Smart City Infrastructure Management

# **1. Introduction**

## **Motivation**

Infrastructure management and maintenance is always a major concern for community improvement and city governing. The aim of *Smart City Infrastructure Management* is to apply data-driven strategies to deal with the city Infrastructure issues by forecasting the possible occurrences of different infrastructure issues. Based on the forecasting information, authorities are able to prepare for the possible city infrastructure issues to avoid possible personal and property damage, plan infostructure upgrade and finally improve the lives of its residents.

## **Solution**

The forecasting system is based on the correlation of environment factors (weather, traffic etc) and the city issue work. By modeling the environment data and city issue work data for last ten years, we build the forecasting system. Based on the model and reliable extrapolation of future environment data, we can make the prediction of future city Infrastructure issues.

# **2. Data**

* **The water and precipitation data:**

Community Collaborative Rain, Hail & Snow Network - Total Precipitation Summary <https://www.cocorahs.org/ViewData/TotalPrecipSummary.aspx>

**Dataset Overview:**

The water and precipitation data in csv format with around 120,000 observations. It is collected by the water monitoring stations in Champaign county and environment analysis department.

**Variables reference:**

*Observation Date* - Weather observation date; In this dataset, the observation date is from November 1st, 2006 to April 1st, 2019

*Observation Time* - The exact time to record the weather

*Entry Data Time* - The date to write down the record of weather data

*Station Number* - Number of each weather station in Champaign county

*Station Name* - Name of each weather station in Champaign county

*Latitude* - Latitude of each weather station in Champaign county

*Longitude* - Longitude of each weather station in Champaign county

*TotalPrecipAmt* - Total Precipitation Amount around each station; Precipitation is represented in inches per 24-hour period

*NewSnowDepth* - The depth of new snow that has fallen since the previous observation, usually 24 hours

*NewSnowSWE* - Snow Water Equivalent (SWE) is the amount of water contained within the snowpack in 24 hours

*TotalSnowDepth* - The total depth of snow, ice pellets, or ice on the ground

*TotalSnowSWE* - The total amount of water contained within the snowpack on the ground

*DateTimeStamp* - The date and exact time to record the weather

* **The city issue data**

Provided by the City government.

**Dataset Overview:**

The data is in csv format, with around 54,000 observations. It is published by the city council regarding the city work from 2009 with its type, location and working status.

**Variables reference:**

*# of SR* - Each cityworks’ number

*DESCRIPTION* - Type of cityworks(Clean inlet, Pick up abandoned bicycle(s), etc.)

*DATETIMEINIT* - The start date  to work on each cityworks

*DATETIMECLOSED* - The finished date on each cityworks

*STATUS* - The status about each cityworks, it is either ‘Closed’ or ‘Open’

*PROBADDRESS*- The address of each construction site

*PROBLOCATION* - The original address of each construction site ; It would be NA, if the construction address is not changed

*SRX* - Coordinate of the issue(x-axis) *SRY* - Coordinate of the issue(y-axis)

* [**Vehicle Turning Movement Counts**](https://data.ccrpc.org/dataset/traffic_counts/resource/3da71f28-2f11-49f9-bb6e-451ecdce1994) **data**

<https://data.ccrpc.org/dataset/traffic_counts>

Raw Data Access is needed

* [**Pedestrian Crossing Counts**](https://data.ccrpc.org/dataset/traffic_counts/resource/eb541724-572b-406a-ac19-ecd283bfff97) **data**

<https://data.ccrpc.org/dataset/traffic_counts>

Raw Data Access is needed

* [**Historical Average Daily Traffic**](https://data.ccrpc.org/dataset/traffic_counts/resource/a632505b-bd5e-4aad-bae7-a84f66b3f7ed) **data**

<https://data.ccrpc.org/dataset/traffic_counts>

Raw Data Access is needed

* **Daily and Monthly Temperature data**

<https://stateclimatologist.web.illinois.edu/data/champaign-urbana/>

Raw Data Access is needed

# **3. Methods**

## **Overview**

Based on R and shiny application, to visualize the insights of infrastructure issues and procced the extrapolation analysis to predict the future infrastructure issues.

## **Prototypes**

The sketched interface of our Shiny App is shown below:

A close up of text on a white background

Description automatically generated

**4. Reference**