Data Science for Urban Mobility
LTAT.06.014
Lecture 7: Data Visualization

Amnir Hadachi, Spring 2022
Data Visualization

Definition

Data Visualization is about perception and understanding a phenomena through a graphical representation of data.
Data Visualization

Objectives

At which level visualisation can be of support in answering questions related to transportation?

What are the traditional and new technique used in visualisation for mobility and transport?
Data Visualization

Topics addressed by visualization

**Topics:**

- Monitoring Urban traffic flows
- Population movement dynamics in urban environment
- Road traffic accident
- Monitoring Urban Emission and Pollution
Data Visualization

Topics addressed by visualization

Topics:

Monitoring Urban traffic flows

Population movement dynamics in urban environment

Road traffic accident

Monitoring Urban Emission and Pollution
Data Visualization

Monitoring Urban Traffic Flows

Rose Diagram

By (Andrienko et al, 2013)
Traffic congestion analysis

Traditionally used for wind speed

https://pypi.org/project/Rosely/

Rose Diagram applied to depict Traffic congestion using Spatio-temporal Analysis
Data Visualization
Monitoring Urban Traffic Flows

Heat map matrix
By (Song & Miller, 2013)
Traffic congestion analysis

https://www.python-graph-gallery.com/heatmap/

Traffic congestion analysis using heat map matrix
Data Visualization
Monitoring Urban Traffic Flows

Heat map matrix
By (Wang et al, 2013)
Traffic congestion analysis

Traffic status based on the heat map matrix in Beijing

Heat map matrix reflecting the congestion formation during the day time
Data Visualization

Monitoring Urban Traffic Flows

Geographic heat maps

https://pypi.org/project/gmaps/

By (Poco et al, 2015)

Exploring traffic dynamic based on vector-valued functions

Coloured road segments based on a given scale

Heat map overlay
Data Visualization
Monitoring Urban Traffic Flows

Isosurface
By (Wang et al, 2013)
Exploring Traffic congestion evaluation and dissipation

https://plotly.com/python/3d-isosurface-plots/
Data Visualization

Monitoring Urban Traffic Flows

**Flow Maps**

By (Andrienko et al, 2013)

Applying clustering approaches combined with colour scale to discover cluster membership

Flow map visualization of speed in road segments (coloured coded in terms of mean speed)
Data Visualization

Topics addressed by visualization

Topics:
Monitoring Urban traffic flows

Population movement dynamics in urban environment

Road traffic accident

Monitoring Urban Emission and Pollution
Data Visualization

Population movement dynamics in urban environment

Sparklines

By (Sagl et al, 2012)

Extracting Spatio-temporal urban mobility information.

Sparkline visualization of temporal variation and net migration flow of total mobility on each urban centre.
Data Visualization
Population movement dynamics in urban environment

Flow Maps
By (Demissie et al, 2013)
Assumption evaluation of mobility patterns using Cellular network handovers.

Volume of incoming vs outgoing handover flows
Handover flows

Flow maps
Data Visualization
Population movement dynamics in urban environment

Line Maps
By (Ferreira et al, 2013)

Exploring taxi mobility patterns based on their daily journeys.

Visualization system of mobility patterns of taxi drivers daily journeys.
Data Visualization

Population movement dynamics in urban environment

Semantic space Maps

By (Andrienko et al, 2016)

Semantic places discovery based on human mobility patterns.
Data Visualization

Population movement dynamics in urban environment

Visual Analytic

By (Chen et al, 2016)

Interactive visual system implementing analytical methods for discovering movement patterns.

- Map-based visualization
- Sankey diagram
- Heat map matrix
- Time plots

Visual Analytic tool.
Data Visualization

Topics addressed by visualization

Topics:

- Monitoring Urban traffic flows
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- Road traffic accident
- Monitoring Urban Emission and Pollution
Data Visualization
Road Traffic Accident

GIS Based Maps
By (Hilton et al, 2011)

Broadcasting location and density of traffic fatalities.

Heat map
Data Visualization
Road Traffic Accident

GIS Based Maps
By (Li et al, 2007)
Analysing spatial-temporal patterns of vehicle crashes using GIS-based bayesian approach.

Bayesian approach
Data Visualization

Topics addressed by visualization

Topics:

- Monitoring Urban traffic flows
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Monitoring Urban Emission and Pollution
Data Visualization

Monitoring Emissions

Circular Heat maps

By (Li et al, 2016)

Visualization approaches for data exploration of air pollution
Data Visualization
Monitoring Emissions

Scatter plot
By (Li et al, 2016)

Visualization approaches for data exploration of air pollution

Representing the relationships between different types of gas emissions PM$_{2.5}$, PM$_{10}$, NO$_2$.
Data Visualization
Monitoring Emissions

Interactive visualization

By Cristie, V et al, 2015

Interactive visual system for estimating generated road traffic heat.

Functionalities for data selection and filtering:
- Pan & Zoom
- Filtering
- Temporal querying
- Heat Cube

Road traffic heat analysis in 3D

Heat distribution on road segment
Data Visualization

Topics addressed by visualization

Topics:

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Other
Data Visualization

Accessibility to jobs and travel time

Heat maps

By (Yin, S, 2018)

Visualization of transit accessibility of Chicago

Travel time and accessibility to jobs
Data Visualization
Time efficiency and OD pairs

Isotime
By (Zeng, 2018)

Isotime visualization for exploring time efficiency of journeys
Data Visualization

Isotime

By (Zeng, 2018)

Time efficiency exploration

Isotime visualization of OD pairs journey
Data Visualization

OD patterns

OD Wheel

By (Lu, 2016)

Exploring origin destination patterns from trajectories.
Data Visualization
Transport systems

Spiral Graph
By (VanDaniker, 2010)

Spiral Graph for transportation system data visualization
Data Visualization

Circos diagram

By (Zeng, 2013)

Junction nodes representation using Circos diagram.

Using Circos graph to represent junction nodes