Geospatial Analysis on Public Spaces and Transport Networks

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The presence of green spaces in a city contributes to improving air quality, and thus positively impacting the health of the inhabitants while mitigating the climate effect. In this project we consider how to measure the accessibility of public green spaces through the city's transport network. In particular, we used Edinburgh, a city with around $750,000$ trees and a large number of parks to date, as a test case.

The industry standard metric is the shortest path, describing the minimum distance between green spaces and other parts of the city. With this as a benchmark, we studied the average round trip distance of a random walk between green spaces and non-green spaces by commute distance, simulated the movement of people through the city over time by diffusion, and finally measured the effect of green spaces as a source of happiness. To implement such models, we construct Edinburgh as a graph where the intersections of streets are nodes and the roads/paths connecting them are edges.

To reduce computational expense, we construct subgraphs of the city of Edinburgh namely Canongate Kirk, Liberton Golf Course and Corstophine Hill Local Nature Reserve and our results show that:

- Focusing on the visualisation for shortest path, we may conclude that green space in Canongate Hill will have the worst access when considering extreme values. However, on average people living in that region have shorter paths to their nearest green spaces than those living in the Corstophine Hill area.

- Commute distance is highly sensitive to the size of the subgraph. Liberton Golf Course appears to far out perform the other two regions, however this subgraph containes the fewest nodes. As such, it is hard to say if the area has better access in a random walk model, or if the fewer nodes and edges from the localisation mean that people are less able to 'become lost' for long periods.

- Through our diffusion models, we gain a better understanding of the connection between green space population and the diffusion coefficient over time.

- The happiness diffusion model suggests that people living around larger parks in the Canongate Kirk and Liberton Golf course seem to be more happy than those living far from those spaces in these regions. However, we could obtain more nuanced results by fine-tuning parameters, because area of the green spaces hold much weight in this model, such that the largest parks dominate over more local influence of adjacency to parks.

Adding new roads and new green spaces to a city will result in changes to how accessible green spaces are. Different metrics may be more or less sensitive to such perturbations. We would therefore like to investigate the robustness of a city to small changes to things like road closures in further development of green space accessibility metrics.