

An automated demand forecasting model for new railway stations

DAFNI for transport research: 24 March 2021

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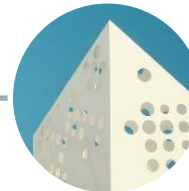
What does the model do?



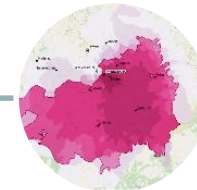
Individual station(s)



New line



Abstraction analysis



Catchment visualisation

A national trip end model with probability-based catchments

$$\ln \hat{V}_i = \alpha + \beta \left(\ln \sum_z Pr_{zi} P_z w_{zi} \right) + \gamma \ln F_i + \delta \ln J_{it} + \epsilon \ln Pk_i + \zeta Te_i + \eta El_i + \theta B_i$$

V - annual trips

Pr - probability of station being chosen

P - population

w - decay function

Z - postcodes with station *i* in choice set

z - postcode

F - service frequency

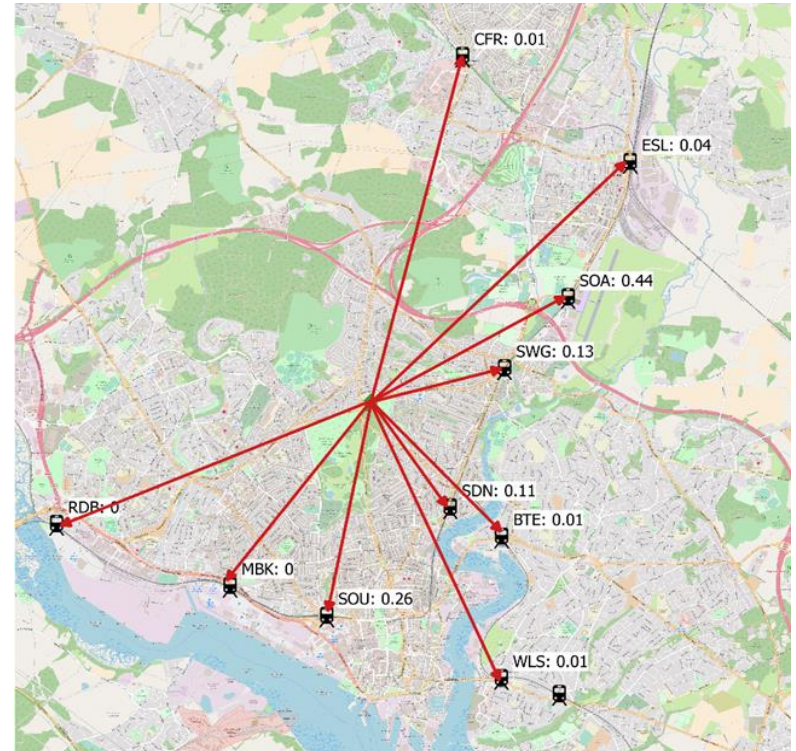
J - jobs (within approx. 0.5 mile)

Pk - parking spaces

B - travelcard boundary (y/n)

Te - terminus station (y/n)

El - served by electric trains (y/n)



Utilises open source tools and data



Identify all postcodes within 60 minutes of proposed station

Find the 10 nearest stations to each postcode

Calculate probabilities using station choice model

Run trip end model to generate forecast

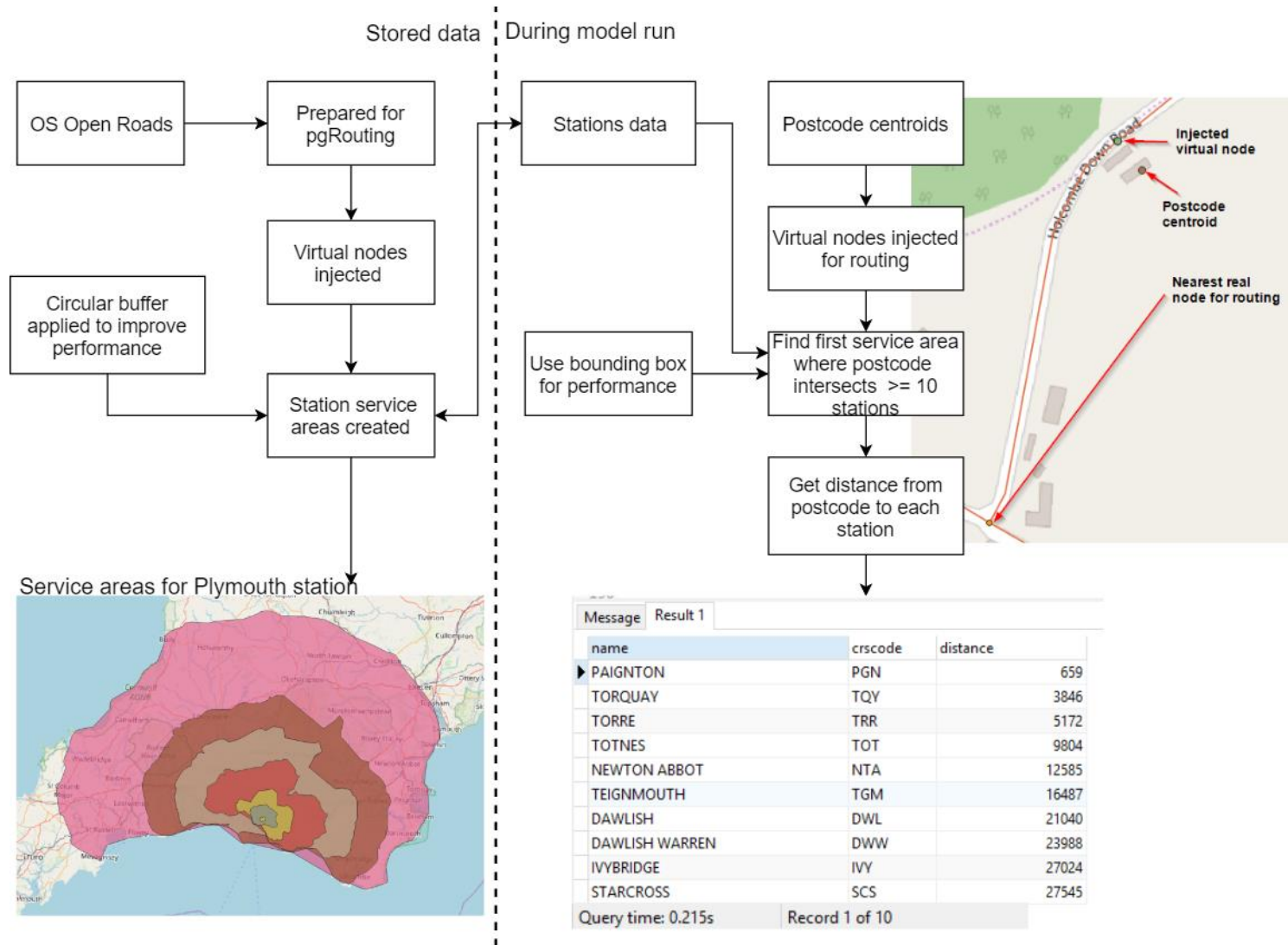
Run abstraction analysis (if needed)



PostgreSQL



Generating choice sets – intensive compute

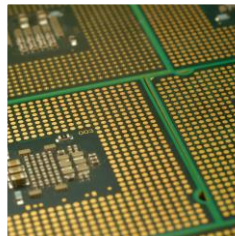


DAFNI - step change in model run times



Parallel processing employed in R

Each job runs in a separate container (virtualised OS)



Up to 30 cores per container

< 5 minutes for a single station forecast



Web app - job creation

DAFNI Pilot 3: Station demand forecasting model

LOGOUT

- About
- Setup
- Add Stations
- Exogenous Data
- Interactive Map
- Submission
- Jobs
- Visualisation
- Help
- Logging

ID: HNW1

Parking spaces: 100

CCTV: Yes

Name: Honiton West

Frequency: 100

Ticket machine: Yes

Region: South West

Frequency group: [dropdown]

Bus interchange: Yes

Station NGR: [Easting: 3333, Northing: 3333]

Terminal station: Yes

Access NGR: [Easting: 314371, Northing: 99587]

Electric services: Yes

Category: E

Travelcard boundary: Yes

Model abstraction for these stations: TR

enter the crscode

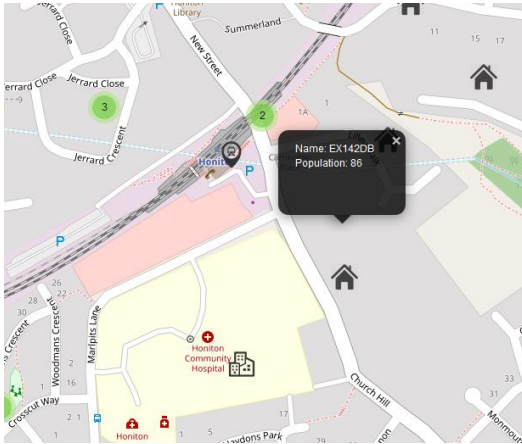
For 'in isolation' mode only:
If sensitivity analysis is required for service frequency or car parking spaces then simply create a new station entry with these fields amended as appropriate. The ID must be unique, but if you use the same name then the model results will be grouped together for this station and processing will be faster as unnecessary duplicate analysis will be avoided. If two or more entries have an identical name they can only differ in the values of the frequency, parking spaces and/or frequency group fields. Remember to define different frequency groups as appropriate for the additional entries.

ID ↑	Name	Region	Station NGR	Access NGR	Frequency	Frequency group	Parking spaces	Ticket Machine	Bus Interchange	CCTV	Terminal	Elect
No data available												

Rows per page: 5

Includes input verification

Web app – job management



Interactive map

Job Name

CPU Cores

12

UPLOAD CONFIG FILE

You may upload a pre-prepared configuration file. If you do so any settings c

RUN PRE_FLIGHT CHECKS

DOWNLOAD CONFIG FILE

SUBMIT JOB

Job submission

Station Demand Model Runs

DELETE

Select ↑	Job Information	Status	Submission Date	End Date
<input type="checkbox"/>	sa_test	Processed	2019-05-30T15:16:53.249491	2019-05-30T15:45:43.979131
<input type="checkbox"/>	Station Demand Test - new queue	Processed	2019-05-30T16:41:32.050020	2019-05-30T16:44:06.091456
<input type="checkbox"/>	helst_test2_pnz	Processed	2019-05-30T18:25:16.597586	2019-05-30T18:33:14.997332

Rows per page: 5 1-3 of 3

Job management

helst_test2_pnz

INFO ERROR

2019-05-30 18:33:13
model finished

2019-05-30 18:33:13
tidying up

2019-05-30 18:33:12
Creating GeoJSON catchment where at_risk = 'PNZ' and proposed = 'H

2019-05-30 18:33:12
Getting probability weighted population for: PNZ, from: probability_pnz

2019-05-30 18:33:11
Making frequency group adjustment for: HYL

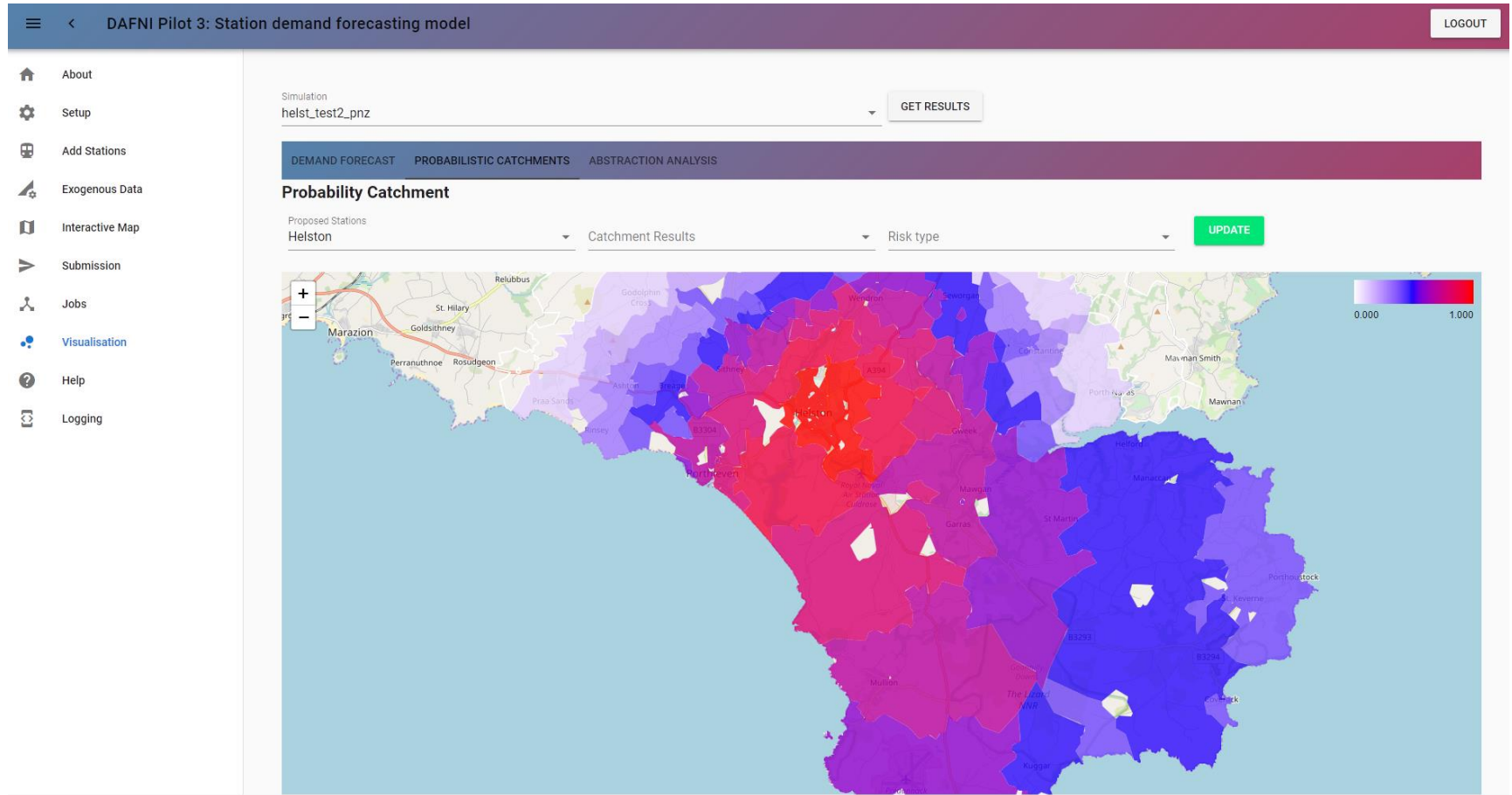
2019-05-30 18:33:11
Making frequency group adjustment for: PNZ

2019-05-30 18:33:11
Creating probability table: job_24_ofbpc.probability_pnz_after_abs_hel

2019-05-30 18:33:11
max choiceset size: 10

Displaying log file

Web app - visualisation



DAFNI has enabled rapid and effective sharing of the model

Not another siloed model

Accessible to students and researchers

Potential links to other DAFNI models.

Maximised knowledge exchange and research impact.



Video demonstration: <https://www.youtube.com/watch?v=q0CmY5lilWg>

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