CYCLE NETWORKS — FINDING THE MISSING LINKS

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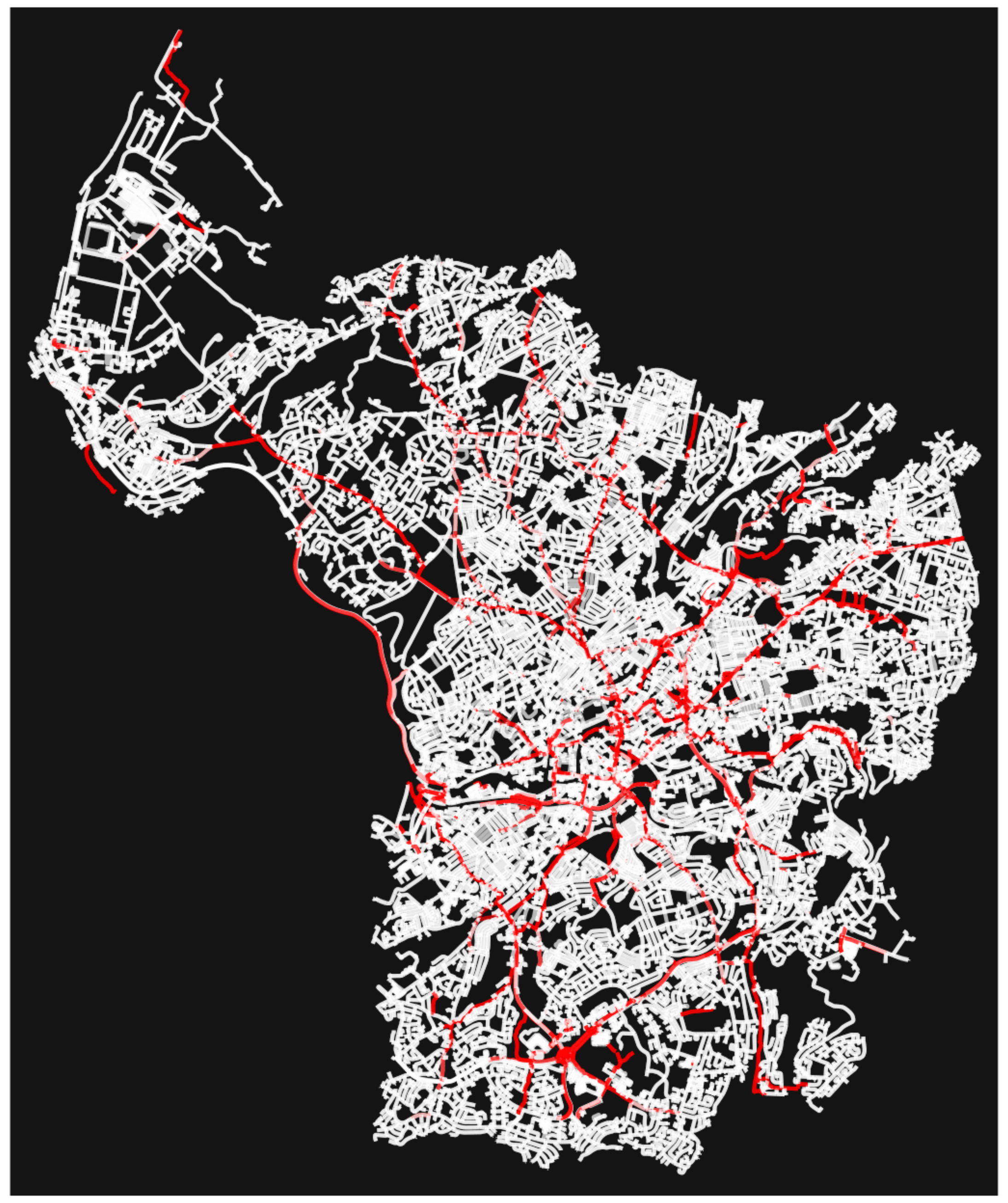
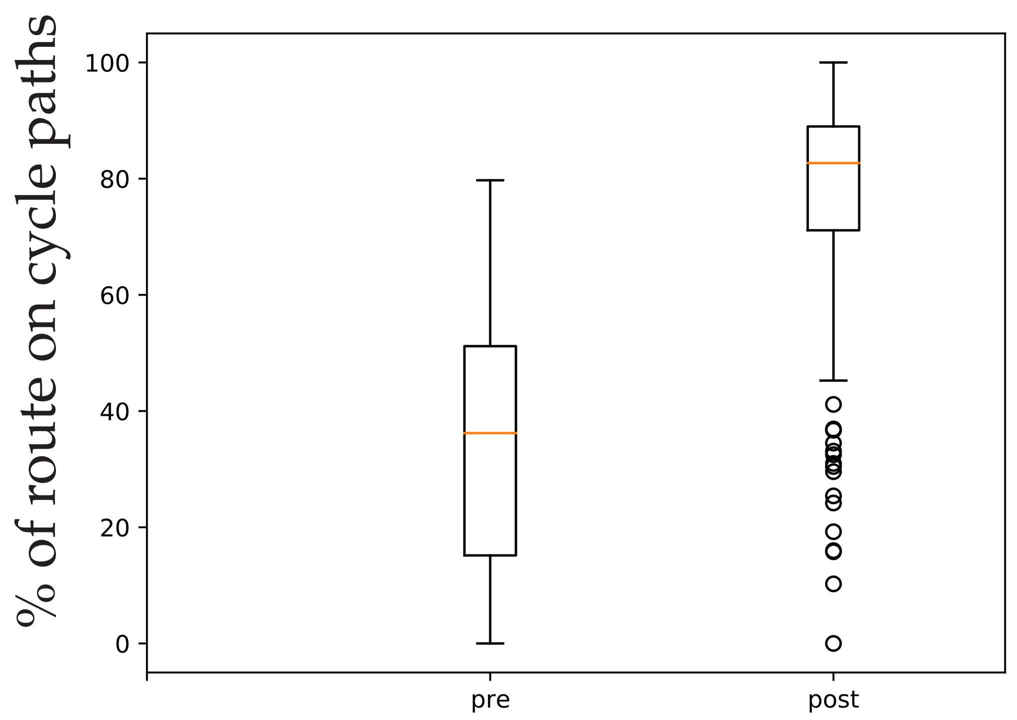
ABSTRACT

Cycling is becoming increasingly more popular as a means of transport around large cities [1]. Research suggests that increased provision of cycling infrastructure is correlated with increased numbers of cyclists in a city [2].
This project asks three questions:

- Can a simple model of propensity to cycle give a good approximation of cyclist route choice?
- Can we use a simple heuristic to inform cycle network upgrades in a given city?
- How close does the heuristic approach come to formal optimal network design?

BRISTOL STREET NETWORK UPGRADE





- We have doubled the amount of cycling infrastructure on the Bristol network.
- The upgrade heuristic strives to create a connected cycle network.
- The upgraded allows the average cyclist to spend upwards of 80% of their route on designated cycling infrastructure.

METHODS

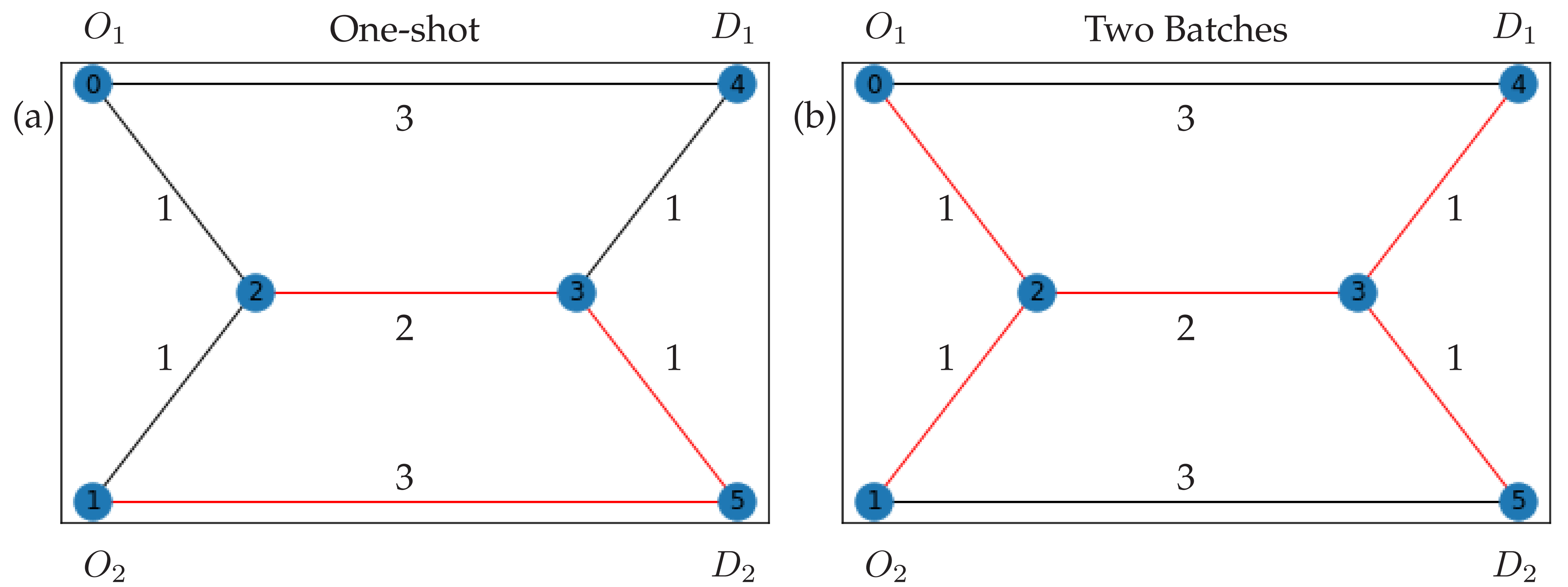
Cyclist route choice is modelled by a single parameter ω_k, their propensity to cycle, the edges in the street network then have perceived length

$$\hat{l}_{i,j} = l_{i,j}(1 + \omega_k p_{i,j}). \tag{1}$$

The network is then upgraded in the following steps:

1. Load network with cycling demand by generating OD pairs.
2. Calculate the shortest route between OD pairs according to perceived length.
3. Calculate edge flows corresponding to how many cyclists use each edge.
4. Upgrade the edges with the highest flow that currently have no infrastructure until upgrade budget L is reached.

CROSS NETWORK EXAMPLE



- Both schemes upgrade half the length of the entire network with cycling infrastructure.
- The output from two batches performs significantly better on our scoring metric.
- In this case the two batches output is in fact the optimal network design for our budget.

REFERENCES

[1] C. Allan. Cycling UK's cycling statistics. https://www.cyclinguk.org/statistics. Accessed 2020-12-02.

[2] J. Dill and T. Carr. Bicycle commuting and facilities in major US cities: if you build them, commuters will use them. *Transp. Res. Rec.*, 1828(1):116–123, 2003.

KEY CONCLUSIONS

- A simple one parameter model for propensity to cycle is enough to effectively model cyclist route choice on journeys within a city.
- Our heuristic approach informs cycle network design in a way that prioritises connected cycle paths, ultimately yielding better cyclist satisfaction.
- It can be shown that in some cases our heuristic can, in fact, yield optimal network design and as such is a great starting point for cycle network planning.