

# Detecting Metro Congestions: A Traffic Monitoring System for the Washington D.C. Metro Network



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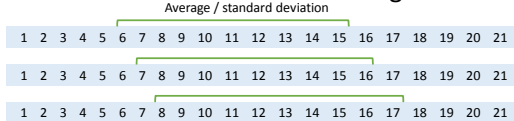
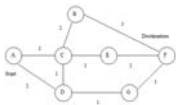


## Introduction

- The Metro commonly experiences **delays** and **inefficiencies** due to **congested areas**.
- Use **fare card data**, which consists of entry and exit time and station of each passenger
- Data-driven system to automatically identify and monitor by **interpolating passenger trajectories**
- Find **outliers**, or areas w/ concentrations that are statistically significant
- Identify **general movement** of passengers

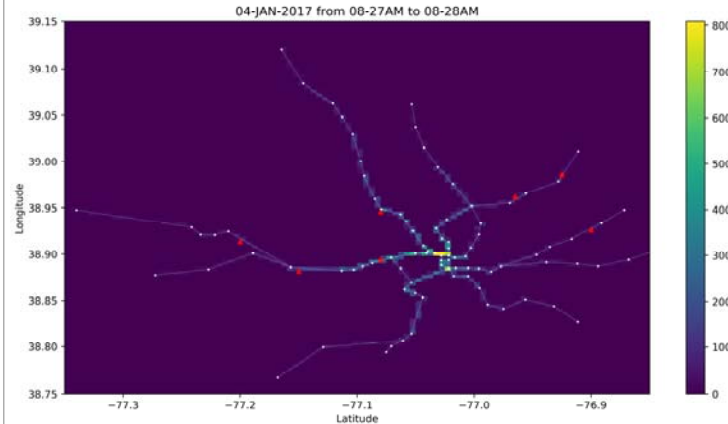
## Methodology

- Modeling the metro network:
  - Network class
  - Station class
  - Trip class
- Find shortest path using Dijkstra's Algorithm
  - Calculate all possible paths
- Assume **constant velocity**
- Plot trips on a heat map (2D-hist)
- **Sliding windows** method
  1. Average of previous ten values
  2. Average of previous nine values and current value
- **Outlier** = concentration that exceeds three standard deviations from the average concentration

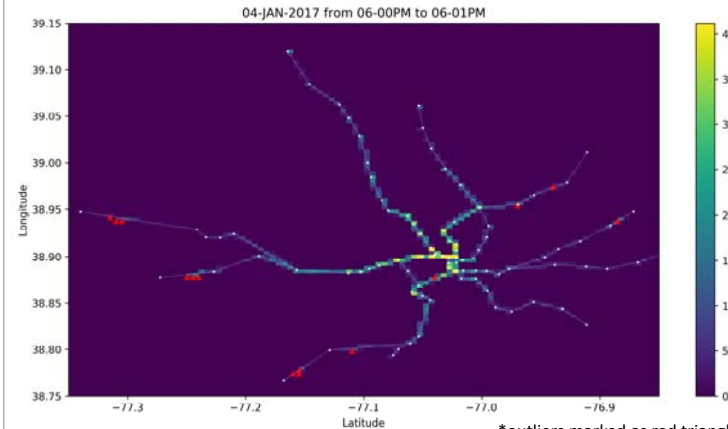


## Results

- **AM Rush: 5:00AM – 9:30AM, SW #1**



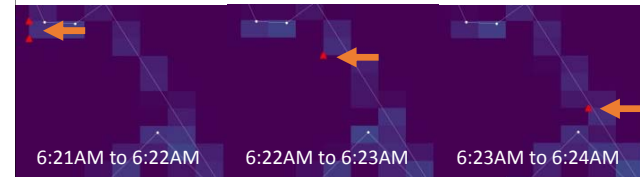
- **PM Rush: 3:00PM – 7:00PM, SW #1**



\*outliers marked as red triangles

## Conclusion

- General **increase** in passenger concentration as location **nears inner city**
- **Greater contrast** in concentration between inner city and suburban areas, during **AM Rush** hours – signifies movement towards **inner city**
- **Smaller contrast** in concentration between inner city and suburban areas, during **PM Rush** hours – signifies movement towards **suburban areas**
- Ability to track groups of passengers through outlier detection
  - Ex) 04-JAN-2017, silver/orange line



- Application: prediction of congested areas

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