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Simple Open Data Measures of Public Transit Service Availability

Usecases for Closeness Centrality and Isochrones

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1 Introduction

In recent years, but for decades by now, the demand for a paradigm shift in transportation infrastructure and service has become louder and louder. While calls for a shift away from car centric mobility are nothing new and were a well established part of German Academic discourse in the 1990s already [1], it has become part of a widespread political discourse around the so called *Verkehrswende* [2]. With increased awareness and concrete experiences of climate change this discourse has reached states of heated debate. Benefits of

1.1 Transit Accesibility Equity and Equality

1.1.1 Terminology

1.1.2 Motivation

- Traditional transport planning centering on men?
  - German Transport Planning post world war 2?
- Transit planning and identifying demand in public transit networks is a complicated process, that takes into account a plethora of data that's hard to access or acquire [3].
  - statistical routing data based on conveyal engine [4]

1.1.3 Research Question

- How can an easy closenes centrality measure help asses transit service availability and equality

1.2 Related Work

- Network Centrality Measures
  - road networks
  - public transit networks
  - bipartite networks
- Transit Equity Studies
  - US
  - Network Planning [3]

1.3 Methodological Approach

1.3.1 Data Acquisition

- explorative data analysis

1.3.2 origins

- hexgrids from h3pandas

1.3.2.1 Transport Data

- osm files from geofabrik [5]
- gtfs files from various transit companies [6]–[8] vrs

1.3.2.2 Destinations

- Usage of openly available data, preferably from osm .. extracted with pyrosm [9]
- specific data if necessary, eg secondary school data not mapped in osm [10]

1.3.3 Data Processing

- Isochrones
  - available from openrouteservice [11], as used in [12], not used because:
- travel time matrices
  - enough for basic reach analyses, isochrone itself not important
  - calculated with r5py [13] as used in [14], based on the conveyal engine [4], [15]

1.4 Geographic Case Studies

- Selected based on data availability, personal familiarity.

2 Closeness or Reachability

2.1 Closeness Centrality

2.2 Reach

2.2.1 Isochrones as a Measure of Reach

2.3 Comparison Use Cases

2.4 Methods

2.4.1 Available Data

- school data from [10]
- sports data from osm

2.4.2 Processing

2.5 Results

2.5.1 Temporal Variability

3 Distinguishing Transit Footprints

3.1 Historical Urban Blueprints

3.2 Radial and Tangential Services

3.3 Methods

3.3.1 Visual Differences

3.3.2 Inequality Measures

- Lorenz Curves and Gini Coefficients being silly sometimes [16]

3.4 Results

3.5 Hub and Spoke Transit Planning

4 Comparisons with Non-Schedule-Based Modes

4.1 Cycling

4.1.1 Methods

4.1.2 Results

4.2 Cars

4.2.1 Methods

- added parking times

4.2.2 Results

4.3 Temporal Discrepancies with Scheduled Transit

4.4 Limitations

- limitations to car traffic estimations
- limitations to parking times

5 Recap of Results

6 Discussion

6.1 General Limitations

- Lack of real world measures as Comparisons
- Focuses solely on door to door travel times and neglects
  - reliability Data
  - delay data both for cars and public transit
  - public transit fare structures [17]
- *inequality* being silly at times [16].

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