Calculating Route Probability from Uncertain Origins to a Destination

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Introduction

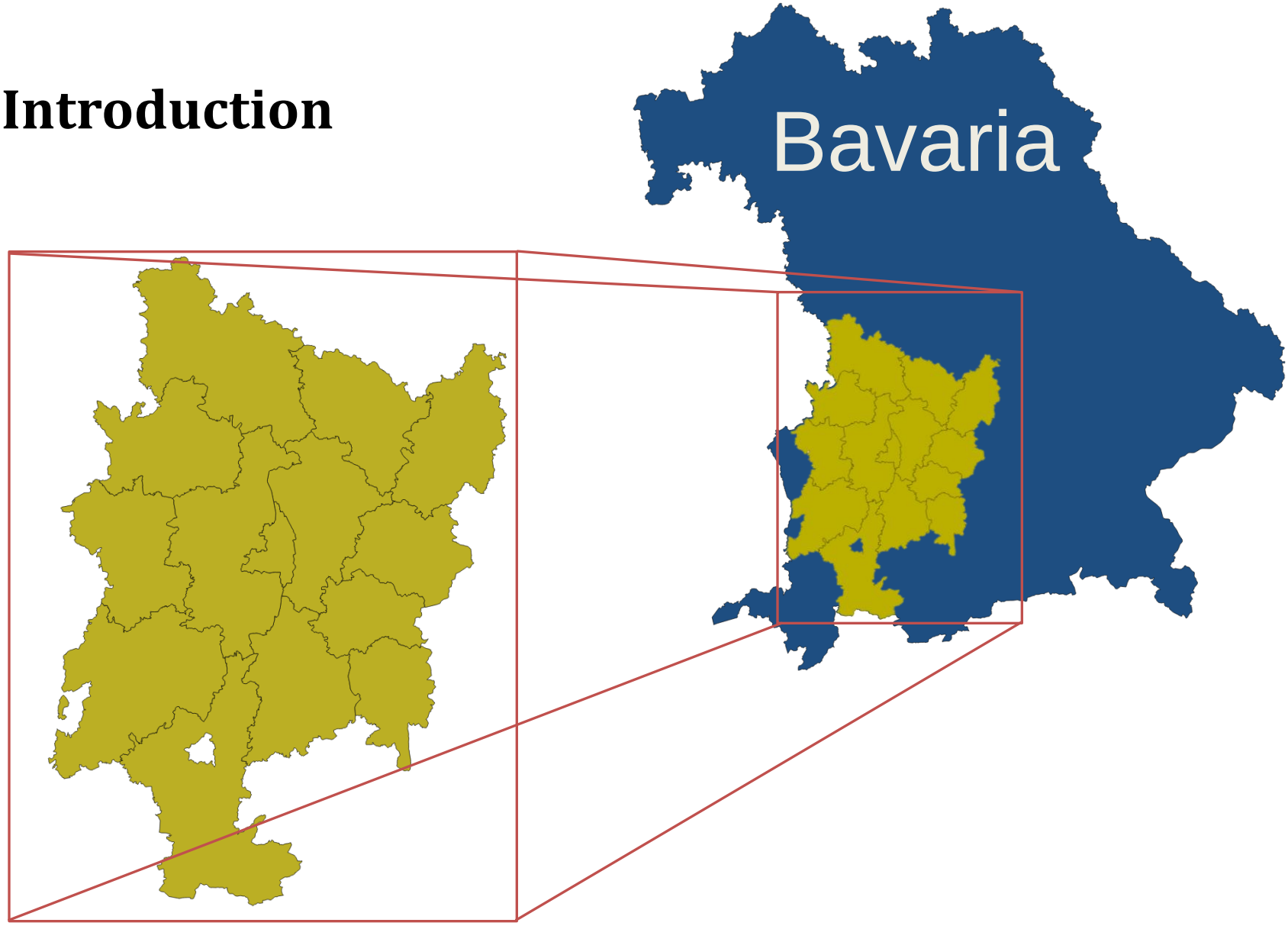
- LBS used for routing functionalities (e.g. to soccer stadium)
- Routing from a Polygon
- Identifying most probable route
  - Unknown origin
  - Known destination

Graph G = (V, E)

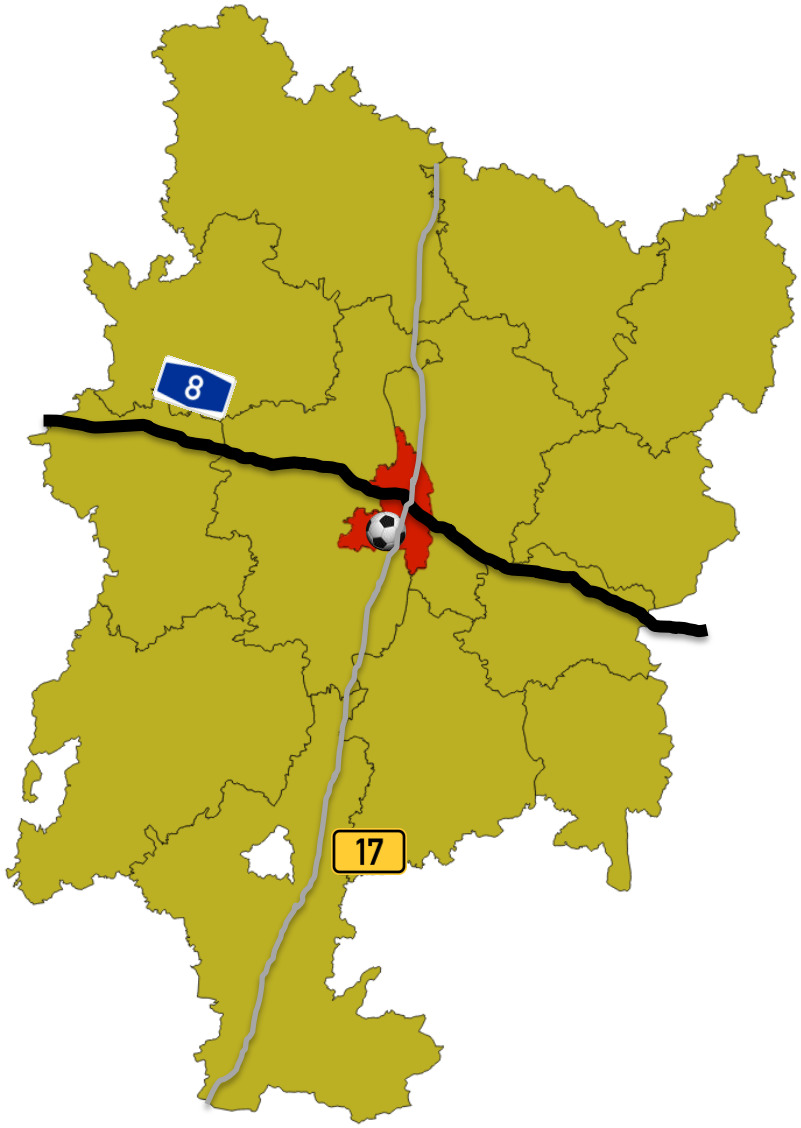
Origin o ∈ V within a polygonal boundary P and o ∈ P

Destination $v_d \notin P$

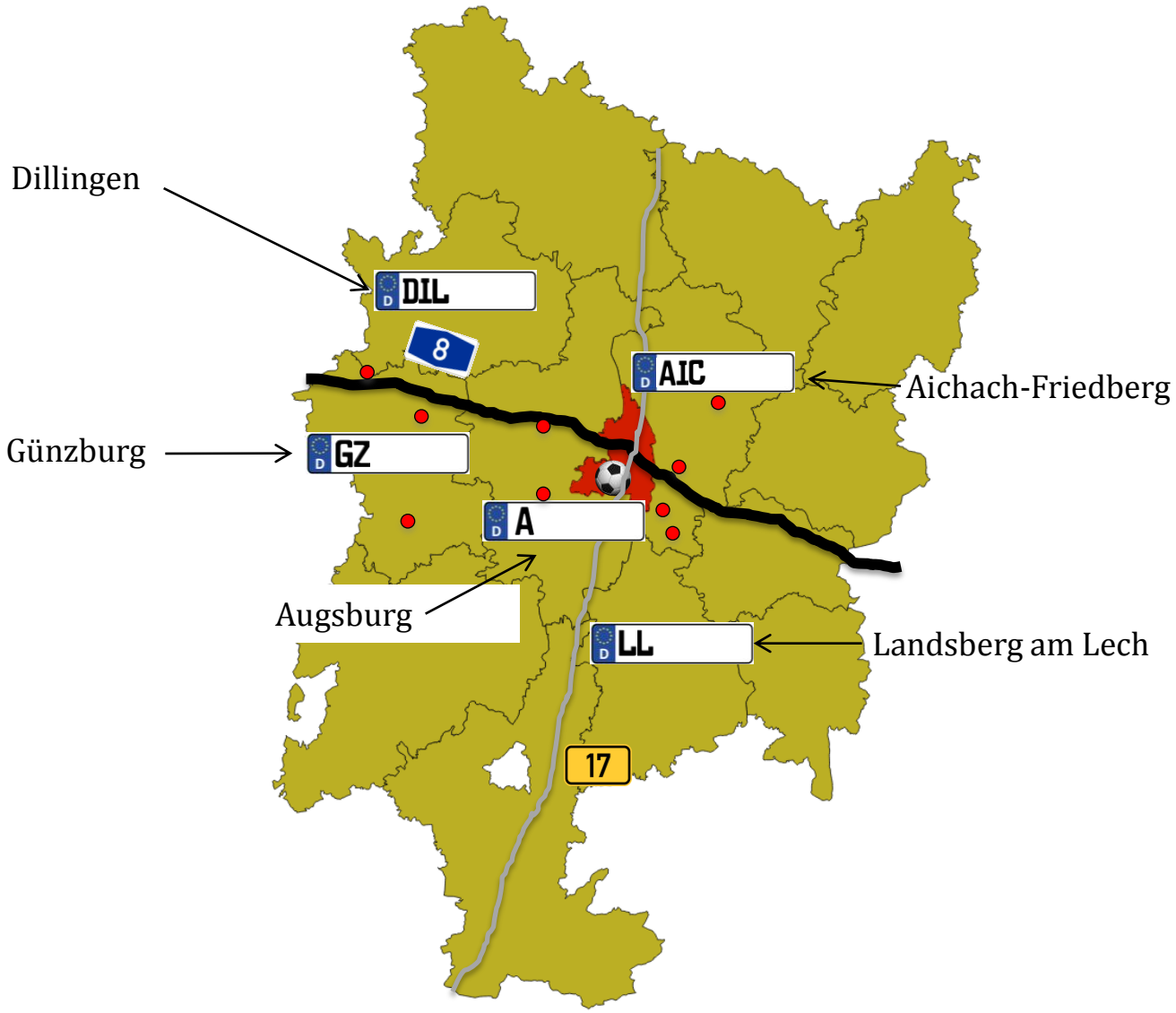
Introduction



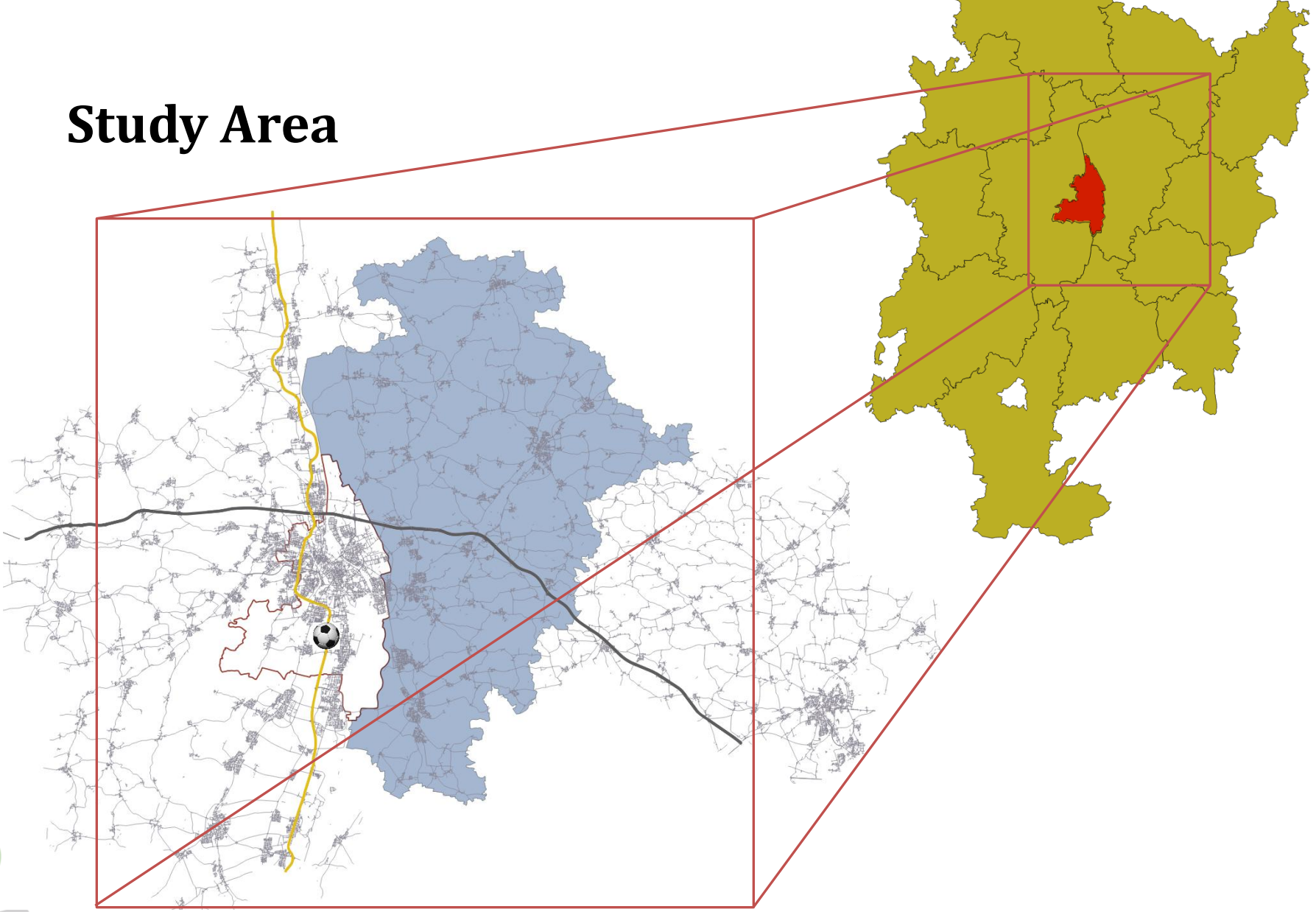
Introduction



Introduction



Study Area



Approach

Testing several methods:

–Randomly dispersed points (50, 1000)

–Regularly dispersed points with a certain mutual distance (500 m, 1000m)

- Weighted
- Unweighted

–Street network density

Comparing Results

Calculating to different values:

–R-Values (relative frequency per method)

- Normalization of values for each method

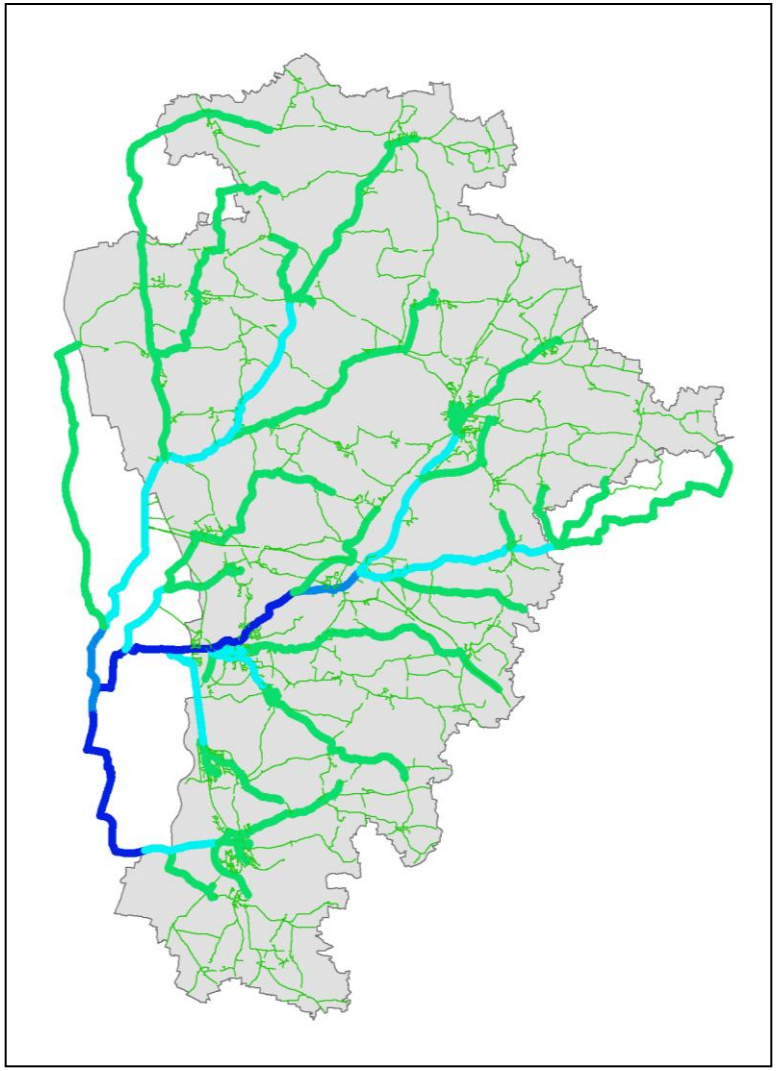
  $relfreq_i = frequ_{max,method\_x} / frequ_i$

–O-Values (relative frequency per segment)

- Normalization of values for each segment

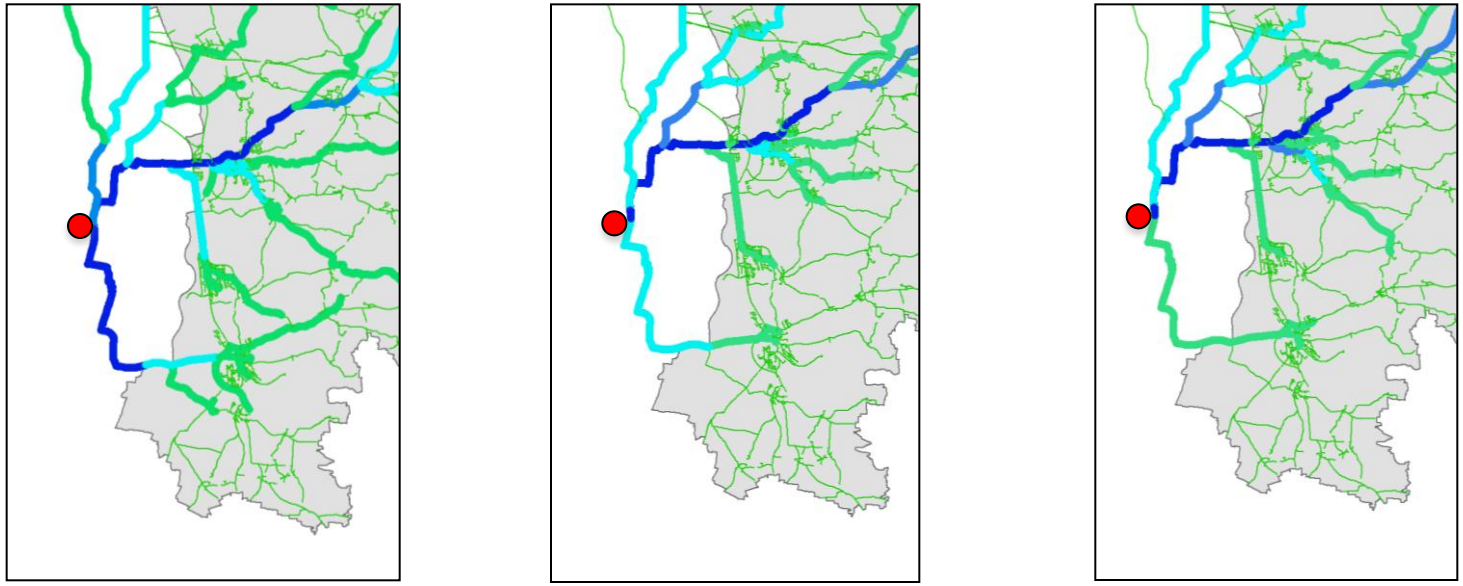
  $oidfreq_i = relfreq_i / max_{oid}$

R-Values



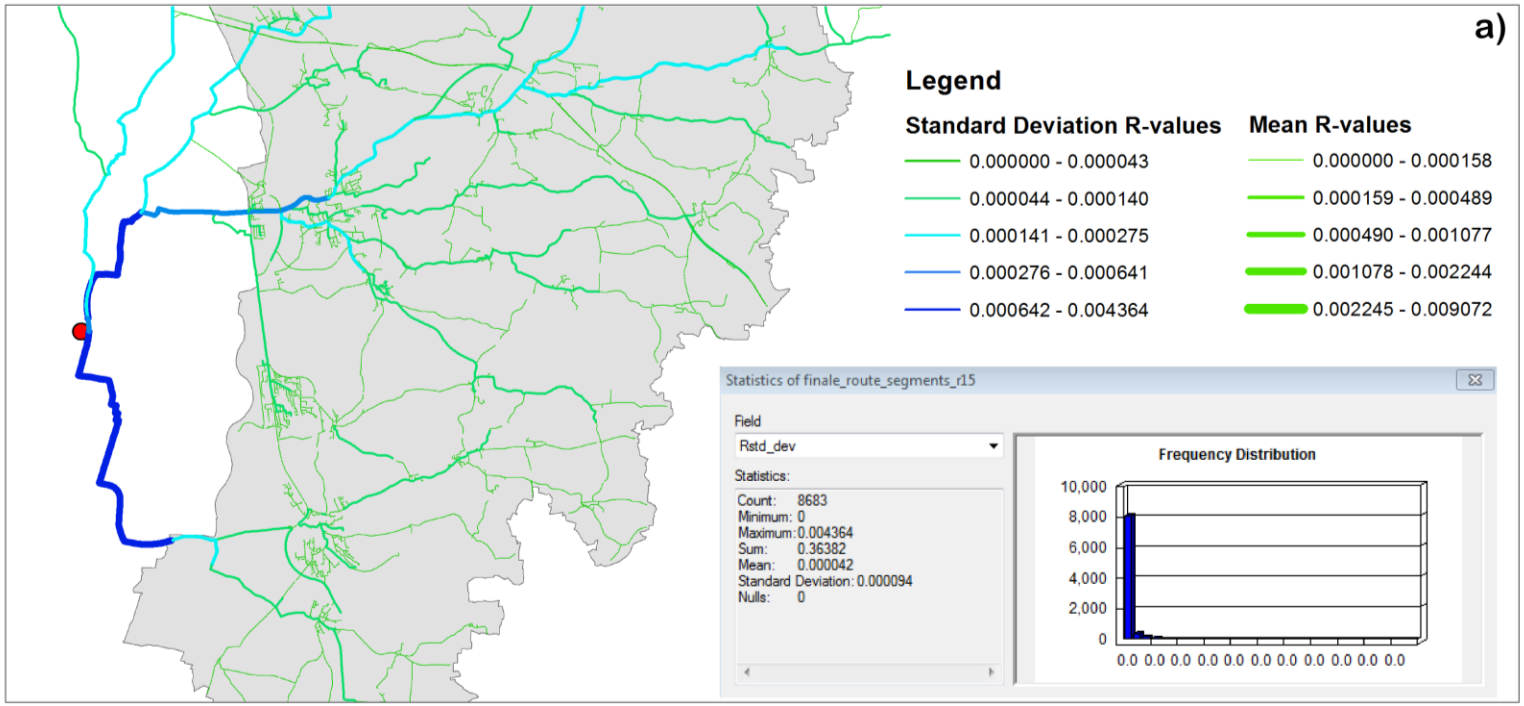
R-Values for 50 randomly dispersed points

R-Values

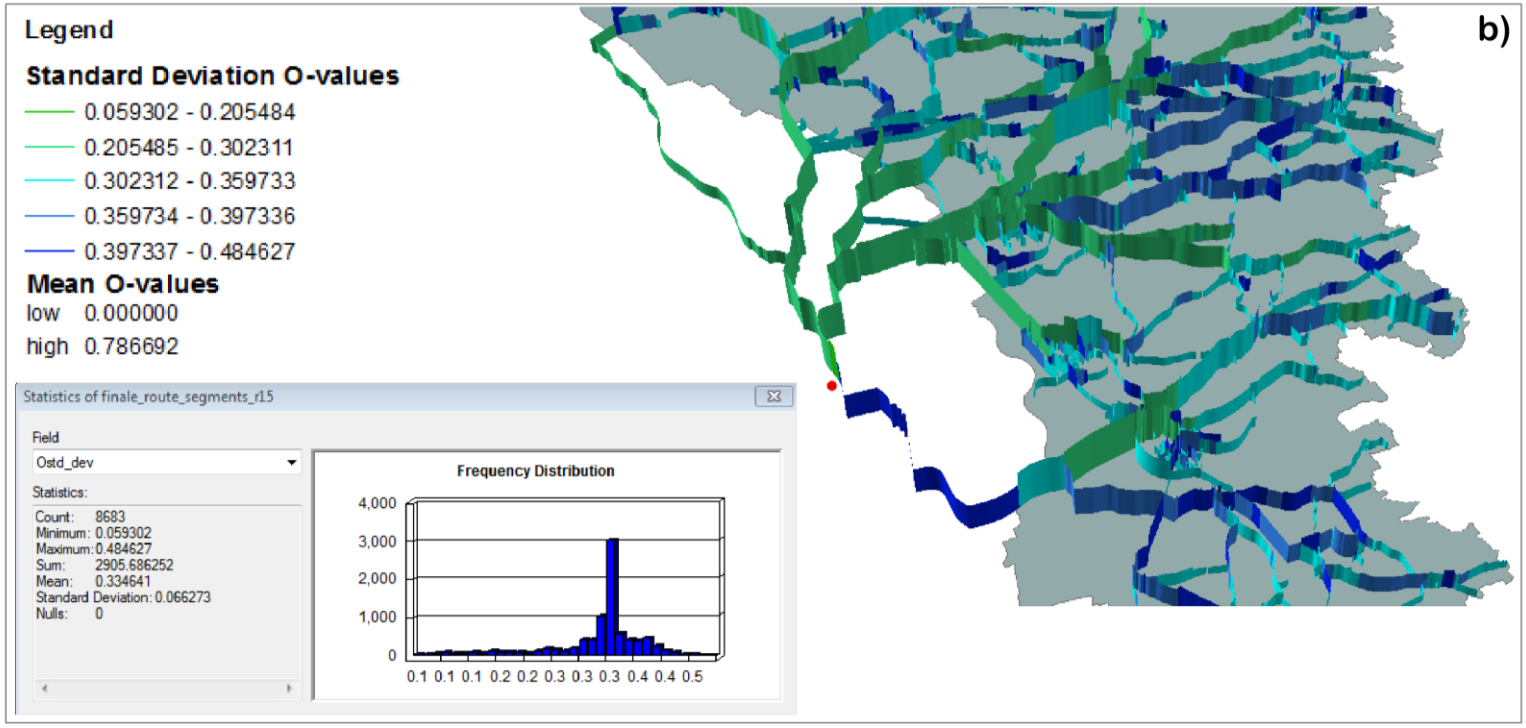


Comparision of the R-Values for 50 randomly dispersed points (left), 500 m regularly dispersed, weighted points (middle) and 1000 m regularly dispersed, weighted points

R-Values


a)
Legend
Standard Deviation R-values
0.000000 - 0.000043
0.000044 - 0.000140
0.000141 - 0.000275
0.000276 - 0.000641
0.000642 - 0.004364
Mean R-values
0.000000 - 0.000158
0.000159 - 0.000489
0.000490 - 0.001077
0.001078 - 0.002244
0.002245 - 0.009072
Statistics of finale_route_segments_r15
Field
Rstd_dev
Statistics:
Count: 8683
Minimum: 0
Maximum: 0.004364
Sum: 0.36382
Mean: 0.000042
Standard Deviation: 0.000094
Nulls: 0
Frequency Distribution
10,000
8,000
6,000
4,000
2,000
0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0

O-Values


Legend
Standard Deviation O-values
0.059302 - 0.205484
0.205485 - 0.302311
0.302312 - 0.359733
0.359734 - 0.397336
0.397337 - 0.484627
Mean O-values
low 0.000000
high 0.786692
b)
Statistics of finale_route_segments_r15
Field
Ostd_dev
Statistics:
Count: 8683
Minimum: 0.059302
Maximum: 0.484627
Sum: 2905.686252
Mean: 0.334641
Standard Deviation: 0.066273
Nulls: 0
Frequency Distribution
4,000
3,000
2,000
1,000
0
0.1 0.1 0.1 0.2 0.2 0.3 0.3 0.3 0.4 0.4 0.5

Results

- Main differences between weighted and unweighted methods
  - With unweighted regularly-dispersed-method the routes are more dispersed on the network
  - Weighted regularly-dispersed-method lead through the agglomeration areas
- Number of random points has to be big enough (1000 random points similar to line density)
- Future routing application can make use of our findings (e.g. transportation planers)

Future Work

– Comparison of
  - the probabilities of the route segments with topological network measures
  - TAZ centroid-based routing processes

  at a number of structurally different networks
– Validation using observed frequency (e.g. FCD)
– Factoring route choice heuristics
– Factoring temporal fluctuation

Thank you