Tallahassee Crime Map

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Outline

Project At A Glance

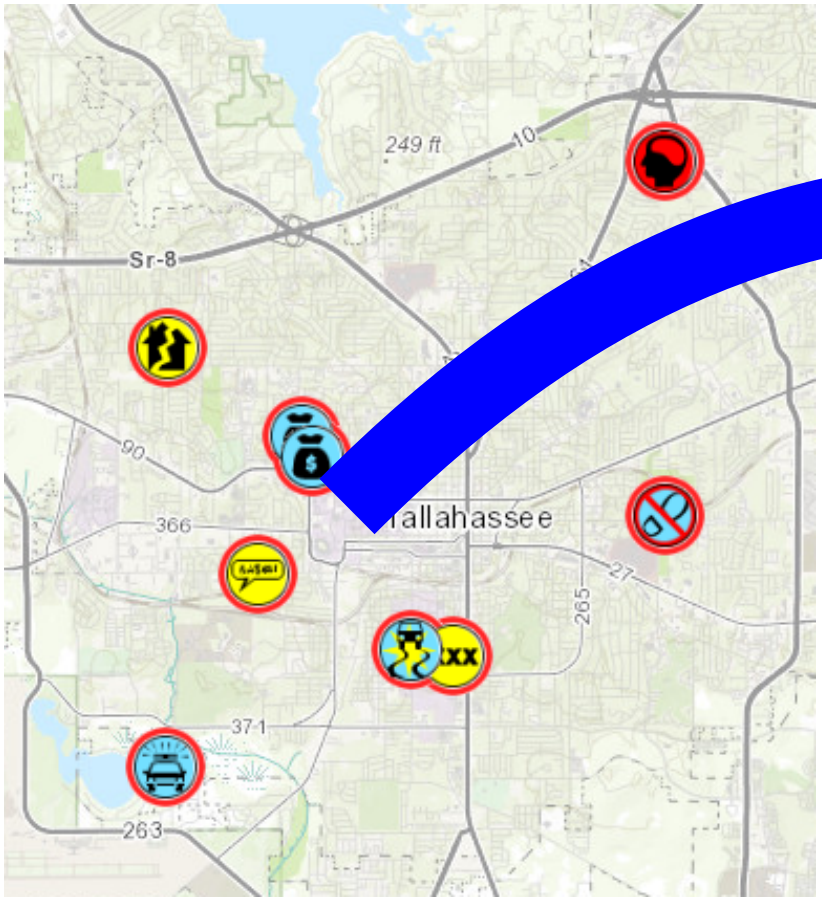
Goal: Develop a generative AI that outputs a crime distribution given a geographical map.

Why: To provide a tool for city planners to see potential crime risks with their plans.

Technology: Generative Adversarial Network (pix2pix)

Figure: Geographical Map to Crime Map(Adapted from He, Zheng 2021)

TOPS Data Collection



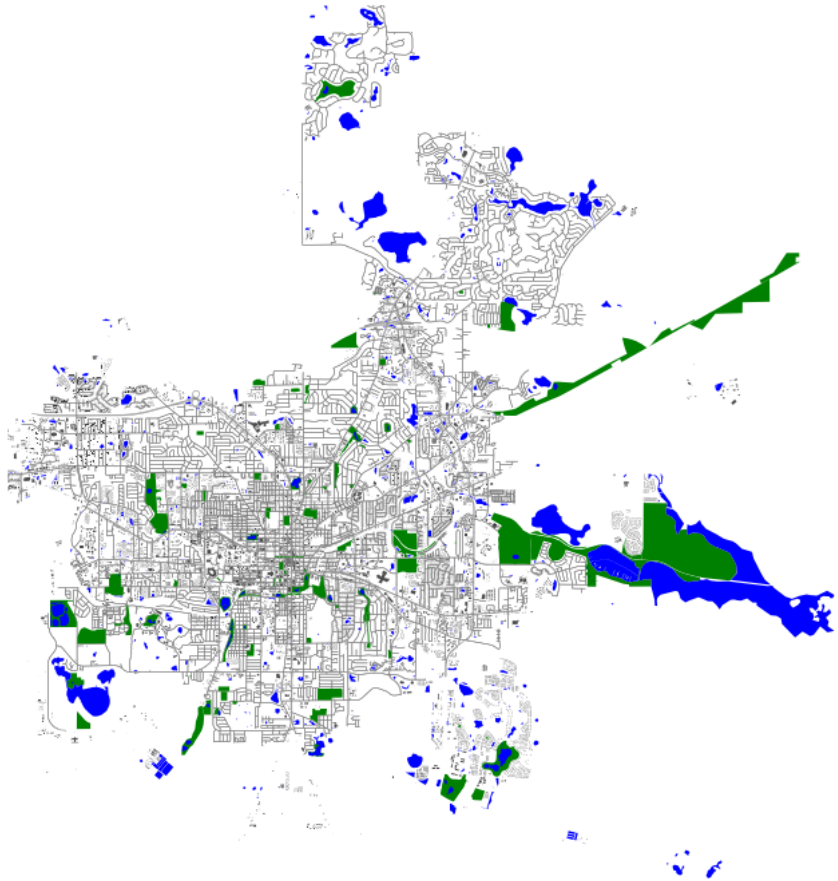
A tabular data

The table contains the following columns:

- Time of the crime report
- Crime type
- Location
- Geographical coordinates

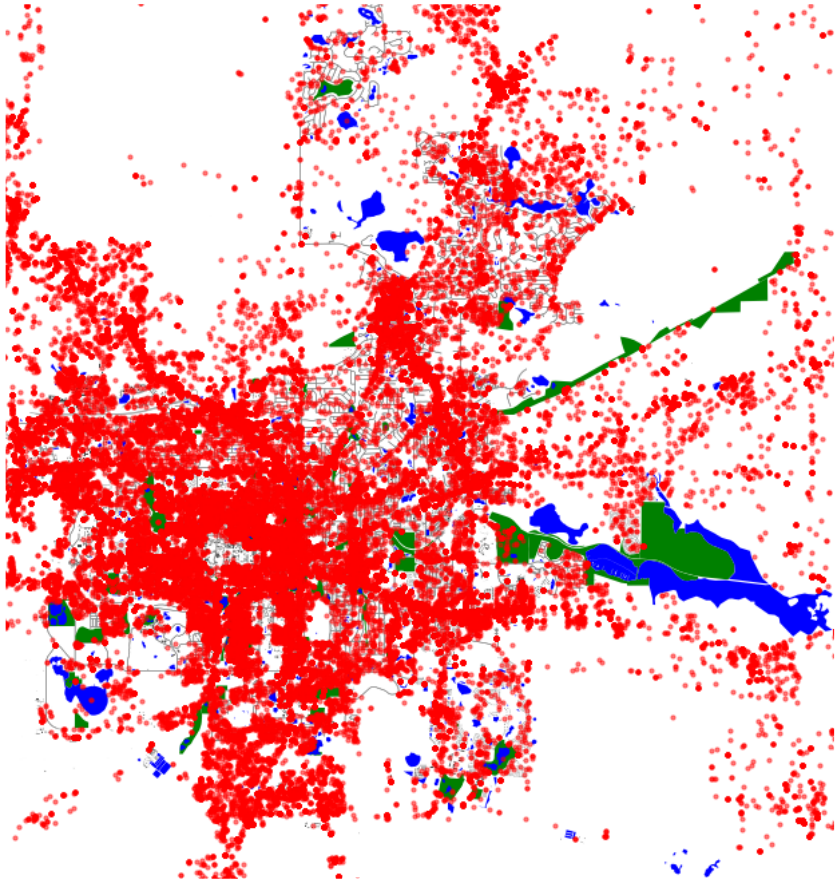
Figure: Tallahasse Police Statistics Homepage

Data Processing



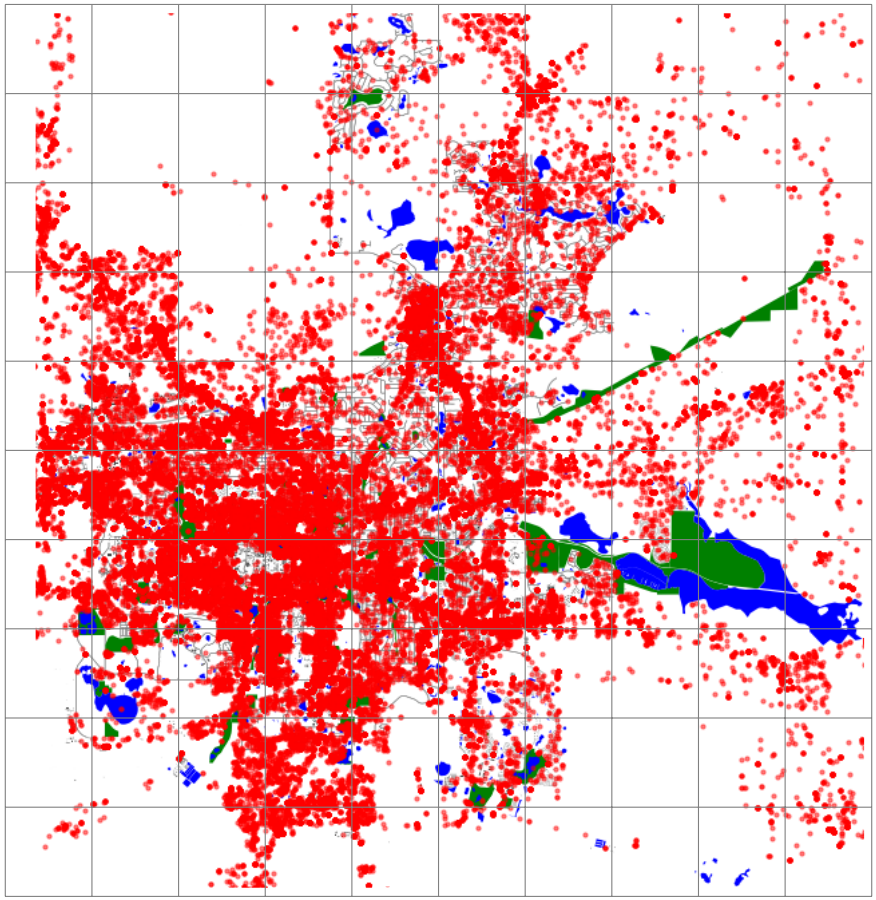
Create Tallahassee map using OSMNx with water (blue), parks (green), roads (gray) and buildings (black)

Data Processing



Superimpose crime data the map, with degrees of red dot indicating frequency of crime

Data Processing



Break map into n pieces by computing coordinate centers and specifying dimensions of bounding box

Categorical Analysis

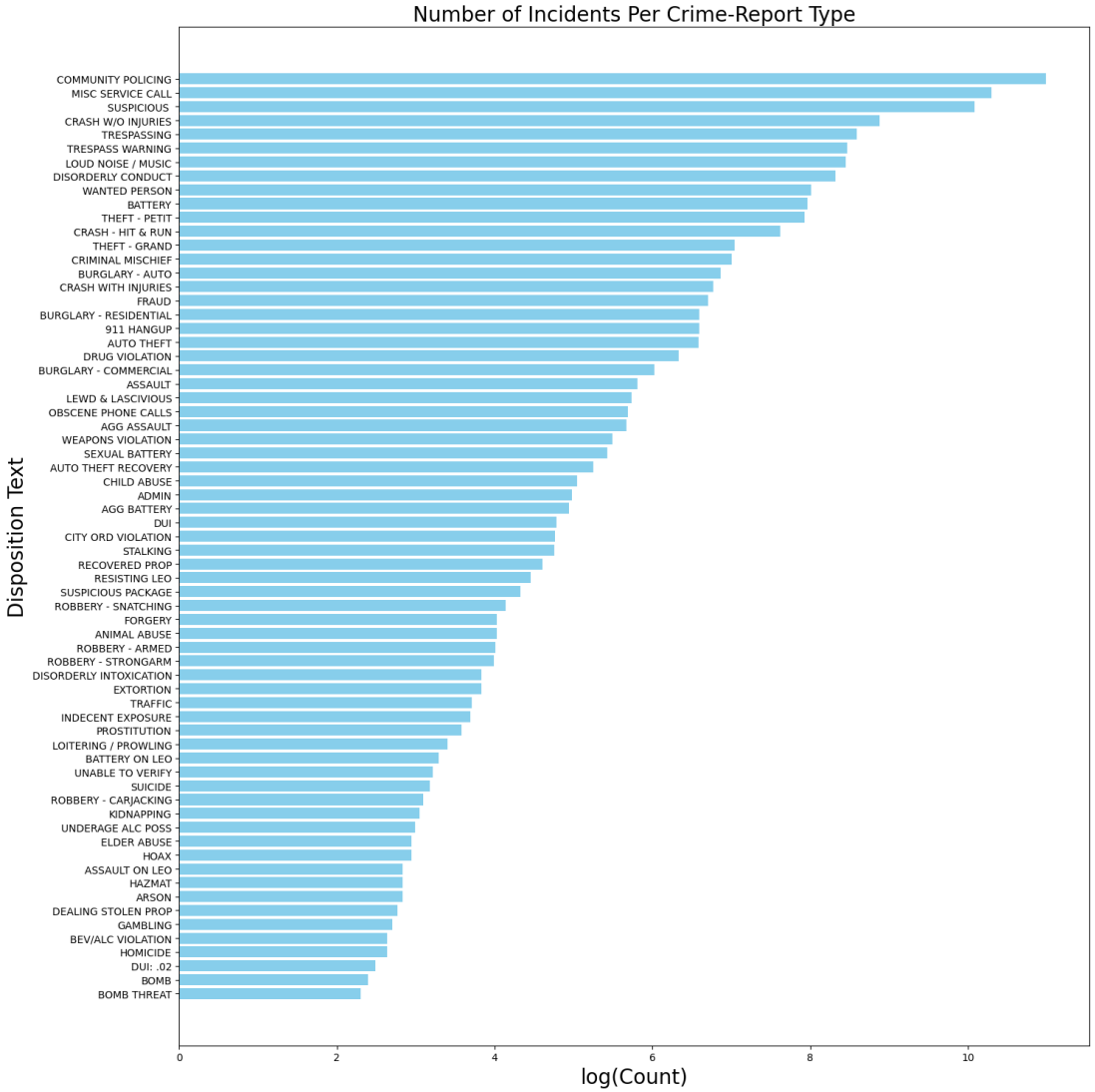
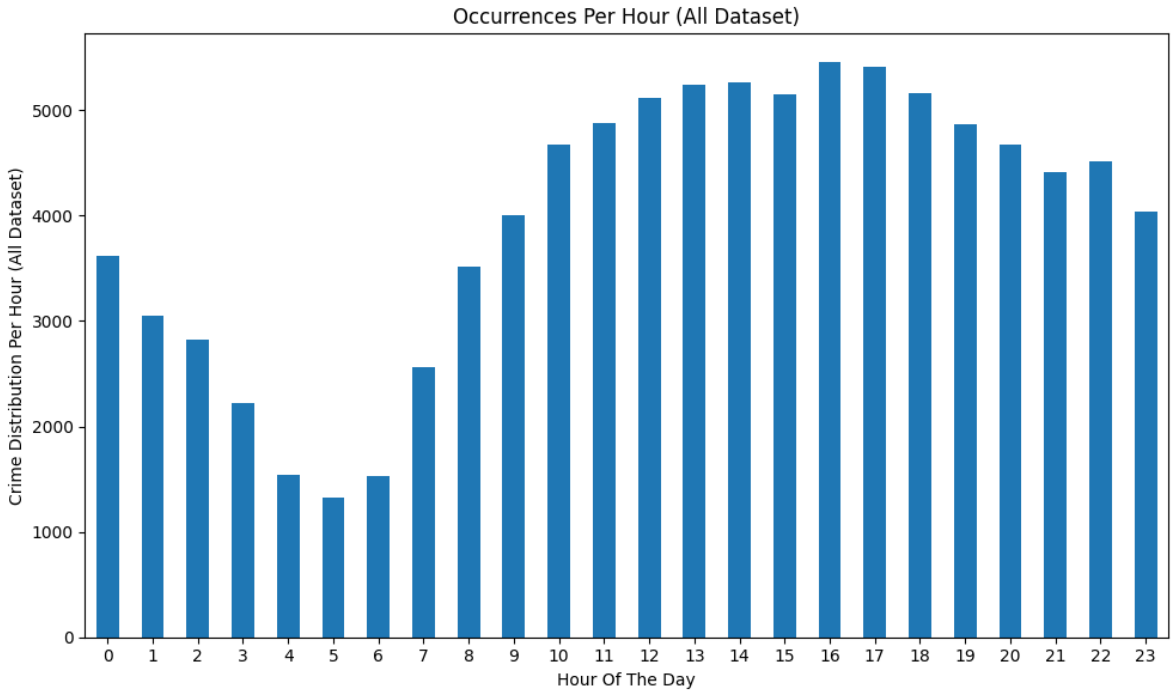


Figure: A bar chart for each type of crime report.

- The values on the x-axis correspond to the log of the actual count for visual purposes.
- On the y-axis all different types of crime reports are listed.
- There are 67 types of reports.
- We will filter out some from our analysis. For example, community policing occurs most often and it is not of interest for our purposes.

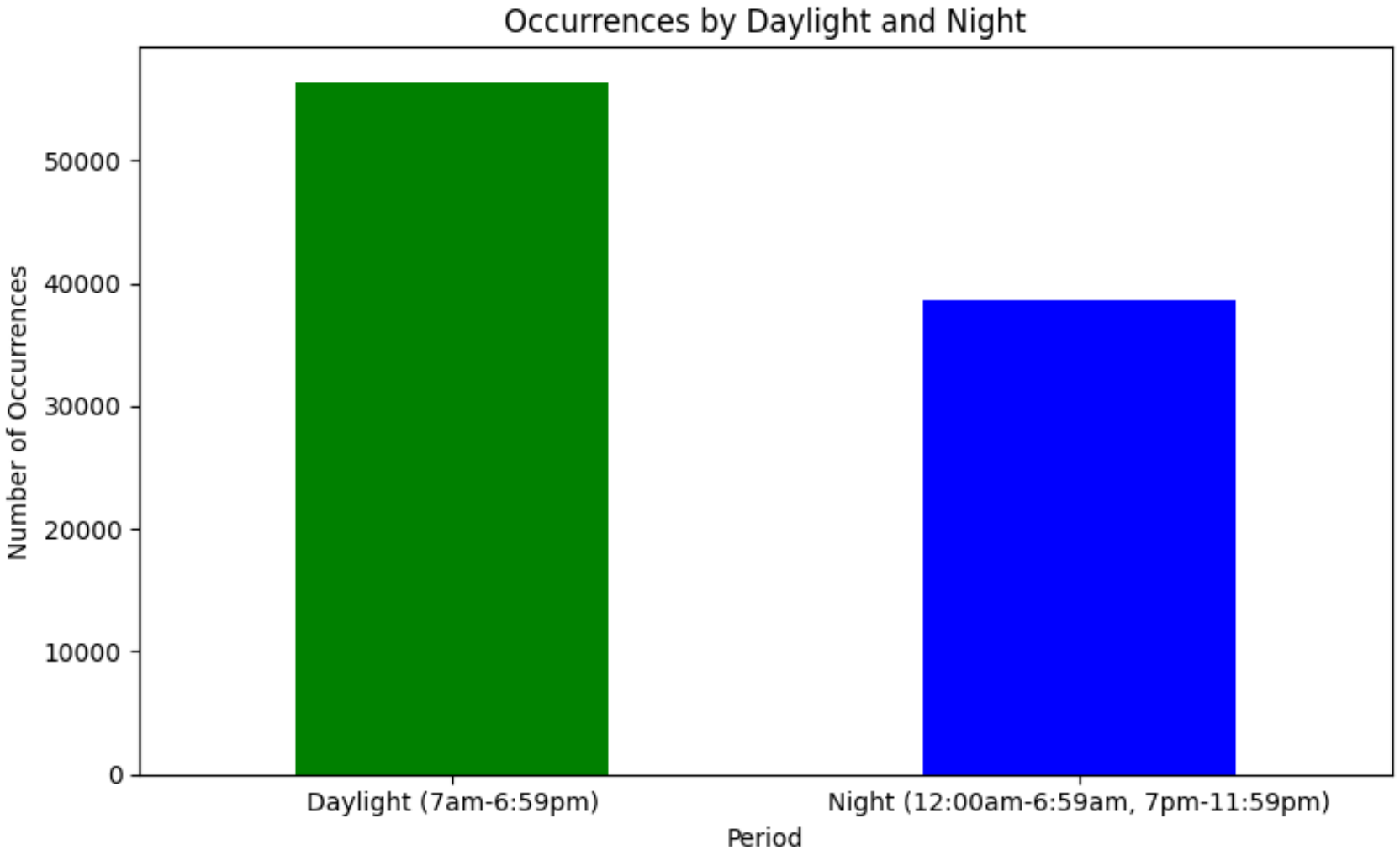
Temporal Analysis



- Hourly analysis of the data reveals a fluctuating trend with peak hours.
- Data includes all of 2023.

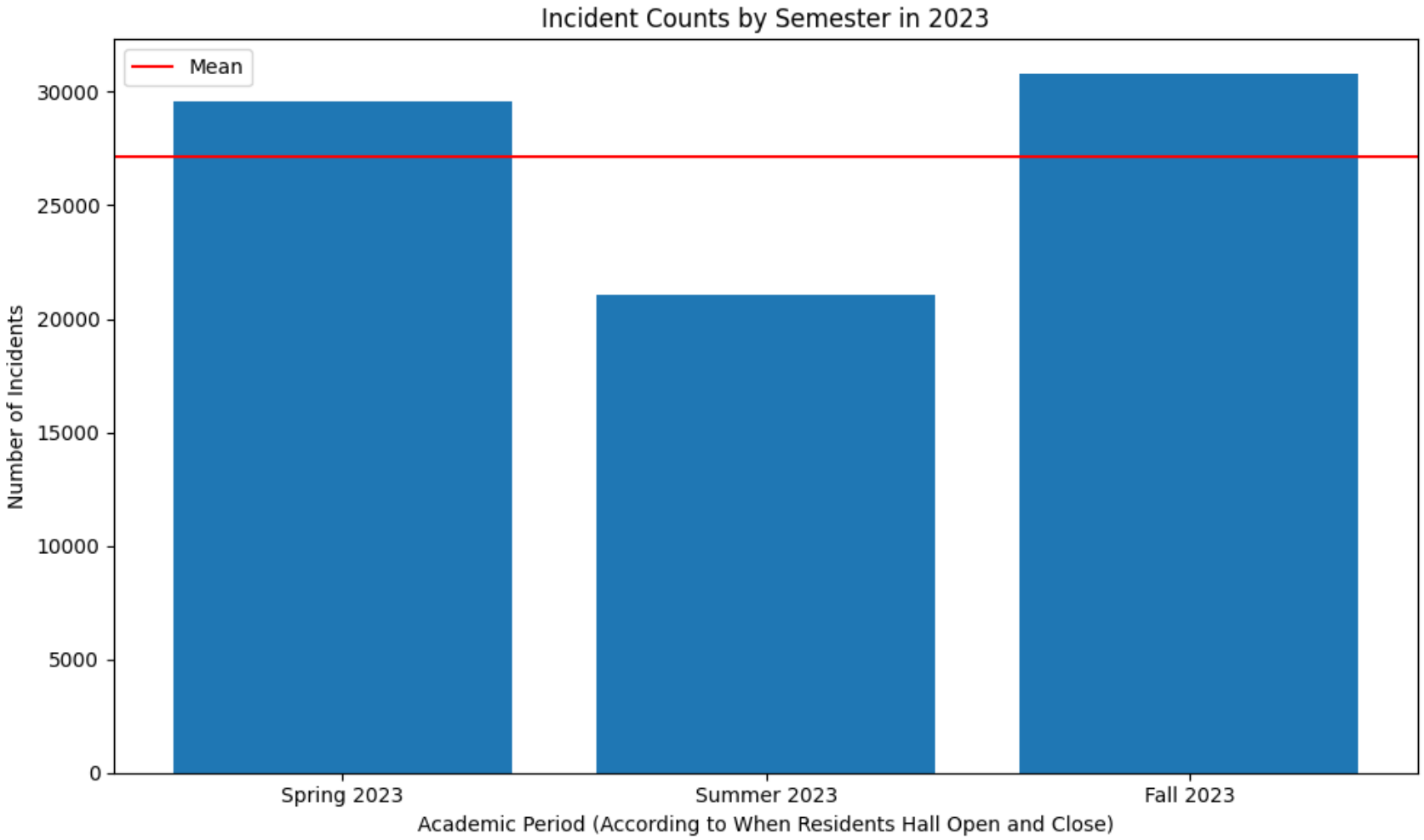
Figure: Crime Distribution Per Hour – All 2023

Temporal Analysis



- Daylight vs no daylight. When is an incident more likely to occur?

Temporal Analysis



- Tallahassee is a college town. (FSU & FAMU & TCC)
- Do students affect the number of crime reports?

What is Generative Adversarial Network-GAN?

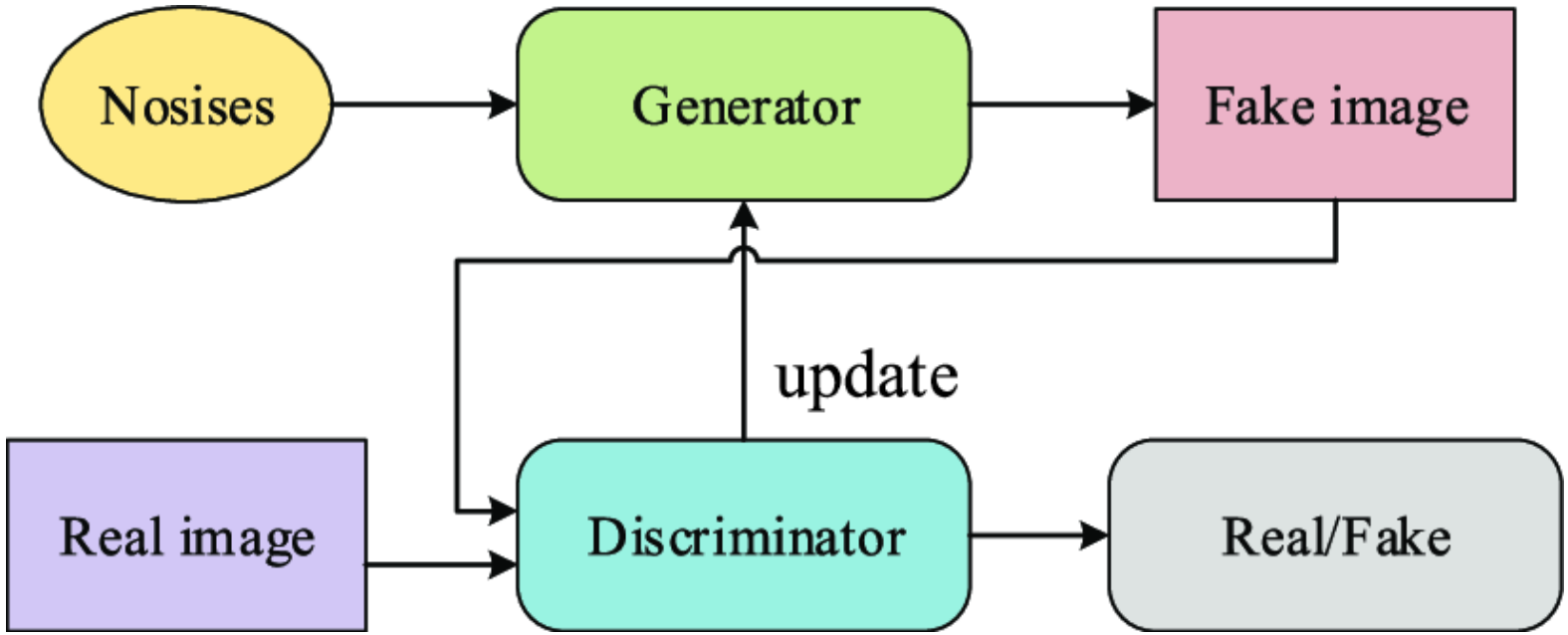


Figure: GAN

In the training, G and D try to beat each other (hence the word "adversarial").
The training stops when D can no longer discriminate fake samples.

Conditional GAN (Pix2pix)

What do we do if we want a G network that takes a geographical map and outputs a crime map?

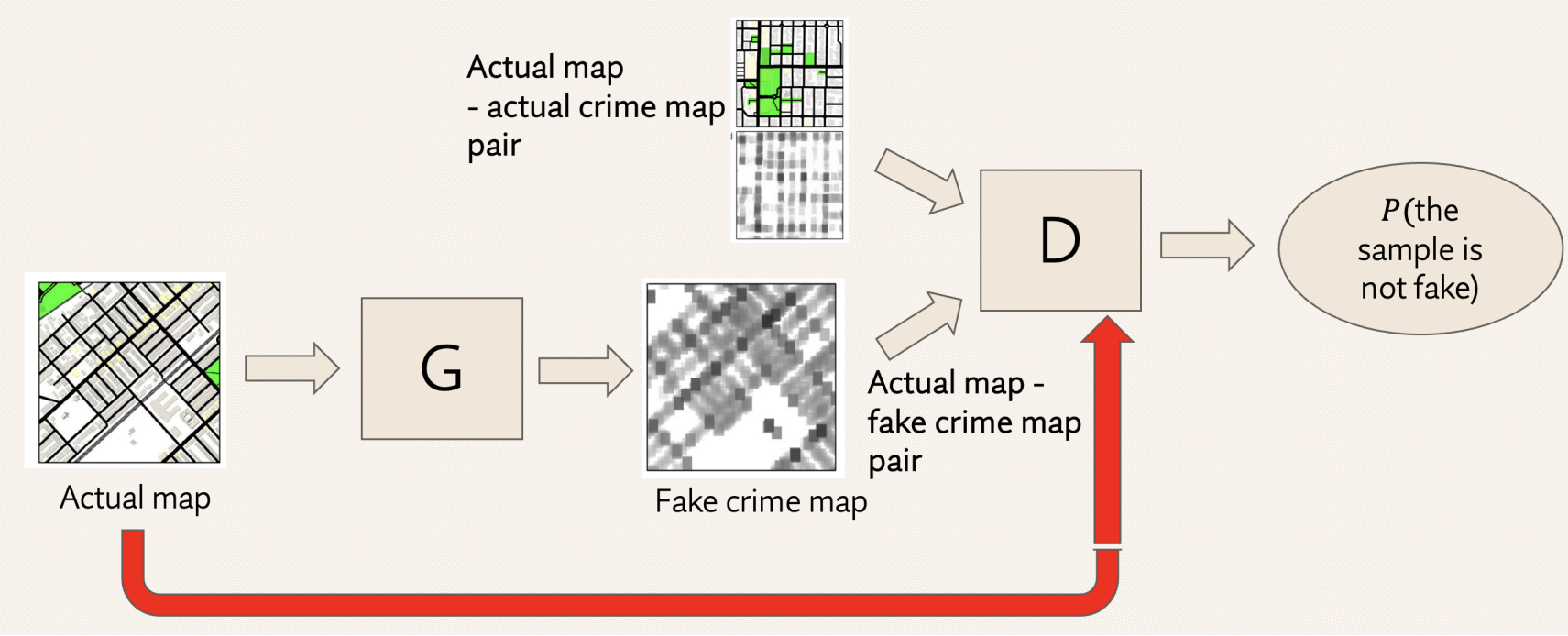


Figure: pix2pix

After training, a crime map generator is born.

Results

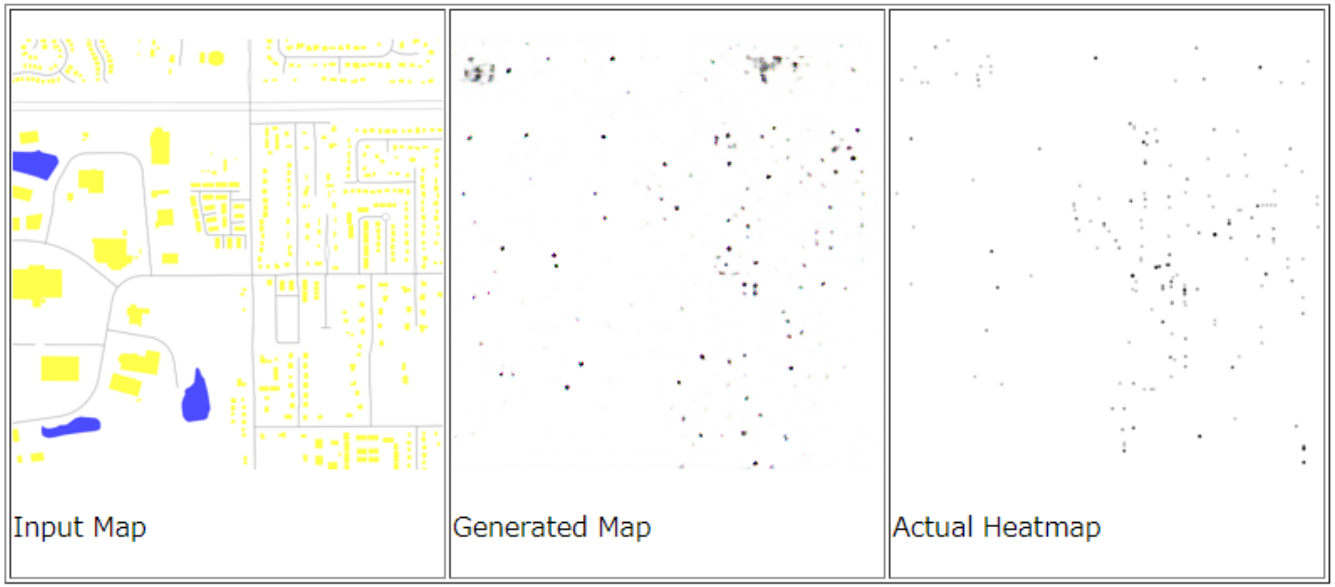


Figure: Generated heatmaps. We observe that the spatial pattern is somewhat similar to the real data.

	Baseline (Random Points)	pix2pix
Average MSE	3.9543179869651794	0.9491354823112488

Conclusion

- The data shows interesting trends in both spatial and temporal dimensions.
- In particular, the absense of students during the summer months is reflected in the crime reports.
- Using pix2pix, we were able to generate heatmaps that resemble the real data.
- In future, we can do:
- Better training of the model
- Implement a user-friendly editor for geographical maps for hypothetical maps
- Implement a web-app for the tool

Thank You!