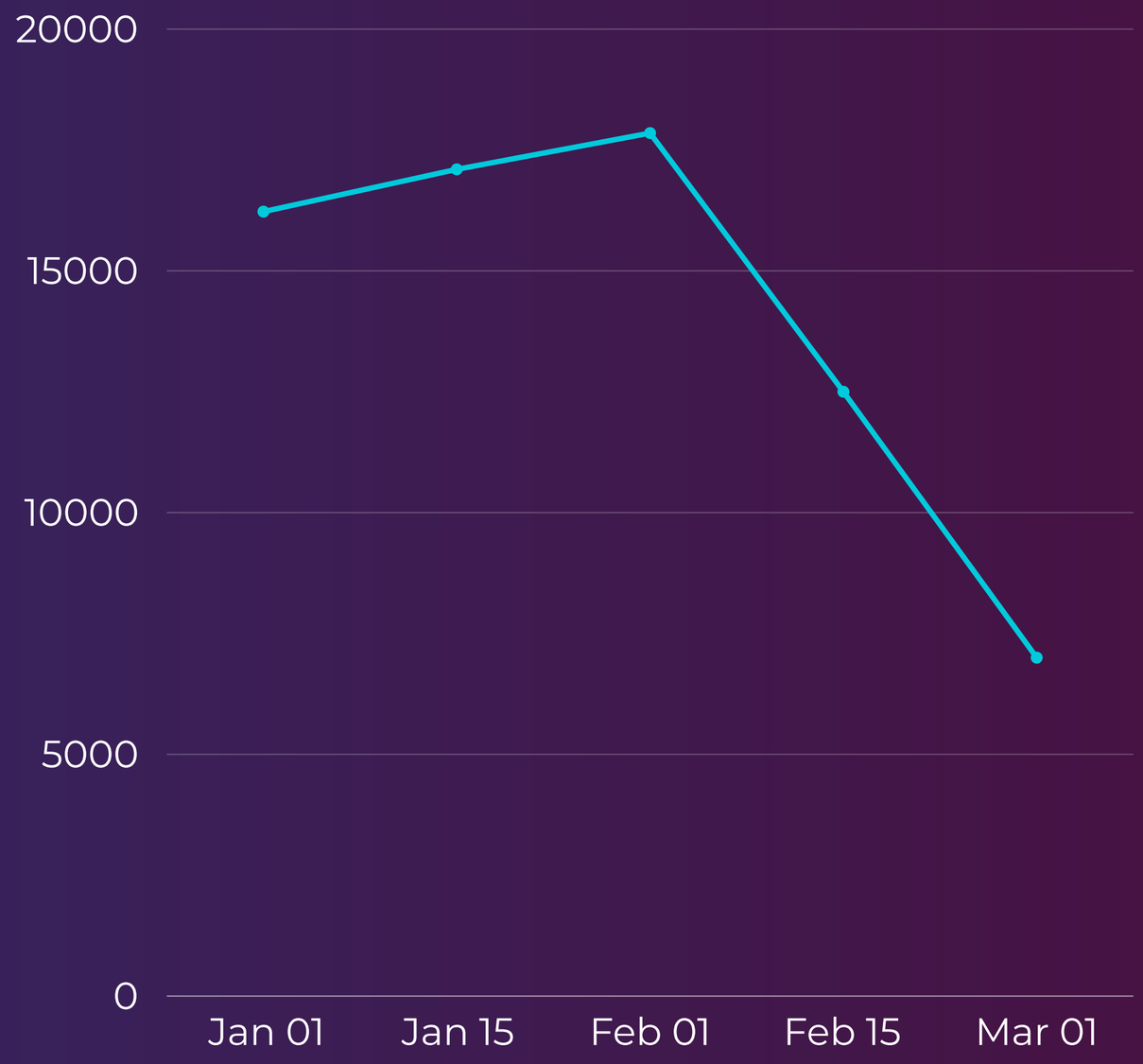
TOP 10 BOROUGHS WITH HIGHEST CRIMES

Observed Trends:

- top_n(10) identifies most affected boroughs.
- Manchester and Bolton are significantly above others.

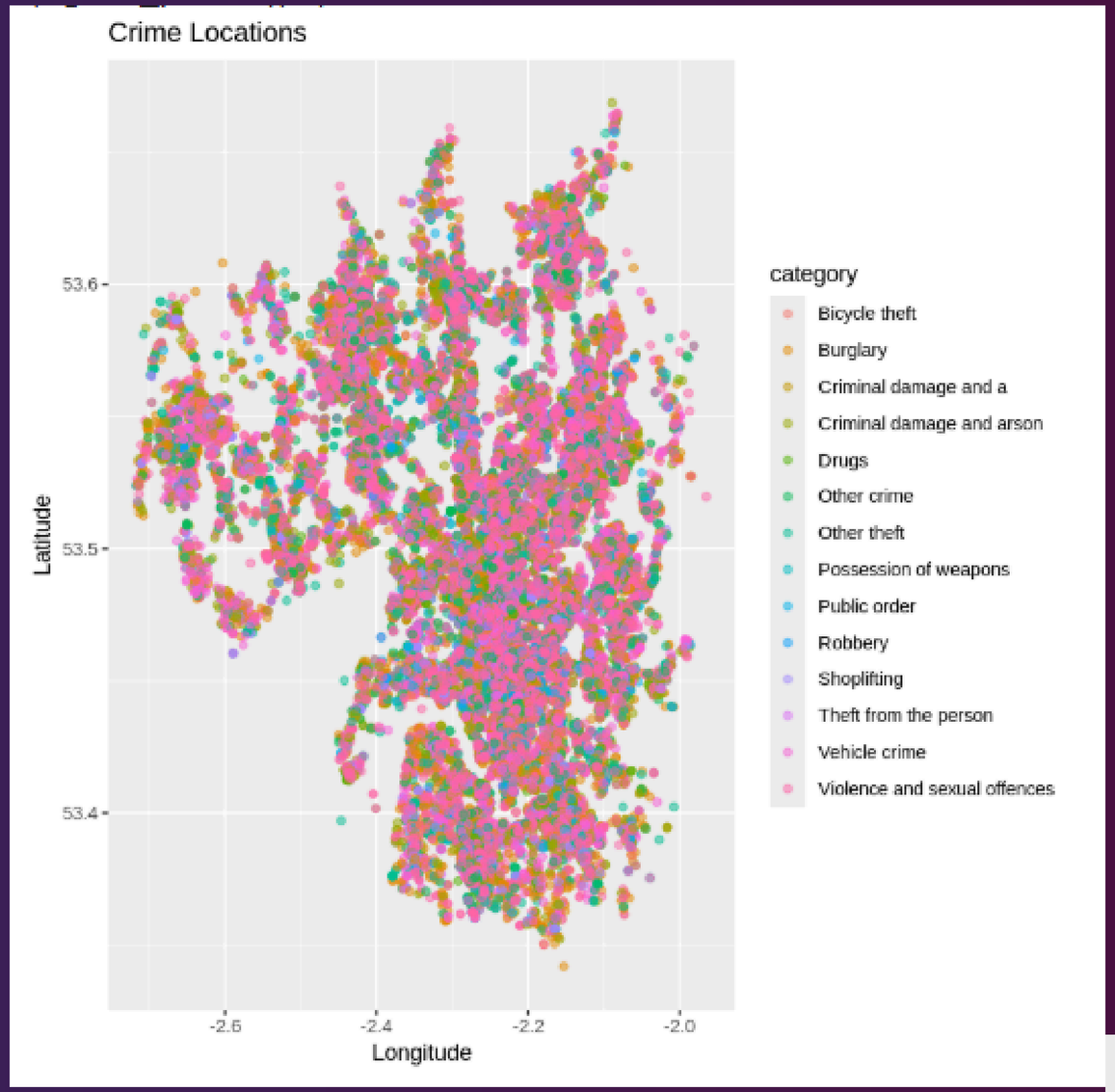
CRIME TRENDS OVER TIME

- Data grouped by date to analyze overall crime volume trends.
- Slight increase in crime observed from Jan to Feb.
- A dramatic drop (~50%) in March, indicating:
- A possible intervention or
- Reporting anomaly or
- Natural decline
- Highlights the importance of tracking temporal trends for better law enforcement planning.



SPATIAL CRIME DISTRIBUTION

- Each point shows the location of an individual crime report
- Color-coded by crime category for clear visual grouping
- Dense clusters suggest urban hotspots or high-traffic zones
- Overlapping points show repeated crimes in same areas
- Insightful for deploying CCTV, patrols, or awareness campaigns



SPATIAL CRIME DISTRIBUTION

ZOOMING INTO SPECIFIC CRIME TYPES

- Filtered the dataset to focus on Burglary and Vehicle crime.
- Both subsets reveal crimes occurring in Bolton borough.
- Many incidents happen in similar locations — indicating repeated targeting.

	date	location	borough	lsoa	category	long	lat
	<date>	<chr>	<fct>	<chr>	<fct>	<dbl>	<dbl>
1	2015-01-01	On or near Belmont Road	Bolton	E01004768	Burglary	-2.444807	53.61151
2	2015-01-01	On or near East Walk	Bolton	E01004803	Burglary	-2.443162	53.62908
3	2015-01-01	On or near Sports/Recreation Area	Bolton	E01004808	Burglary	-2.434273	53.61604
4	2015-01-01	On or near Cottage Croft	Bolton	E01004790	Burglary	-2.400717	53.60668
5	2015-01-01	On or near Sports/Recreation Area	Bolton	E01004810	Burglary	-2.413434	53.60430
6	2015-01-01	On or near Darwen Road	Bolton	E01004810	Burglary	-2.414786	53.61278

A data.frame: 6 × 7

	date	location	borough	lsoa	category	long	lat
	<date>	<chr>	<fct>	<chr>	<fct>	<dbl>	<dbl>
1	2015-01-01	On or near Shepton Close	Bolton	E01004768	Vehicle crime	-2.441729	53.61492
2	2015-01-01	On or near Chapel Street	Bolton	E01004803	Vehicle crime	-2.442286	53.63200
3	2015-01-01	On or near Lower Mead	Bolton	E01004808	Vehicle crime	-2.430057	53.62211
4	2015-01-01	On or near Dene Bank	Bolton	E01004790	Vehicle crime	-2.406715	53.60655
5	2015-01-01	On or near Lee Gate	Bolton	E01004790	Vehicle crime	-2.398091	53.60546
6	2015-01-01	On or near Winterburn Avenue	Bolton	E01004810	Vehicle crime	-2.410000	53.60862

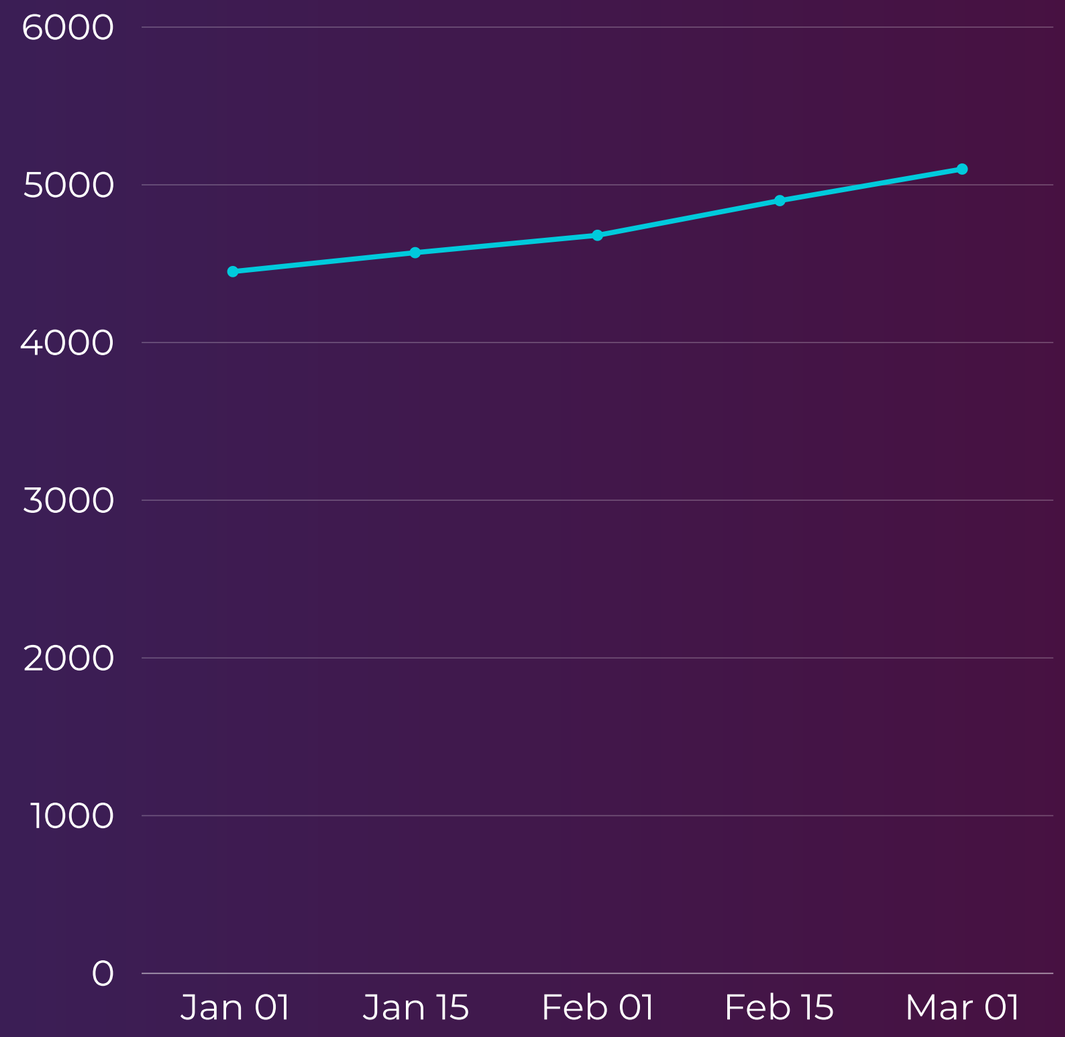
CRIME COUNT BY LOCATION

- Crime data grouped by exact location description.
- Shopping areas, supermarkets, and parking lots are the top 3 hotspots.
- High-crime locations often share traits like high traffic, open access, or poor surveillance.
- Nightlife venues (e.g., nightclubs) also show significant numbers.
- Data helps prioritize security measures for public zones.
- Enables better urban planning and CCTV deployment in high-risk zones.

location	crime_count
On or near Shopping Area	1262
On or near Supermarket	1147
On or near Parking Area	1141
On or near Petrol Station	793
On or near Nightclub	571
On or near Sports/Recreation Area	377
On or near Further/Higher Educational Building	212
On or near Pedestrian Subway	183
On or near Hospital	155
On or near Piccadilly	130

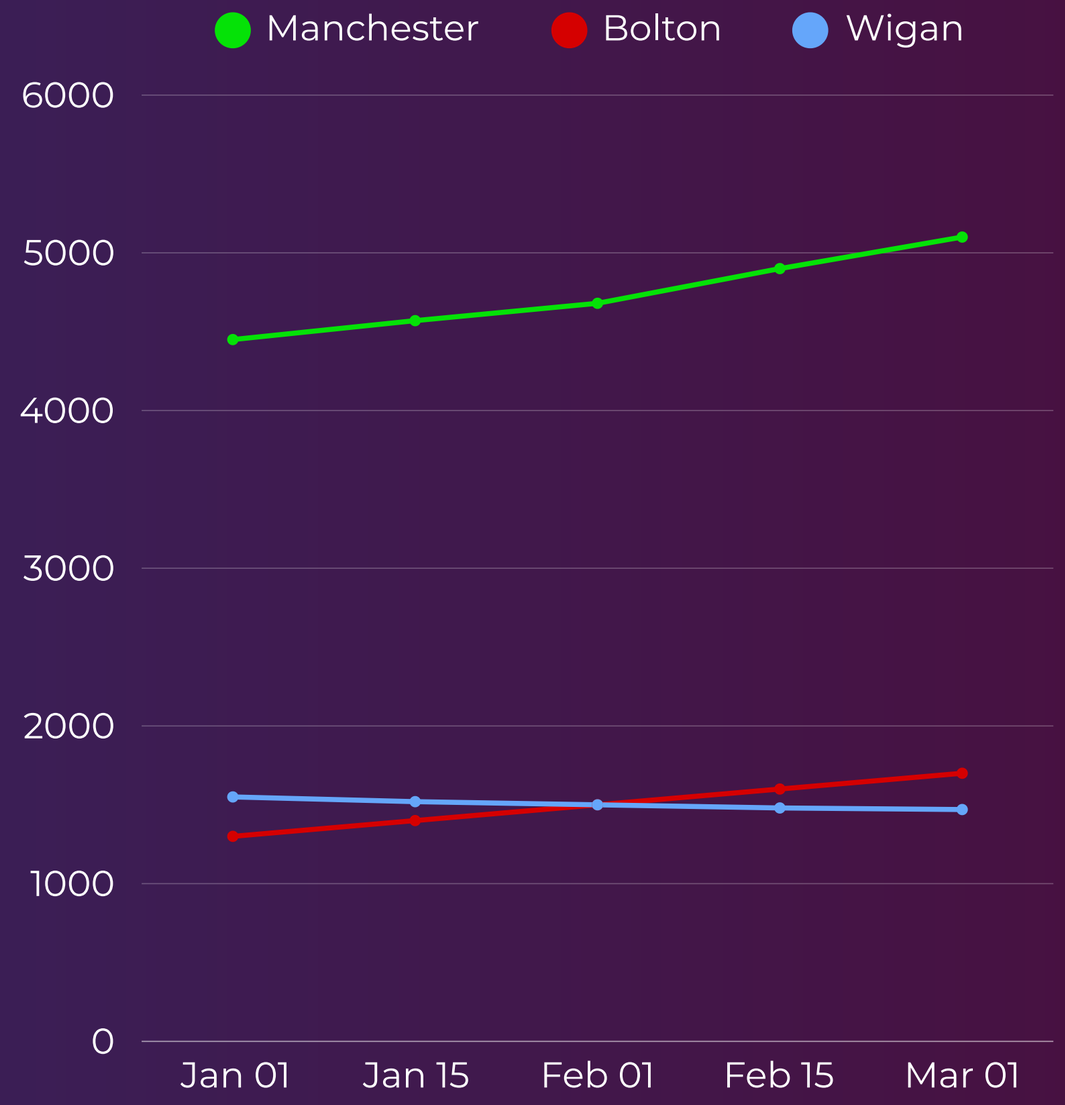
CRIME TRENDS IN MANCHESTER

- Manchester was identified as the borough with the highest crime count overall.
- Line chart shows a steadily increasing trend from January to March.
- Crime rose by ~15% in just 2 months — from ~4,450 to ~5,100.
- Indicates a need for immediate intervention and deeper investigation.
- Highlights the importance of tracking borough-level crime over time.



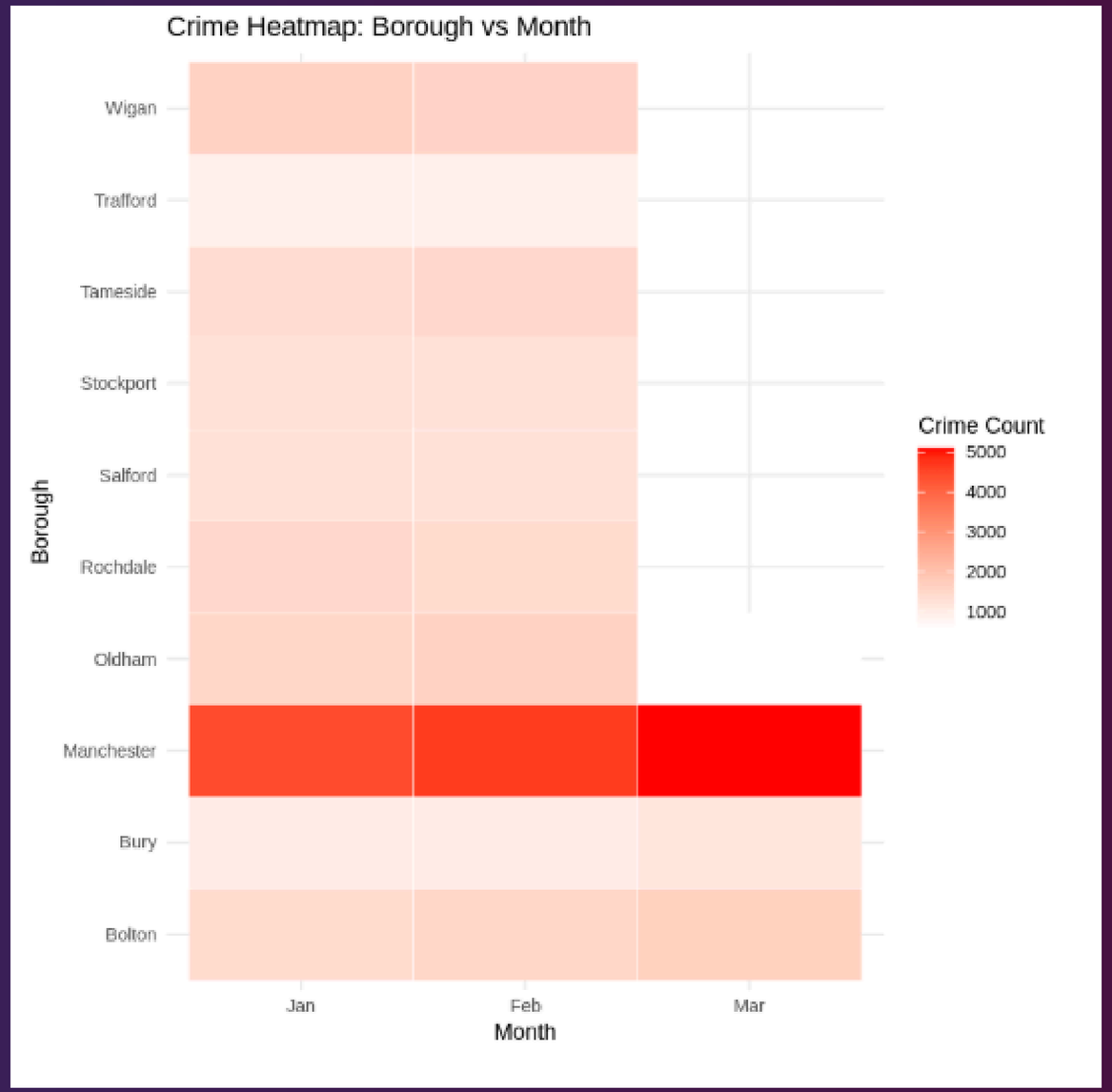
CRIME TRENDS IN
MANCHESTER, BOLTON & WIGAN

- Compared three boroughs with the highest crime volume.
- Manchester showed a consistent and sharp increase in crimes.
- Bolton displayed a moderate upward trend, indicating gradual rise.
- Wigan had a flat or slightly declining trend over the same period.
- This comparison helps in resource planning, patrolling allocation, and identifying stable vs. worsening zones.



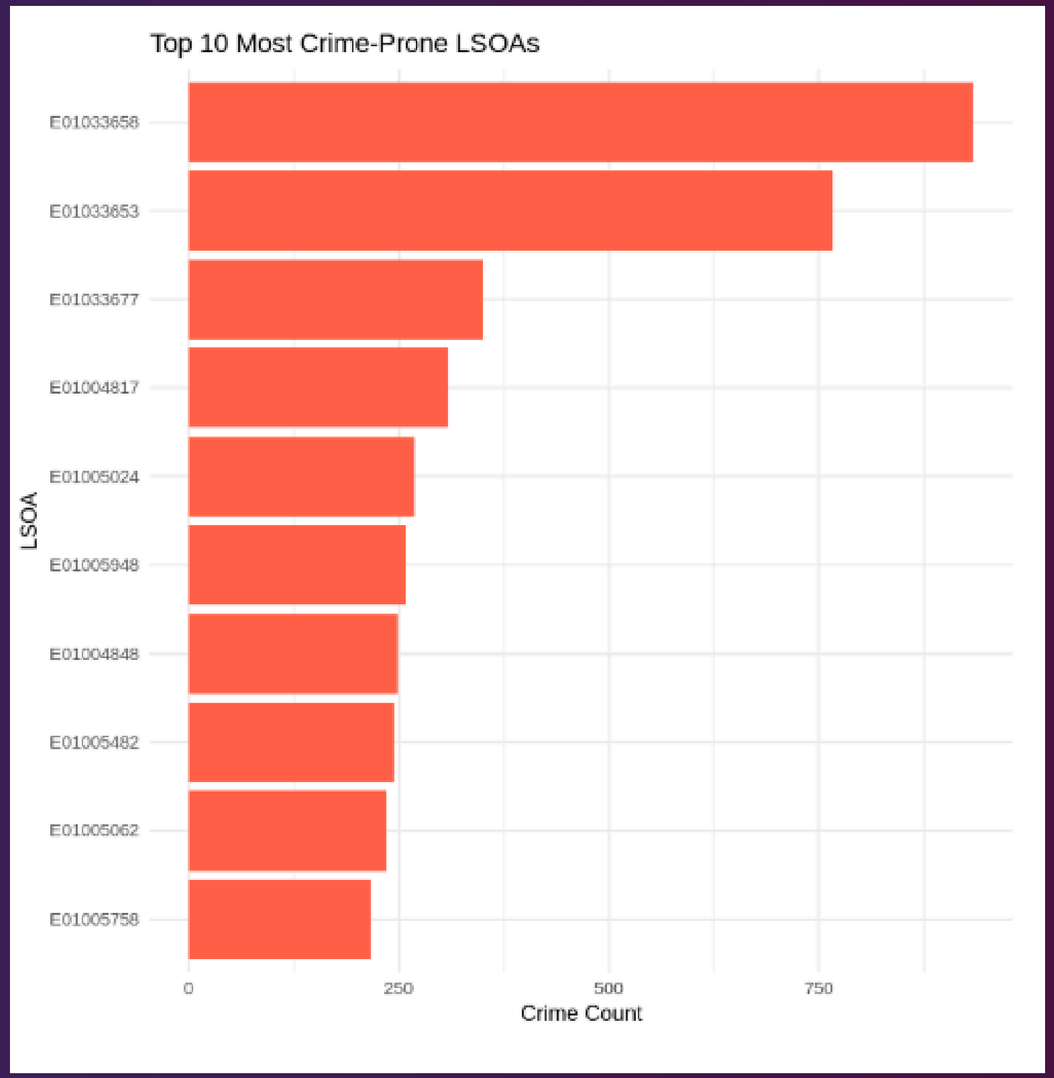
CRIME HEATMAP
BOROUGH VS MONTH

- A heatmap visually compares crime counts across boroughs and months.
- Manchester consistently records the highest number of crimes — peaking in March.
- All other boroughs show relatively lower but steady activity.



CRIME PRONE
LSOA

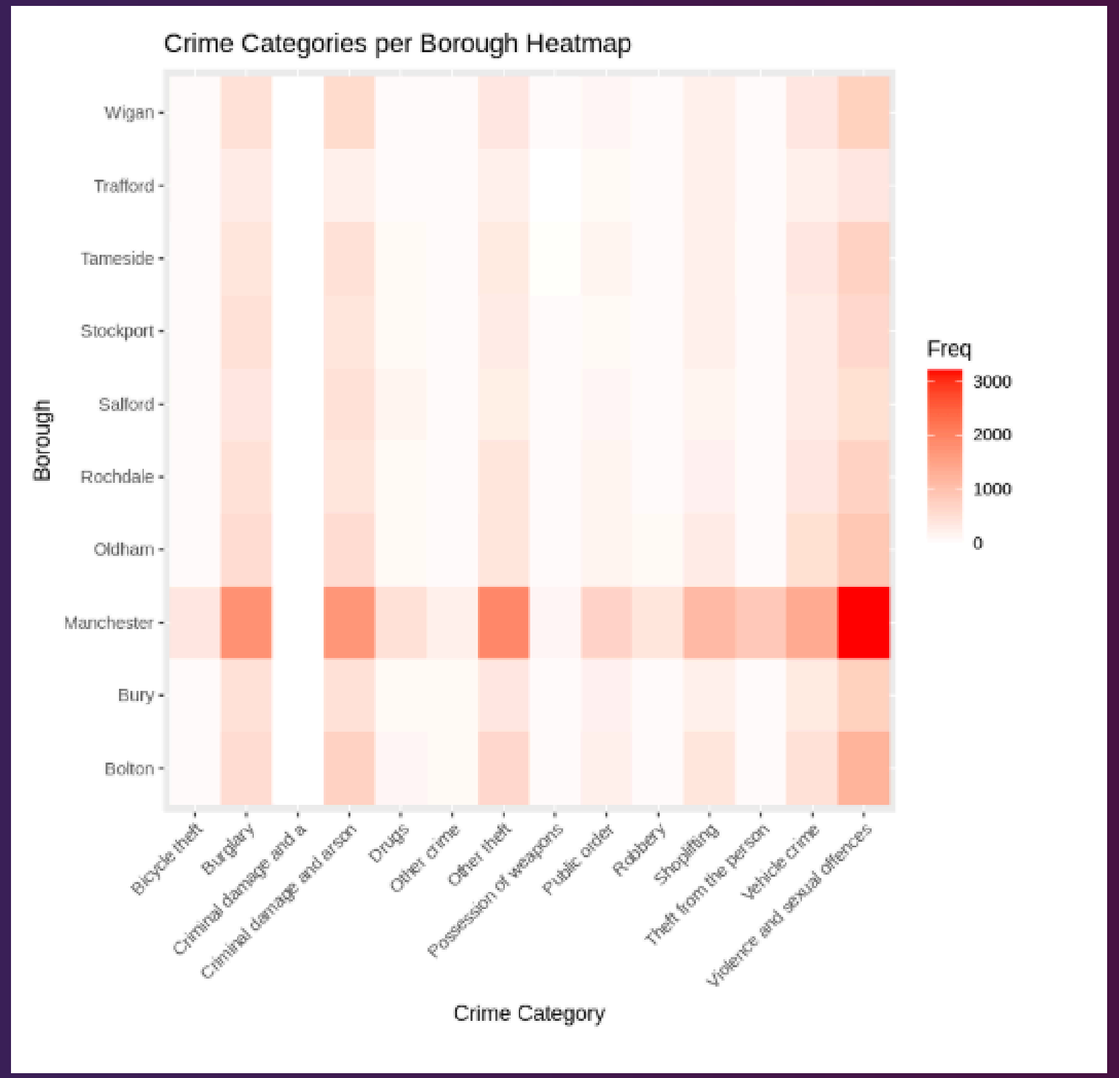
- LSOA = Local neighborhood unit used in UK statistics (1,000–3,000 people).
- Crime data grouped by LSOA to identify most affected micro-areas.
- LSOAs E01033658 and E01033653 have exceptionally high crime counts.
- Some local zones show over 900 incidents, compared to others around 250–300.
- Helps law enforcement:
- Focus patrols
- Install CCTV
- Plan outreach at the neighborhood level



CRIME CATEGORIES
PER BOROUGH

- Manchester leads in nearly all crime categories — especially violent and sexual crimes.
- Other boroughs have specific patterns:
- For example, Bolton and Bury have relatively higher counts in theft-related crimes.
- Heatmap helps identify which crime types are common in which areas.
- Allows for targeted interventions, like:

1. More policing in areas with violent crime
2. Community programs for burglary-prone zones



THANK YOU!

DATA ANALYSIS IS KEY TO BUSINESS GROWTH AND SUCCESS!