

A Novel Approach to Identify Spatio-Temporal Crime Patterns in Dhaka City

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Problem Definition

- Street crimes have become a prevalent problem in Dhaka city [1]
- These crimes are spatio-temporal in nature (e.g: Car-theft is more frequent in Dhanmondi at noon than other areas in Dhaka)
- Based on historical spatio-temporal crime data, we develop a model to predict a street crime with respect to a given location at a particular time

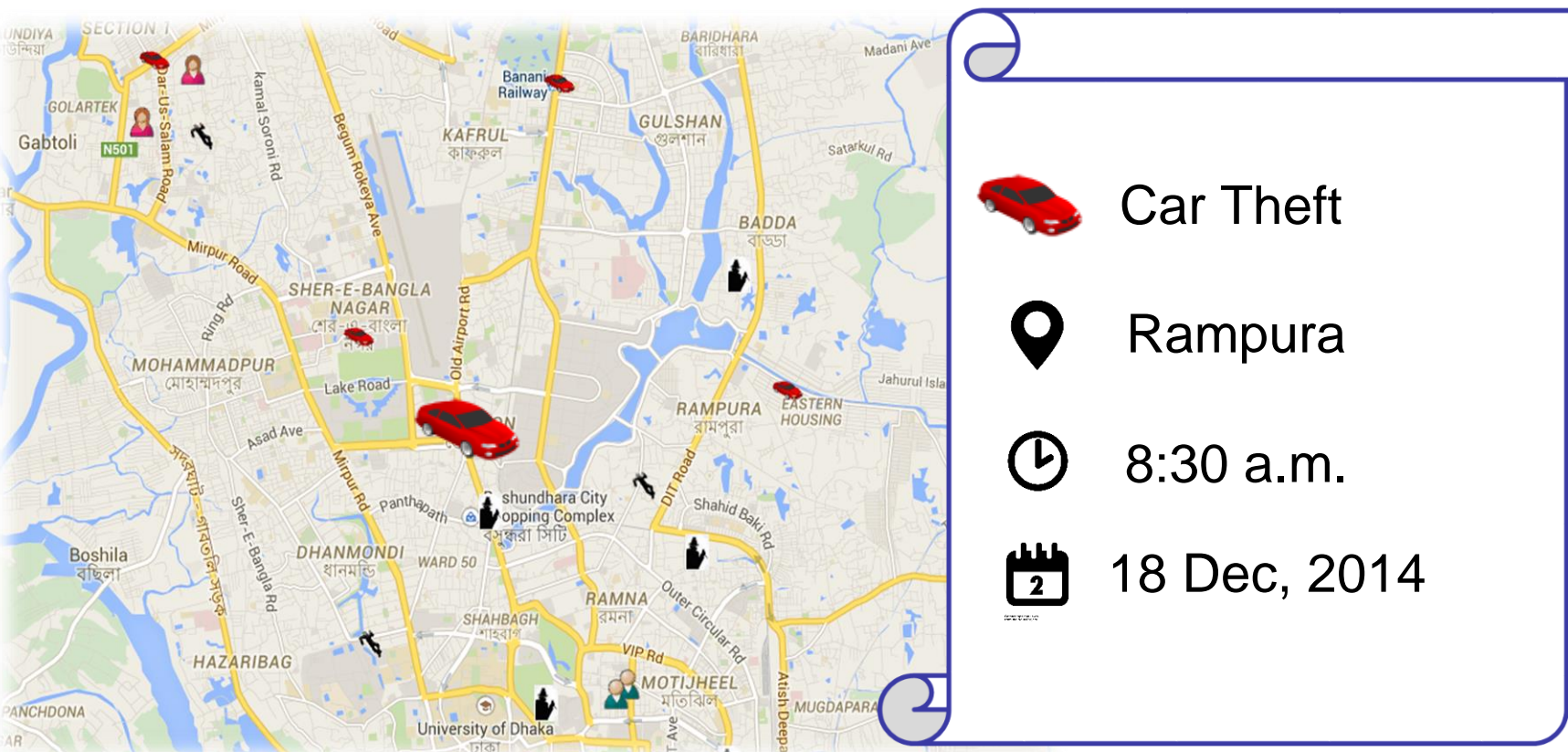


Figure 1: A sample crime record on DMP map

Motivation

- Alert people about crime probable locations so that they can take necessary precautions
- Help law enforcement agencies to take effective actions
- Can not use existing models [3] and tools [2] because of the unavailability of required attributes

Objective

- Develop a spatio-temporal crime prediction model that gives a portability of a crime at a particular location in the specified time
- Identify the crime patterns of Dhaka city
- Develop a location based mobile application that alerts a user about the possibility of crime when he/she visits a location

Our Approach

- Extract the necessary and available attributes:
 - Location, Crime type, Day, Time
- Compute the probability of a crime in a location
 - Divide the whole Dhaka city into grids
 - Consider the impact of occurring a crime on its own grid and surroundings

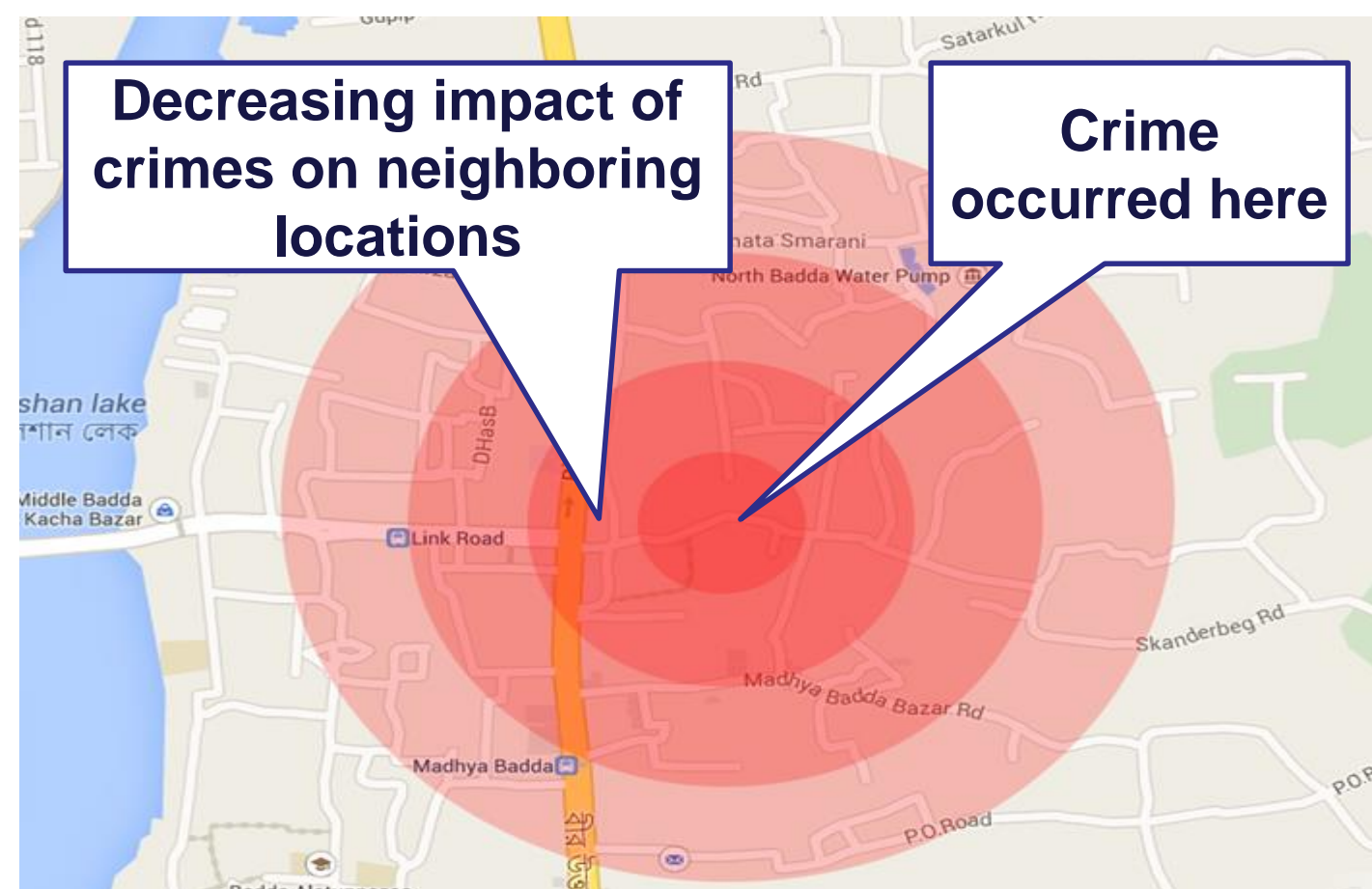


Figure 2: Impact of a crime on its own and neighboring locations

- Compute the probability of a crime at a particular time
 - Divide the whole day into fragments of time zones
 - Consider the impact of occurring a crime on its own and neighboring time zones

- Compute the prior probability of a crime of a particular **type, day of week** from DMP data
- Compute the total probability of occurring a crime for a given **location, time, day and type**
- Compute the **weighted average** of crime probabilities of different months where the recent months have the maximum weight



Figure 3 (a): Crime incidents of recent months



Figure 3 (b): Crime incidents of 1 month earlier

- Classify the probability of occurring a crime for given location, time, day, and type into one of the following risk categories: **high, moderate, low**

- Test the correctness of our model by comparing with real data

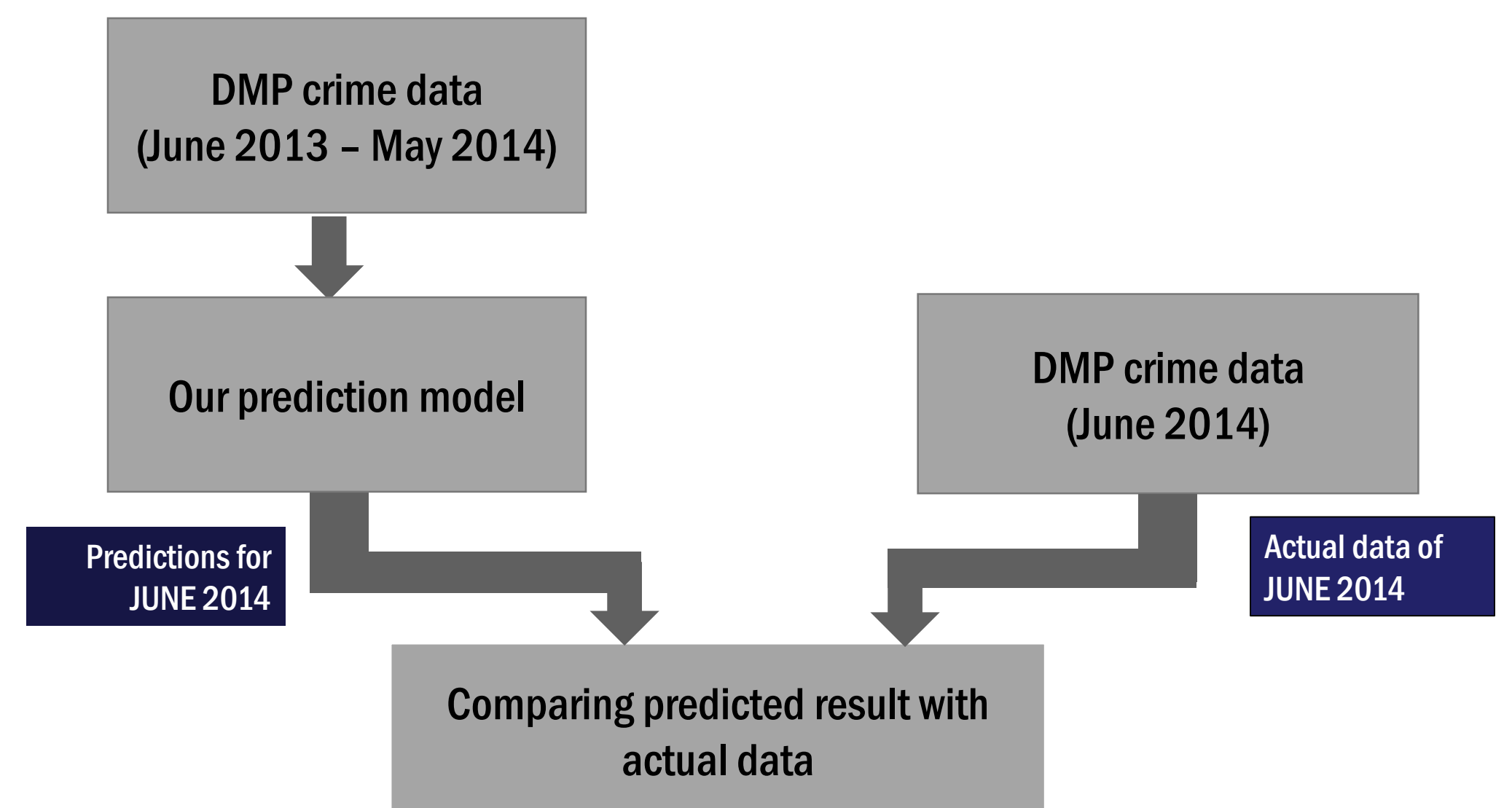


Figure 4: Validation of our prediction model

Outcome

- Perform extensive experimentation to fix the values of the following necessary factors of our model:
 - Impact of a crime on its own grid
 - Impact of a crime on its neighboring grids
 - Impact of a crime on its own time zone
 - Impact of a crime on its neighboring time zones
 - Number of grids
- Evaluation metrics:**
 - our model can accurately predict a crime in **79.24%** where it actually happens.
 - our model can accurately predict a crime not likely to occur in **68.2%** where it does not actually happen.

Future Work

- Develop a **mobile app** which gives auto alert in case of entering into a crime probable areas and fine tuning our model

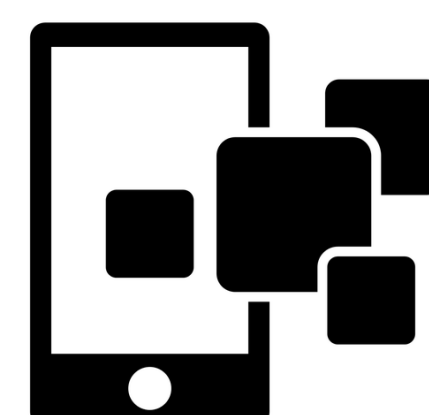


Figure 7: Mobile app based on our computation model

References

- Dhaka metropolitan police. <http://dmp.gov.bd/application/index/page/crime-data>
- Predpol usage. <http://www.predpol.com/atlanta-police-chief-george-turner-highlights-predpol-usage/>
- Short, Martin B., and R. D. Maria. "Orsogna, Virginia B Pasour, George E Tita, Paul J Brantingham, Andrea L Bertozzi, and Lincoln B Chayes." *A statistical model of criminal behavior. Mathematical Models and Methods in Applied Sciences* 18 (2008): 1249-1267.