

# Smart Mobility & Accessibility for BarrierFree Access









### 1 — Data Challenge



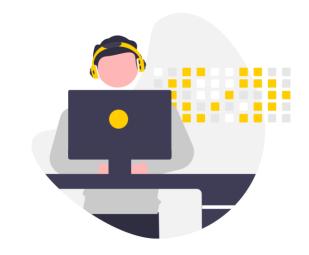


How do we process the noisy GPS data collected by volunteers so that we can convert it into a format that can be used for accessible navigation?





### 2 Data Cleaning







## Reducing Spatial Data Set Size with Ramer-Douglas-Peucker Algorithm

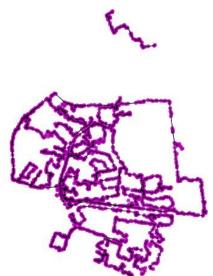
- Ramer-Douglas-Peucker algorithm produces a simplified polyline by recursively dividing the line
- The final result is a **subset of points** from the original curve that still keeps the original's characteristics/shape





### Ramer-Douglas-Peucker Algorithm





**Original** vs **New**Data Points





#### **Reverse Geocoding**

 Convert latitude/longitude into address/location details to give more insight to data



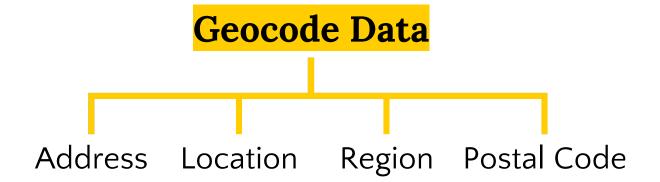
Point location (Latitude/Longitude)



Address and Location details







This provides **more value** by tying the latitude/longitude values to actual locations in Singapore, providing ways to potentially sort and classify the points.



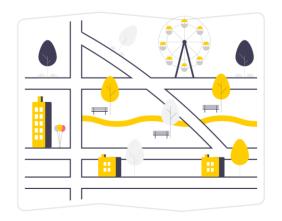
### Plotting to a Map







### Plot data points to a map using Folium

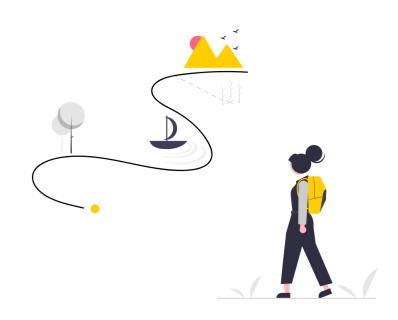


Plot points into a map using Folium

Provides a visual representation of data on a map



## Finding Shortest Path

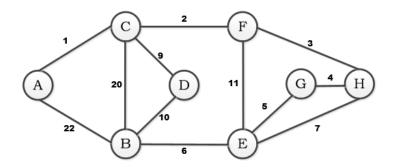






#### **Data representation**

- Use an undirected weighted graph to represent the points
- Weight of edges between nodes represents distance between each point







#### Dijkstra's Algorithm

 Use Dijkstra's to find the shortest path between a start point and end point (with inputs from user)





#### Calculate Distance between Geo-locations

- Calculate distance based on weights of the path taken implement Haversine distance formula to compute distance from lat/long change between 2 points into actual distance measures (i.e. metres, kilometres)
- Haversine distance is the angular distance between two locations on the Earth's surface



#### **Limitations of Our Solution**

### Strong reliance on historical data

Only referencing the data points restricts our pathfinding ability, only being able to derive paths that have been mapped before

### Elevation change not accounted for

As the data was inconsistent, we felt that the mean values were not an accurate representation, hence we remove it when weighting nodes

#### Validation of shortest path

Visualised path may not accurately reflect reallife path

Difficult to validate based on map information alone



#### What's next?

### Improving data cleaning process

A number of different ways to reduce spatial data set sizes (e.g. Kmeans clustering) that may produce better results than current approach (RDP)

A combination of algorithms may result in a finer and detailed data set

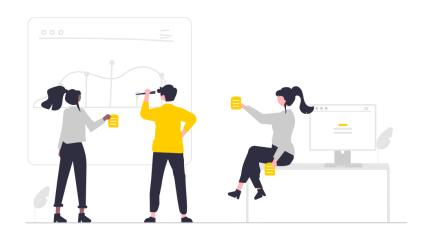
### Improve validation of pathfinding algorithm

Cross-referencing data points from other sources such as Google Maps to validate the shortest paths generated by the current algorithm

Take into account elevation change to validate if generated paths are feasible for wheelchair users.



## Thank you for your kind attention!



I hope that what I have accomplished will value add to SmartBFA's efforts of mapping routes for wheelchair users





### {Code for Asia}



presented to

#### **Than Than Swe**

for completing the
DigiLABS Data Science Foundational Course
25 April - 18 June 2022

Ms Enjiao Chen

Co-founder Code for Asia Mr Jaryll Chan

Division Director, Programmes Singapore International Foundation (SIF)





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### Certificate of Completion

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#### **Than Than Swe**

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20 June - 30 July 2022

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