A NEW ROUTE SIMILARITY MEASURE

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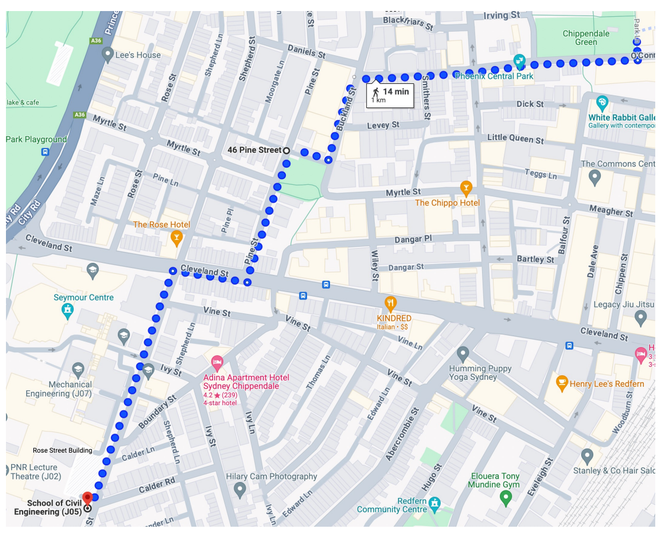
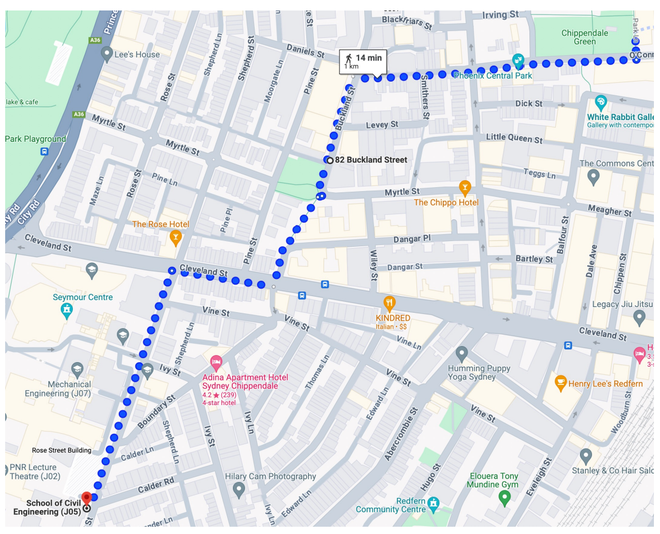
Motivation

ROUTE CHOICE can be regarded as a discrete choice problem. However, given that the selected route and other alternative routes in the choice set may share certain links, possess nearly identical attributes, or be positioned adjacently, the alternative routes in the choice set are not entirely independent of each other. The partial independence increases the difficulty of modelling but also makes the incorrect route choice prediction still useful. This contrasts with many other discrete choice problems. Therefore, this study introduces a new similarity measure that encompasses the overlap rate, attribute similarity, and spatial similarity.

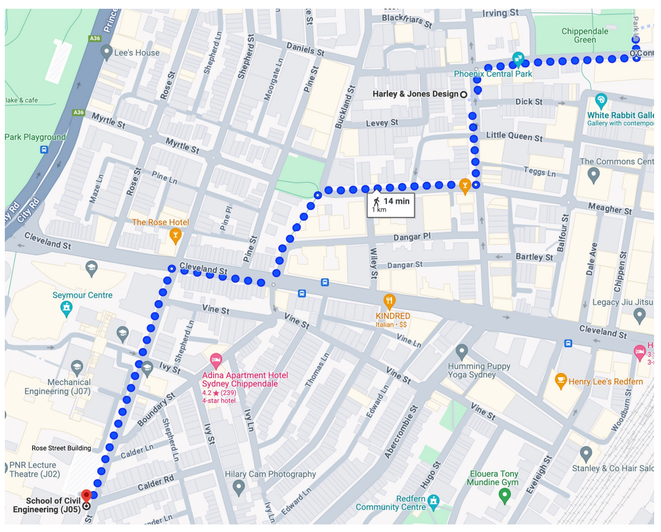
How different are these three routes?



Chosen route



Predicted Route 1



Predicted Route 2

Methodology

Overlap Rate (Ω)

$$\Omega = \frac{L_s}{L_t}$$

L_s: the total length of links that shared between predicted route and chosen route
L_t: the total length of the chosen route

Attribute Similarity (X)

$$X = 1 - \frac{1}{\sum_i^I w_i} \cdot \sum_i^I \frac{w_i \cdot |\widehat{x_i} - x_i|}{\widehat{x_i} + x_i}$$

w_i: the weight of attribute i
x_i & $\widehat{x_i}$: attribute i of non-overlapped parts in the chosen route & in the predicted route

Spatial Similarity (1-D)

$$\mathrm{D} = \frac{d}{d + L_n}$$

d: the average deviation between the predicted route and the chosen route
L_n: the total length of the non-overlapped links in the predicted route

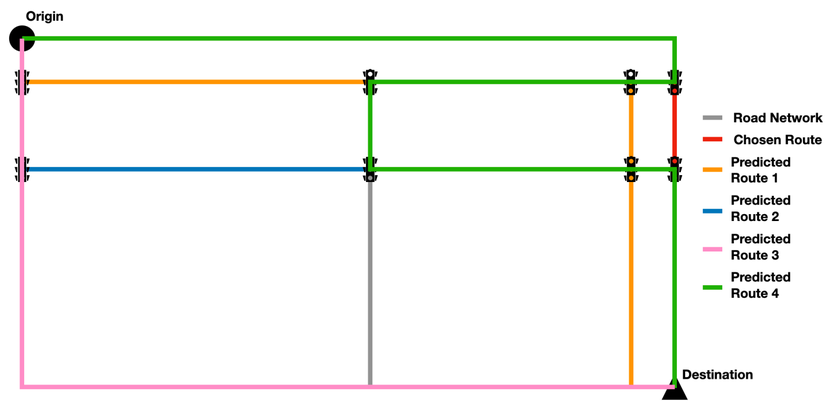
New similarity measure

$$S = \Omega + (1-\Omega) \cdot [\alpha \cdot X + (1-\alpha) \cdot (1-D)]$$

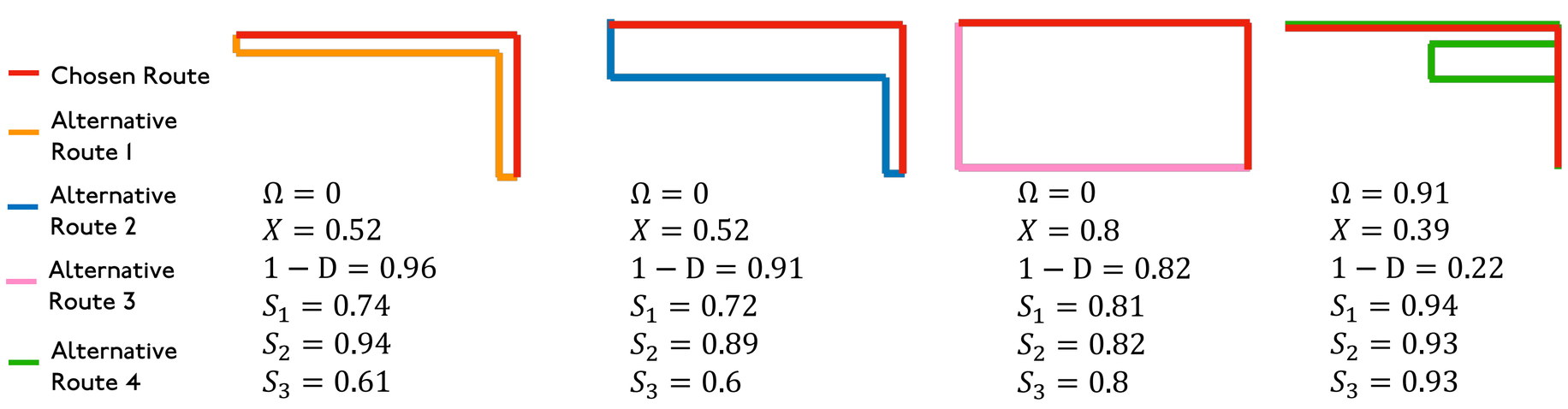
α: the weight of attribute similarity in measuring overall similarity
$1-\alpha$: the weight of spatial similarity in measuring overall similarity

Example

Three Scenarios are included:
S_1: $\alpha = 1 - \alpha$
S_2: $\alpha < 1 - \alpha$
S_3: $\alpha > 1 - \alpha$



Results



$\Omega = 0$	$\Omega = 0$	$\Omega = 0$	$\Omega = 0.91$
$X = 0.52$	$X = 0.52$	$X = 0.8$	$X = 0.39$
$1 - \mathrm{D} = 0.96$	$1 - \mathrm{D} = 0.91$	$1 - \mathrm{D} = 0.82$	$1 - \mathrm{D} = 0.22$
$S_1 = 0.74$	$S_1 = 0.72$	$S_1 = 0.81$	$S_1 = 0.94$
$S_2 = 0.94$	$S_2 = 0.89$	$S_2 = 0.82$	$S_2 = 0.93$
$S_3 = 0.61$	$S_3 = 0.6$	$S_3 = 0.8$	$S_3 = 0.93$

Takeaway tips:
1. The similarity measure provides extra information to overlap rate (PR4)
2. By setting an appropriate weight and a threshold, routes with similar attributes (PR3) or spatially closer (PR1) can be identified.