

CIVIL-557

Decision-aid methodologies in transportation

Lecture I: Data preparation and visualisation in Python

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Motivation



Motivation



First game of playoffs - tree falls on tracks no trains from Prilly

- How many replacement busses are needed...
- ...and to where?

LHC move stadium to 20,000 seater stadium in Crissier

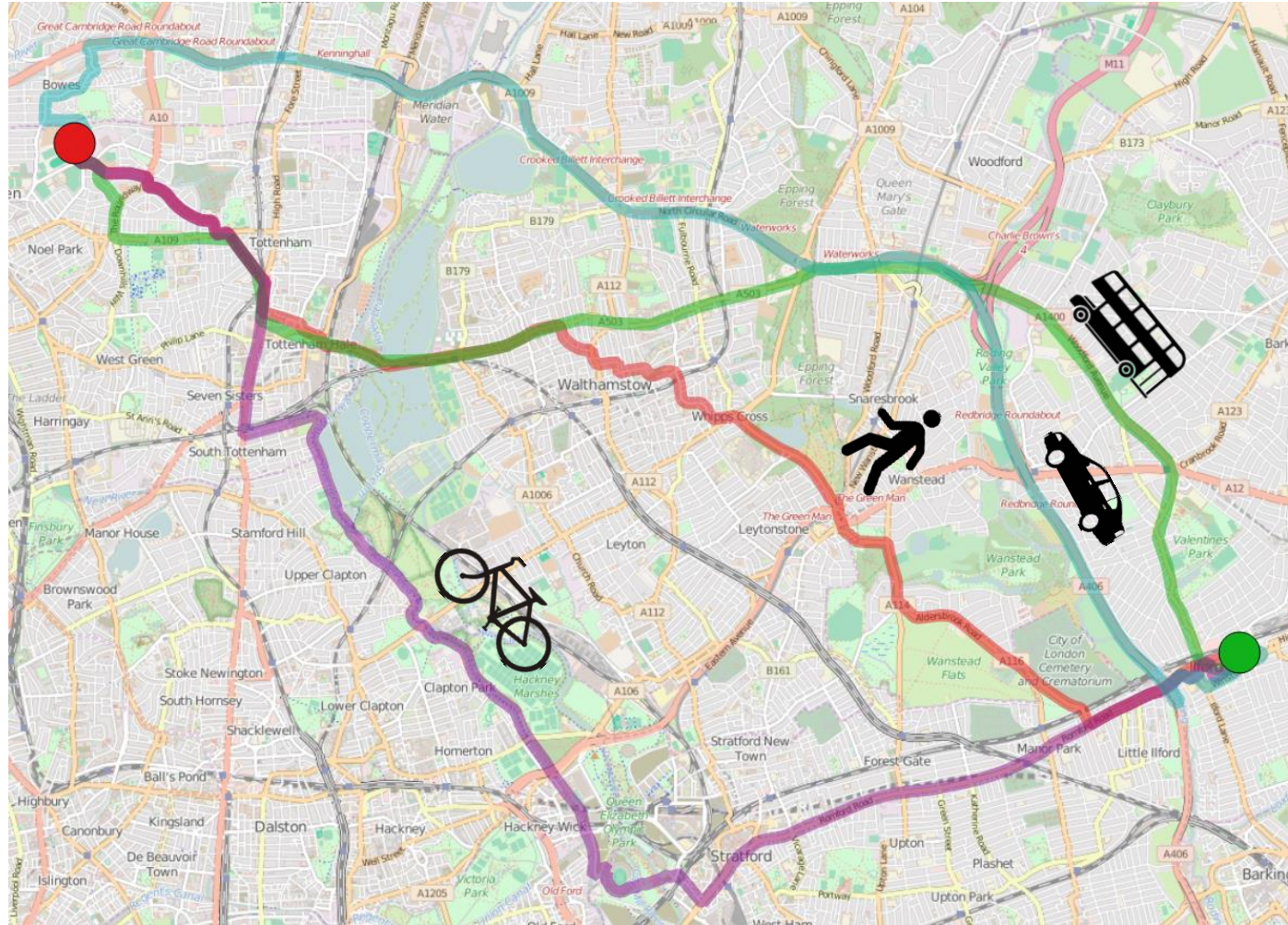
- Extension of M1 line to Crissier?
- Shuttle busses to Renens?
- Let people walk?
- Other solution?

Motivation

How to **aid** informed **decisions** for **transportation** network management and investment?

Understand how people interact with a transport network

Motivation: Mode choice



Motivation: Mode-choice

For a given *origin-destination pair* (trip)...

... predict *chosen mode*

Historically tackled using *Discrete Choice Models (DCMs)*

Motivation: Machine learning

This course will introduce *Machine Learning (ML)* approach (as alternative to DCMs)

Specifically, *supervised classification* of mode choice

(Mathematical Modelling of Behaviour module for DCM approach)

Structure

- One case-study
- 5 *interactive(!)* sessions
- Each session introduces new element of approach...
- ...and covers both *theory* and *practice*

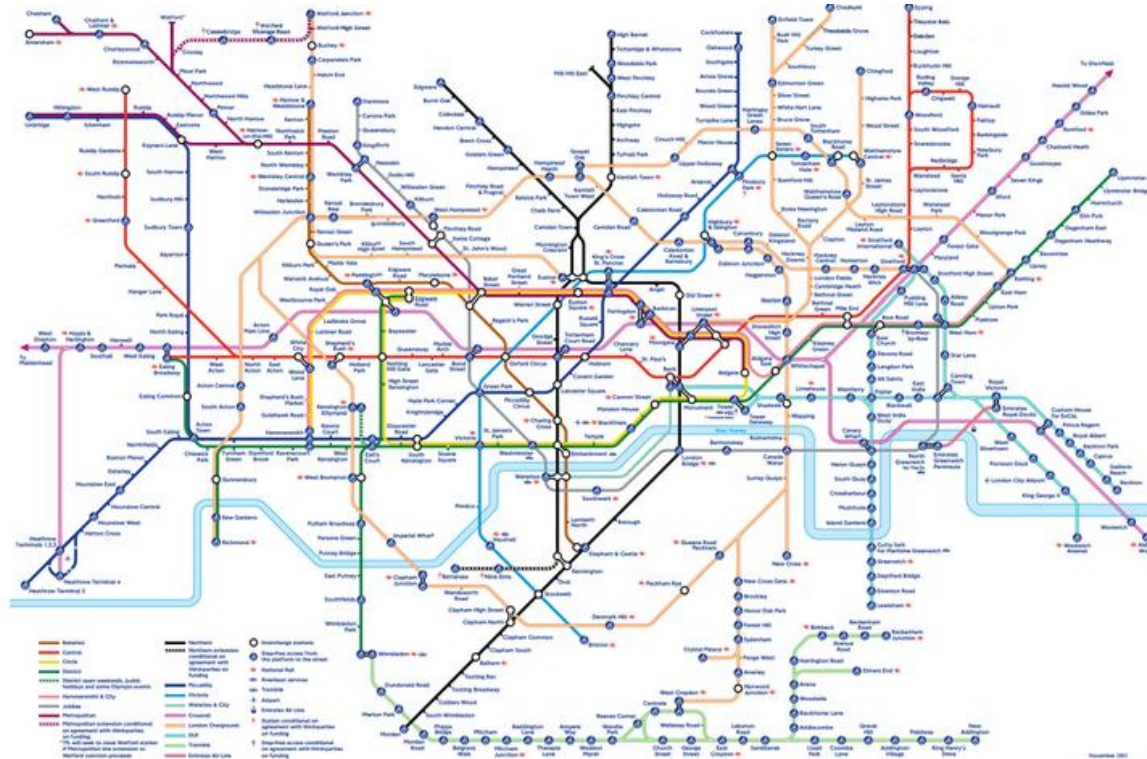
Structure

| Date | Lecturer | Topic |
|--------|----------------------|---|
| Feb 19 | Nikola Obrenovic | Introduction to decision science and linear optimization |
| Feb 26 | Nikola Obrenovic | Linear Programming and Duality |
| Mar 5 | Tim Hillel | Introduction to Python and data visualisation |
| Mar 12 | Tim Hillel | Classification methods 1: Logistic regression and probabilistic metrics |
| Mar 19 | Tim Hillel | Classification methods 2: Deterministic methods and discrete metrics |
| Mar 26 | Guest Speaker | Operations Research in Practice |
| Apr 2 | | Mid-term exam |
| Apr 16 | Nikola Obrenovic | Integer optimization |
| Apr 16 | Nikola Obrenovic | Multicommodity Network Design I |
| Apr 23 | | No Lecture (Easter Holidays) |
| Apr 30 | Nikola Obrenovic | Multicommodity Network Design II |
| May 7 | Tim Hillel | Classification methods 3: Ensemble methods and hyperparameter search |
| May 14 | Tim Hillel | Classification methods 4: Issues with performance validation |
| May 21 | Hillel and Obrenovic | Research Topics from TRANSP-OR and Presentation of the Final Projects |
| May 28 | Hillel and Obrenovic | Questions and Answers |

Case study



Transport for London



Case study



6 stadiums with over 60,000 capacity



Today

- Introduce and use tools
- Including:
 - Python
 - Jupyter
 - Numpy
 - Matplotlib
 - Pandas