



UNSW
SYDNEY

Trends and Challenges using Data and Technology for City Planning

Chris Pettit

Professor of Urban Science

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<https://cityfutures.be.unsw.edu.au/>



UNSW
City Futures
Research Centre

Content

- Introducing City Futures
- Data and Technology in Planning
- Emerging digital planning tools

What if? Scenario planning support system

Rapid Analytic Interactive Scenario Explorer

AI Classifier - Planning Applications

MapGPT

- Conclusions

Our People

12 Professors and Associate Professors
20 Post-doctoral research fellows and assistants
30 Masters and PhD students.
16 CFRC Fellows

Our Senior Leadership Team:



Professor Chris Pettit
Director



Professor Hazel Easthope
Deputy Director



Professor Hal Pawson



Professor Simon
Pinnegar



Professor Susan
Thompson

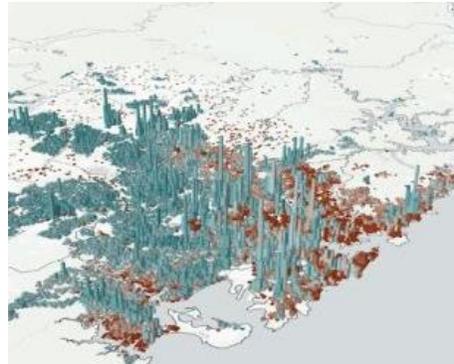


Professor Hoon Han

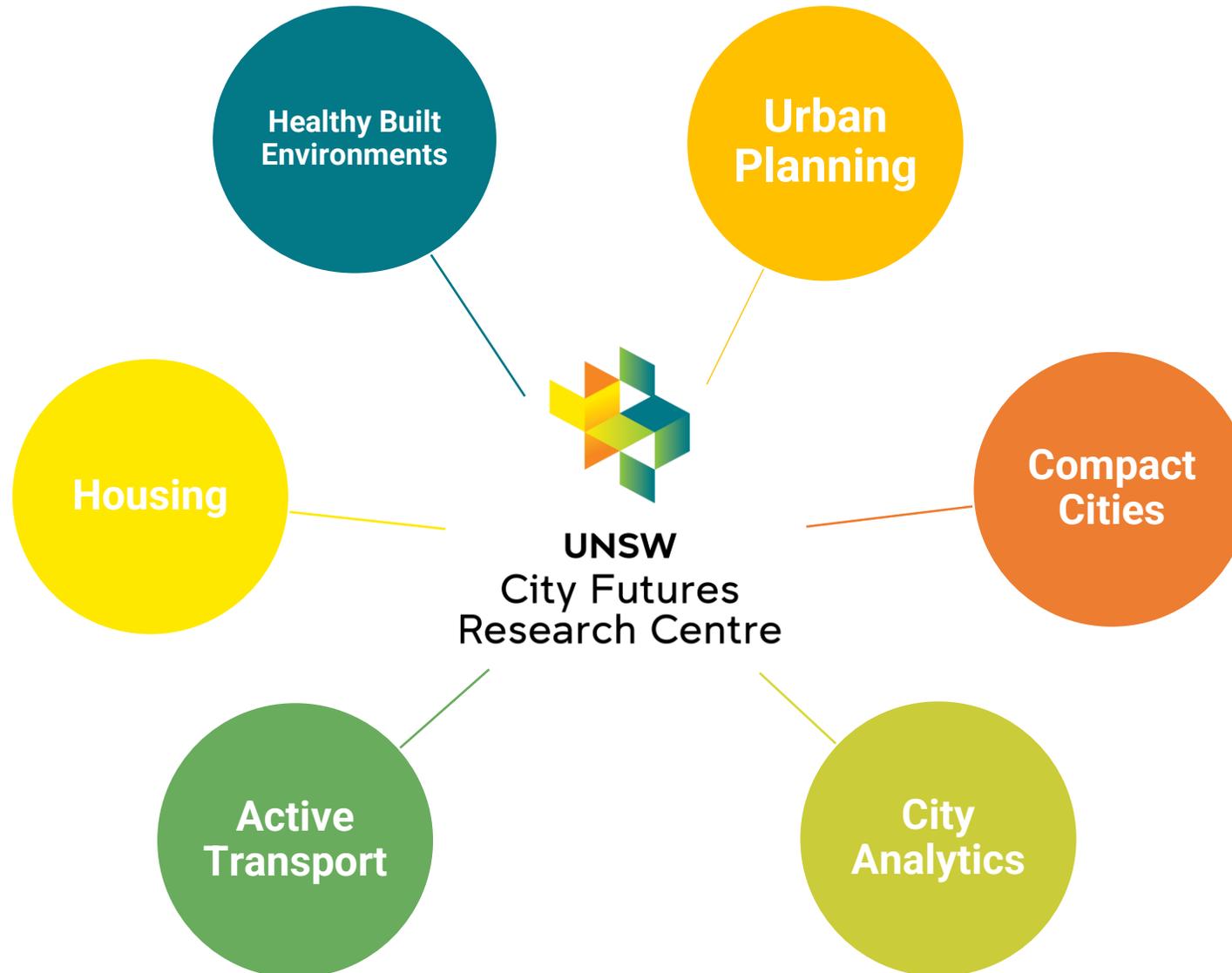
Our Mission

Our work advances the understanding of cities focusing on people, places, policies and technologies. We research the major urban challenges of city equity, housing, productivity, sustainability, resilience, governance and renewal.

We do this in partnership with governments, industry, not for profit organisations and communities.



Our Research



CFRC and the SDGs



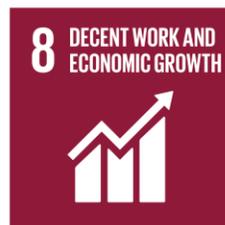
24% projects



19% projects



2% projects



12% projects

100% of projects
relate to at least
one Sustainable
Development Goal



18% projects



43% projects



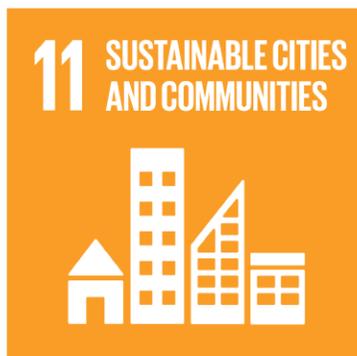
2% projects



10% projects



4% projects



97% projects



63%



6%



25%



14%



4%



26%



17%



Our Facilities

City Analytics Lab

The City Analytics Lab is a hybrid space with smart equipment including:

- 6 Mobile touch screen workstations
- Augmented Reality Sandbox
- Streaming and conference capabilities
- Virtual Reality Equipment

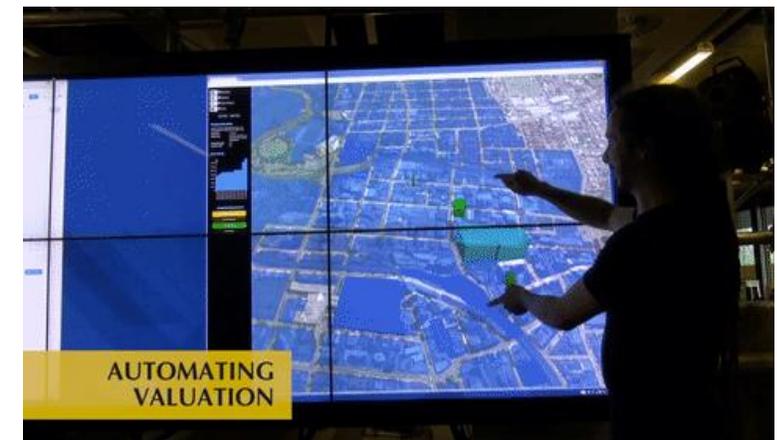
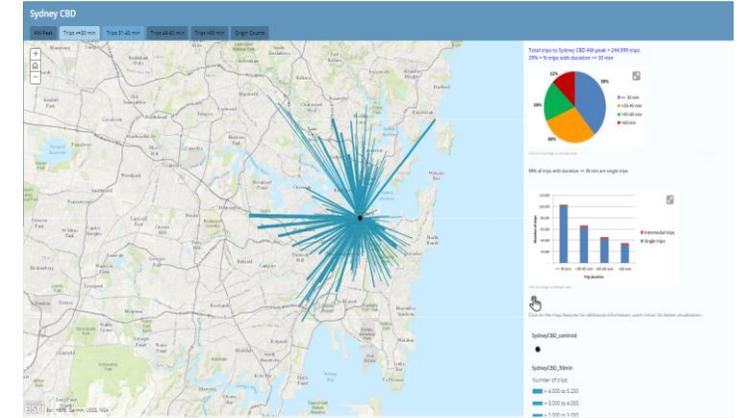
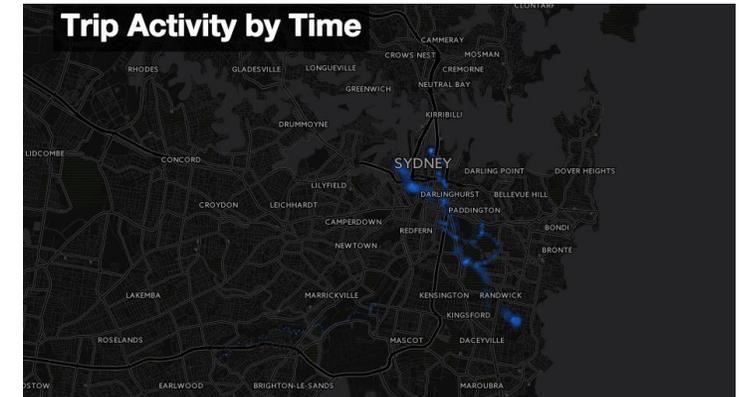
<https://www.be.unsw.edu.au/content/city-analytics-lab>



Digital Planning tools

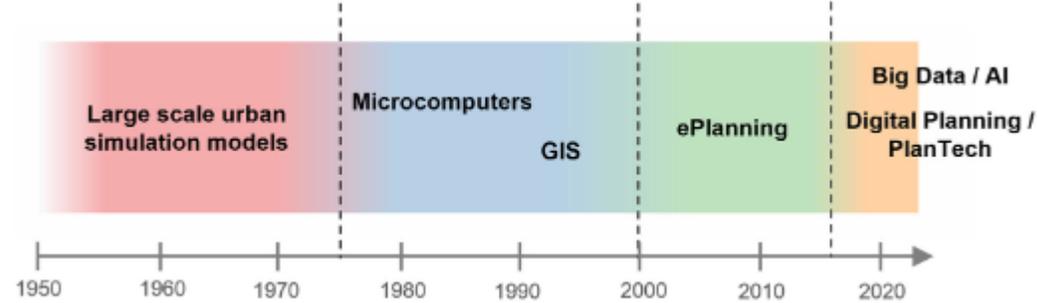
- Digital Planning
- Decision Support
- Scenario planning
- Geodesign
- Big Data
- Open data
- Dashboards
- Rapid analytics
- Value uplift
- Data analytics
- Modelling
- Simulation
- Usability
- Visualisation
- Virtual Reality
- Automated valuation

“Geodesign, is a design and planning method which tightly couples the creation of design proposals with impact simulations informed by geographic contexts.” (Flaxman 2010)



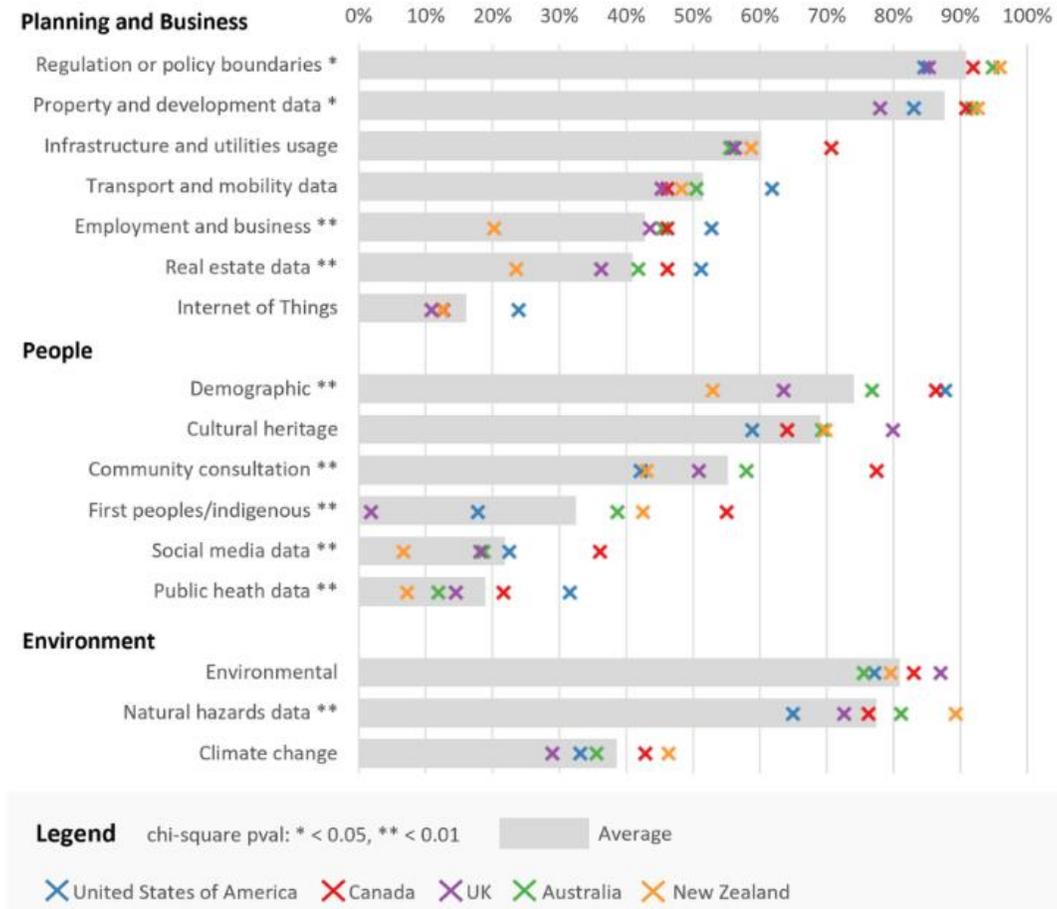
Pettit, C.J. Zarpelon Leao, S. Lock, O. Ng, M. & Reades, J. (2022) Big Data: The Engine to Future Cities—A Reflective Case Study in Urban Transport. Sustainability 2022, 14, 1727. <https://doi.org/10.3390/su14031727>

Data and technology in planning



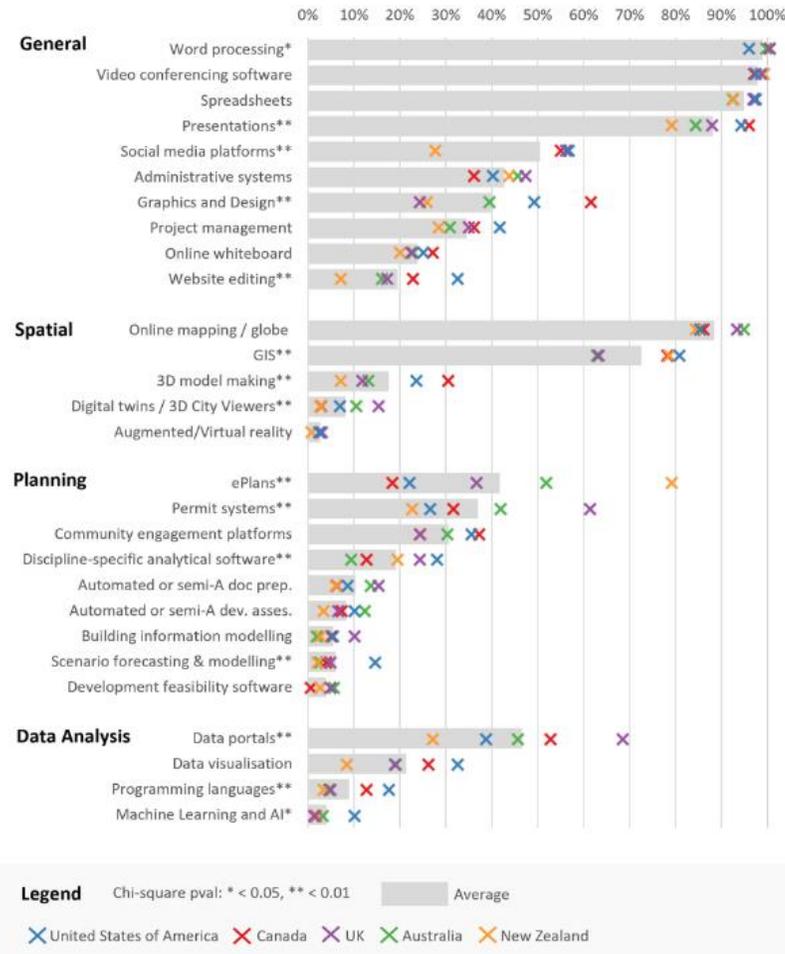
Waves of interest in the application of new digital technologies in planning practice

Data and technology in planning



What type of data do you refer to in your current role?

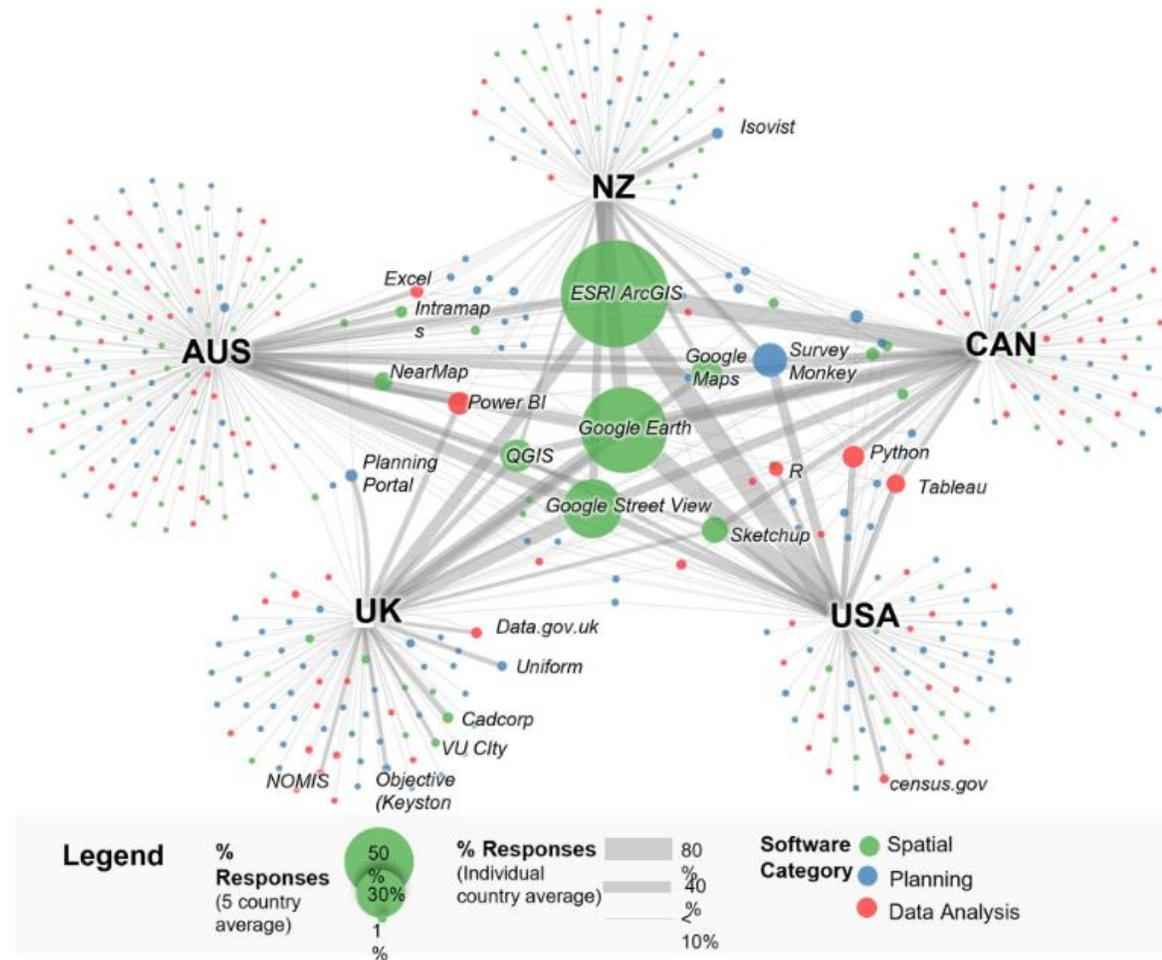
Data and technology in planning



What type of software, web or phone applications do you use in your current role?



Data and technology in planning



What is the name of the software or application you use?

Emerging Digital Planning Tools

What if? Scenario planning support system

Rapid Analytic Interactive Scenario Explorer

AI Classifier - Planning Applications

MapGPT

Australian Housing Data Analytics Platform

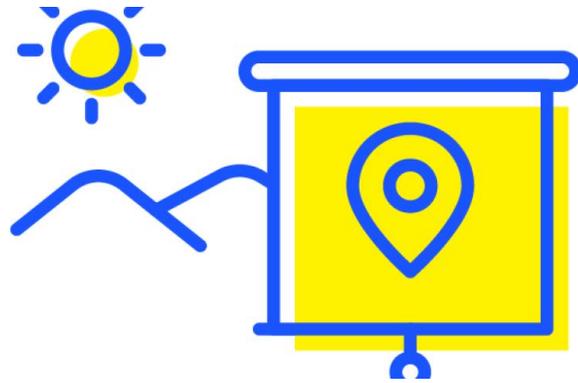
A Platform which connects academics, government, industry and communities to the best available data, analytics and insights to assist in solving the challenges facing Australia's housing future.



Digital Tools

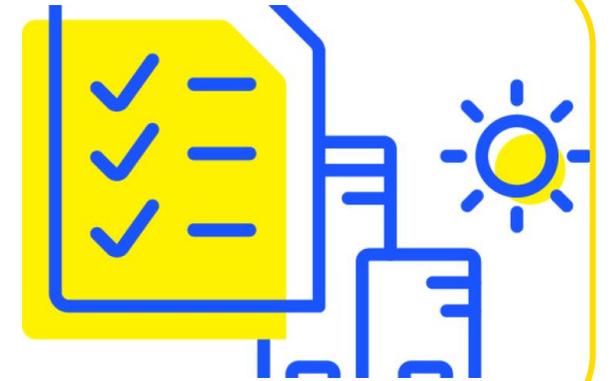
What If?

A planning support system (PSS) that informs strategic planners on the impact of population growth and other socio-economic factors on the future of Australian cities



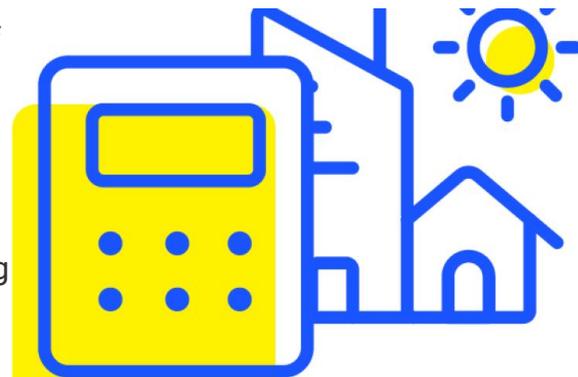
Envision?

Offers a set of tools allowing users to query a wide variety of data sets to undertake multi-criteria evaluation and strategic, map-based, precinct-level planning



Affordable Housing Assessment Tool

Designed to calculate the impact of different cost and subsidy parameters on housing affordability. This tool models the financial impacts of a range of policy mechanisms and levers to meet the costs of providing housing for a given mix of housing needs groups



Australian Property Market Explorer

An online, visual exploration tool for conducting visual analytics on data available on property markets across Australia. Property values are rapidly calculated using any one of the automated valuation models available on the toolkit.



What If?

Planning Support System (PSS) are broadly defined as geo-information technology-based instruments designed to assist in the decision-making processes associated with urban planning and policy-making. The online What If? tool is one such PSS which has been built on the principles of transparency, flexibility, and user-friendliness. It enables planners to explore an envelope of what if? scenarios and understand the implication of land supply, demand and future urban growth of a city, metropolitan area or region. The online What If? tool beta version has been developed as one of the foundation digital workbench tools available via the Australian Housing Data Analytics Platform (AHDAP).

Utilising open and public datasets, the AHDAP-What If? PSS possesses the capability to support significant and challenging tasks within land use and urban planning areas. These tasks include: 1) analysing the suitability of land for future housing, commercial, industrial and other purposes, 2) simple projections of future population and trends, as well as corresponding land use demands, 3) allocating the projected land use demands to the most suitable locations under various planning and infrastructure controls and growth functions. The AHDAP-What If? offers a user-friendly interface accompanied by clear guidance of the entire workflow to support strategic planning exercises. By providing accessible and comprehensible functionality, the What if? tool is set up to support collaborative planning involving a range of stakeholders, allowing their expertise and preferences to be converted into metrics which can be used to drive future urban growth scenarios for an urban settlement. For example, what if we explore a population

<https://www.ahdap.org/what-if1>

In this section

[Home](#)

[About us](#)

[Colouring Cities](#)

[Digital Workbench](#)

[National Housing Data Exchange](#)

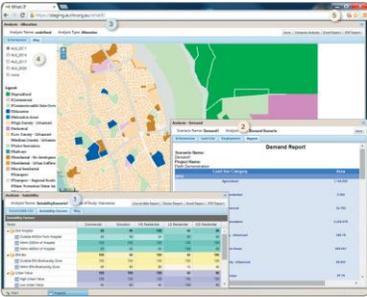
[Contact us](#)



What If?



2010



2023

What If? 1.0

The initial desktop version of What If?

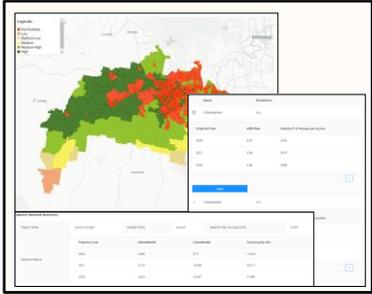
AURIN - What If?

The first online version of What If? based on AURIN

1999



2013



What If? 2.0

The updated desktop version of What If?

AHDAP - What If?

The upgraded online version of What If? based on AHDAP

What if? Planning Support System

What if? General workflow



Suitability Module

Evaluate the suitability of land conversion (from one category to another).



Demand Module

Computes the land use demand to accommodate the projected population and household growth.



Allocation Module

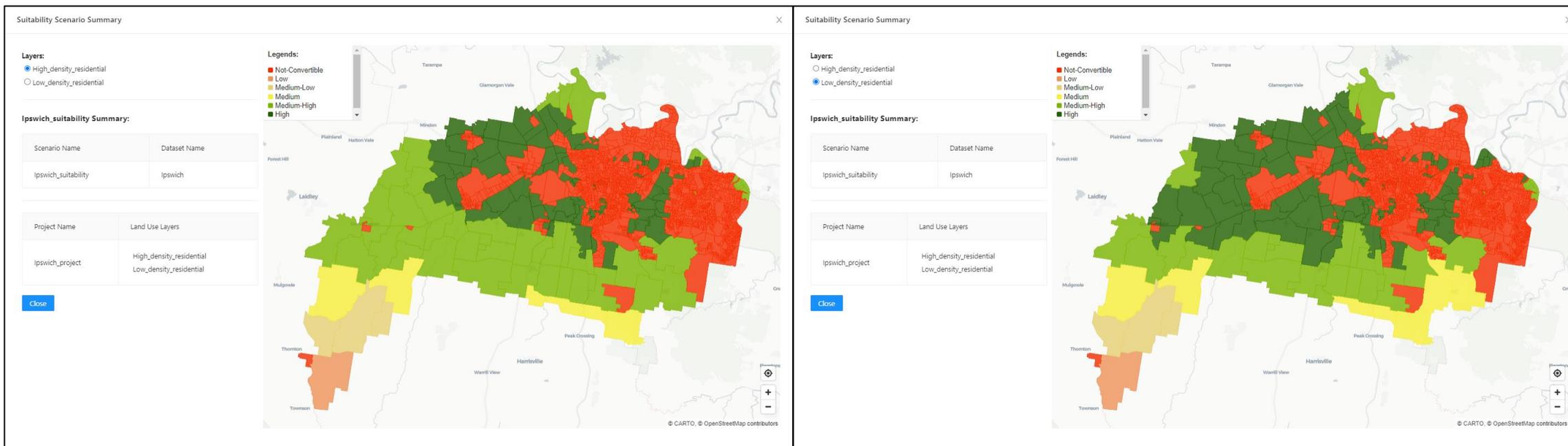
Allocates various land use demands to different locations under different scenarios.



Suitability Module

Evaluate the suitability of land conversion (from one category to another).

- Input: conversion rules, factors and weights
- Output: the overall suitability for different land uses



Suitability maps for High_density_residential and Low_density_residential

General workflow



Demand Module – Stage 1

Calculate the residential land use demand to accommodate the projected population and household growth.

- Input: Historical population and housing data; Breakdown, infill and vacancy rates; Predicted housing density
- Output: Land use demand in projected years

Demand Scenario Summary					
Ipswich_demand Summary:					
Project Name	Ipswich_project	Dataset Name	Ipswich	Baseline Year Housing Units:	87287
Demand Report:	Projection Year	High_density_residential	Low_density_residential	Total Area(Sq KM)	
	2026	3.14	6.467	9.607	
	2031	5.266	11.304	16.570	
	2036	8.115	17.664	25.779	

Close

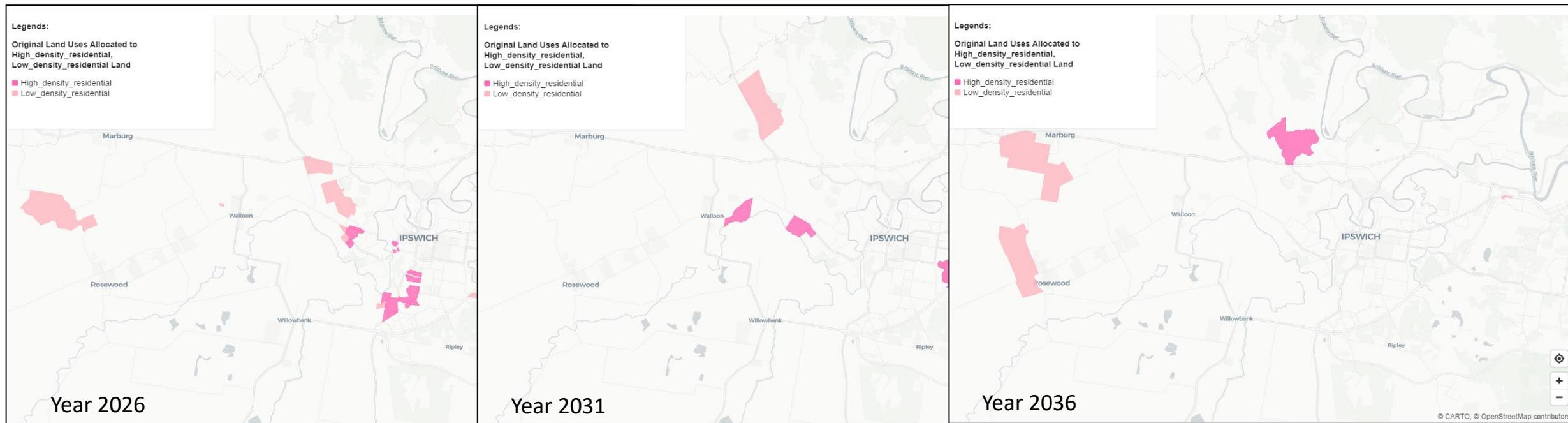
Case study



Allocation Module

Allocates various land use demands to different locations under different scenarios.

- Input: Suitability and demand outputs, control settings
- Output: The allocation scheme of designed land uses.



Locations of newly developed residential land in projected years (2026, 2031, 2036)

Log in AHDAP-What If?



What If webpage:
<https://www.ahdap.org/what-if1>

AHDAP - WhatIf Tool (Beta)

AHDAP-WhatIf Tool Login

* userEmail:

* Password: 

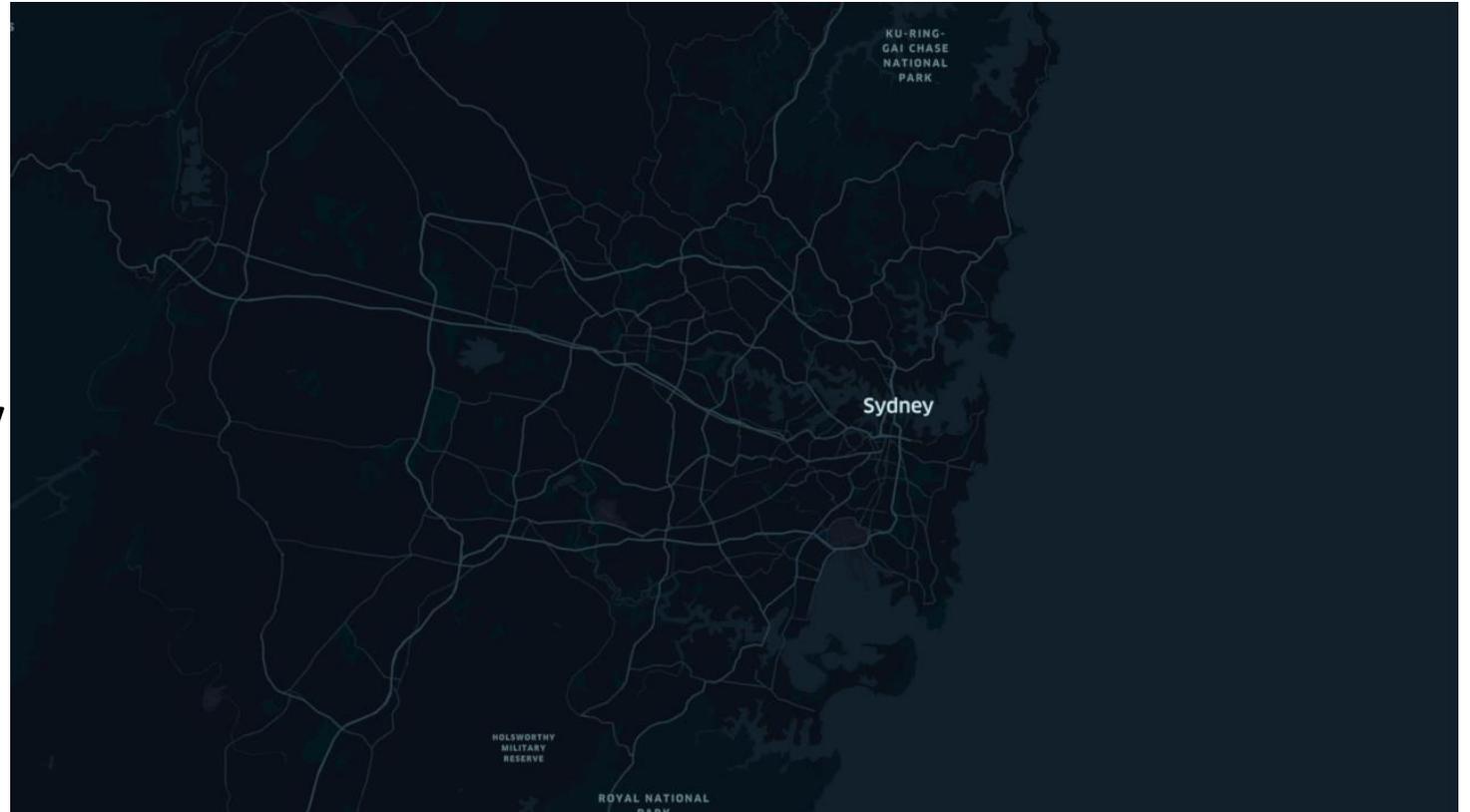
The image shows a screenshot of a web browser displaying the login page for the AHDAP-WhatIf Tool (Beta). The page has a blue header with the title "AHDAP - WhatIf Tool (Beta)". Below the header is a white box containing the login form. The form is titled "AHDAP-WhatIf Tool Login" and contains two input fields: "UserEmail" with the value "admin@ahdap.org" and "Password" with a masked value of ".....". There are two buttons at the bottom of the form: a blue "Submit" button and a white "Reset" button.

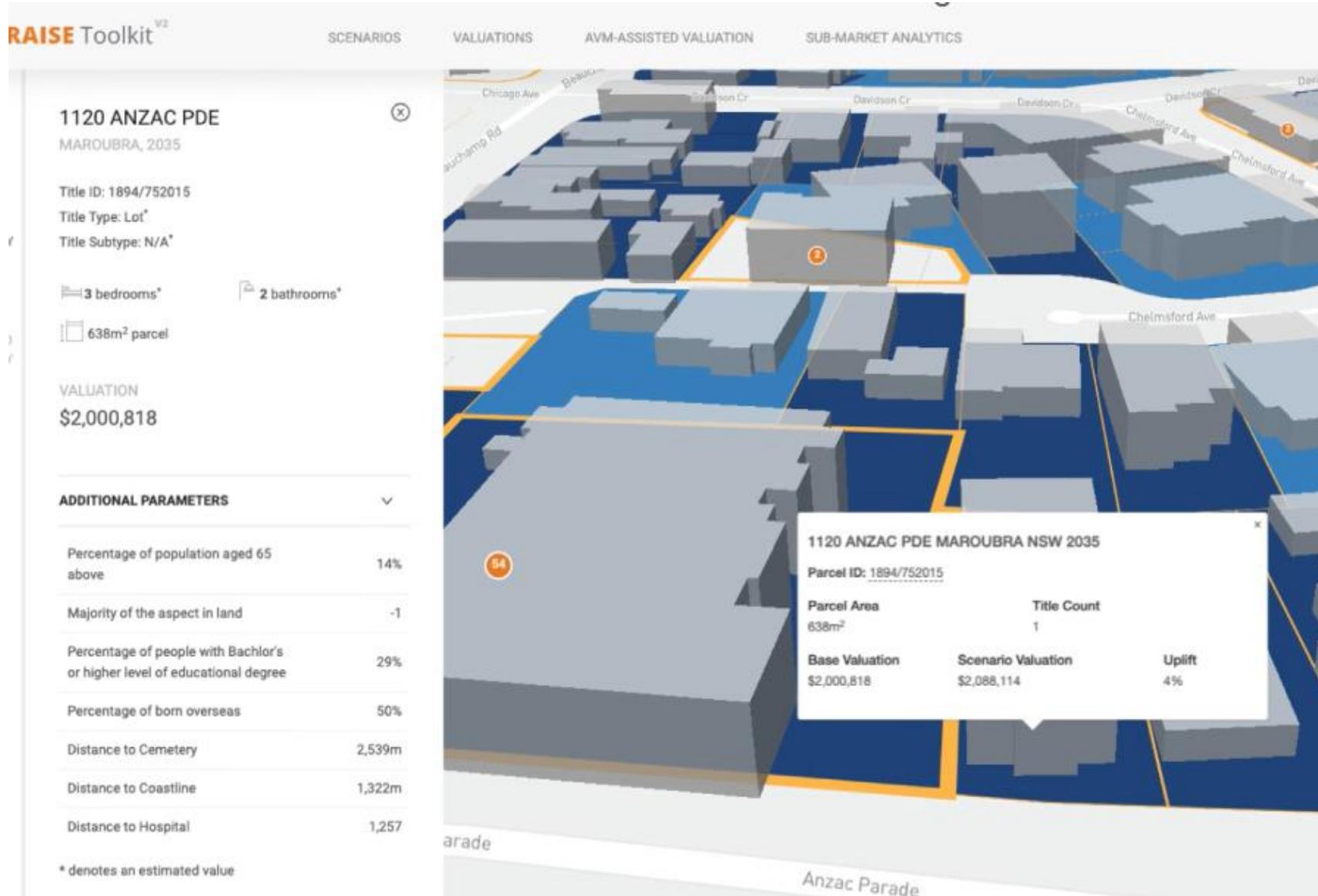
<https://whatif.ahdap.org/login>

Please contact us on
admin@ahdap.org for signing up
your own What If? account.



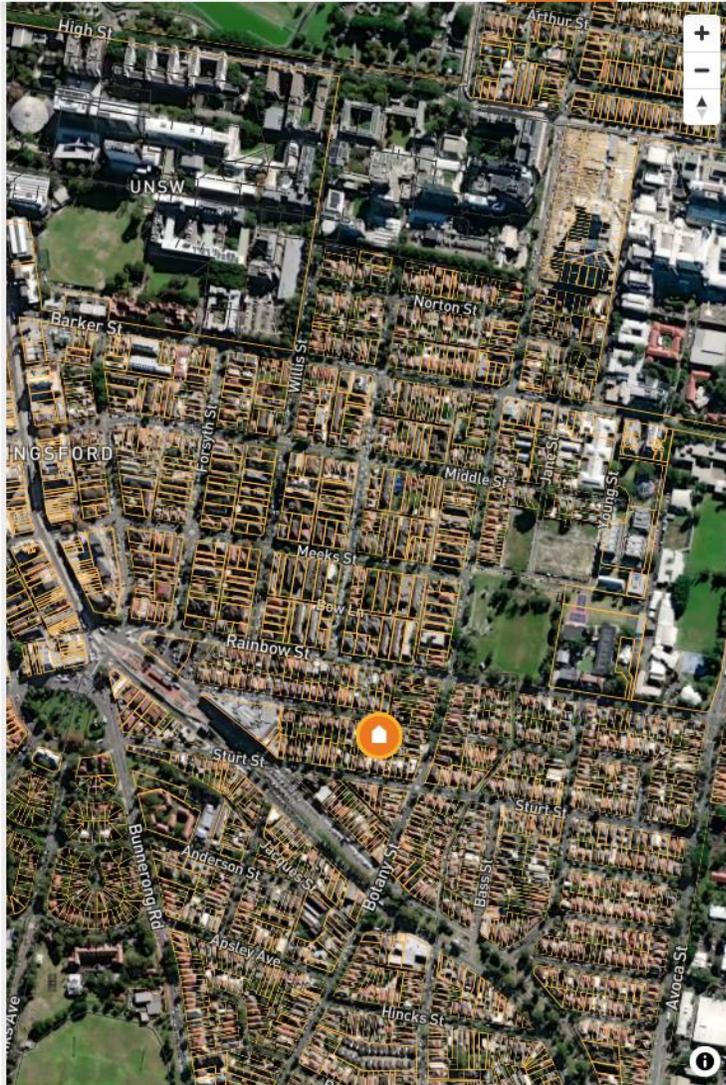
Sharpening our land and property decisions with Artificial Intelligence





Transparent Automated Valuation Model

LAYERS



37 WALLACE ST, KINGSFORD, NSW 2032

37 WALLACE STREET KINGSFORD NSW 2032

Title ID: 3/14006	 3 bedrooms	Lower	Midpoint	Upper
Title Type: Lot	 1 bathrooms	\$2.31m	\$2.54m	\$2.67m
		Valuation Confidence: ● Medium		

Property Information

Comparable Sales

Suburb Sales Trends

EXPORT REPORT

Distance to Preschool	Distance to Primary School	Distance to Railway Station
650m	380m	390m
Distance to Secondary School	Distance to Shopping Center	Distance to Super Market
540m	3.1km	550m
Distance to nearest Town (Major City)	Distance to University	Dwelling Density (Meshblock)
6.8km	850m	1,957
Median Family Income (weekly)	High Income (%)	Median Bed (SA1)
\$2,161	15%	3
Median Income Level (SA1)	Median Vehicle (SA1)	Median Mortgage (monthly)
14	1	\$3,050
No of Parkings	Population Density (Meshblock)	Professional (%)
3	5,326	24%
Median Rent (weekly)	SA3 name where the property located in	Unemployed (%)
\$601	Eastern Suburbs - South	5%
Latitude	Longitude	
1,580,314	-3,929,467	

VALUATION TOOL

Search Select a property title

Property Details Known property details

Building information Aspects related to the building

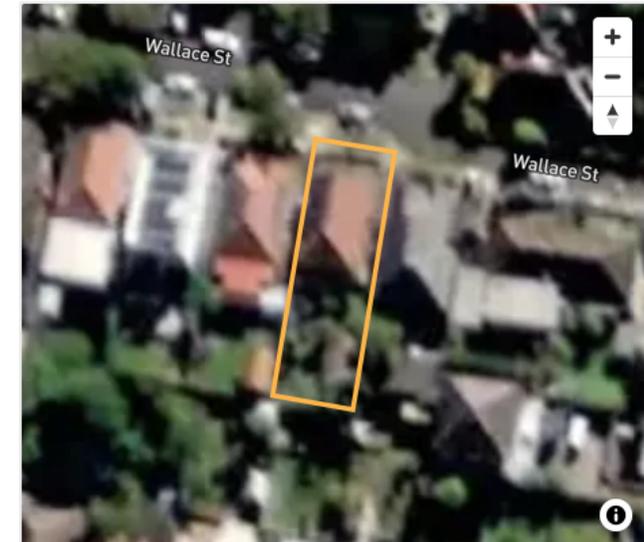
Comparable Sales Select comparable sales

Suburb Summary Suburb valuation statistics

Complete valuation Finalise the valuation and export reports

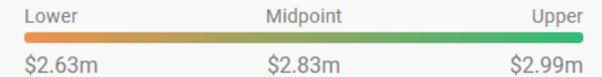
Bedrooms:

Bathrooms:



37 WALLACE ST, KINGSFORD

2032



Valuation Confidence: ● High

CREATE SCENARIO

Setup Scenario

Describe the scenario

Enter parameters

Modify the parameters for the scenario such as updating zoning or adding infrastructure

Complete

Review and confirm



INSTRUCTIONS

Select a type of infrastructure below and then click to place it on the map.

-  DISTANCE TO HOSPITAL
-  DISTANCE TO RAILWAY STATION
-  DISTANCE TO SECONDARY SCHOOL



To move a placed marker click and drag it to its new location while holding down the mouse button. To delete a placed marker click on it and follow the prompts.

CANCEL

PREVIOUS STEP

NEXT STEP

Scenario planning for future land use & infrastructure

Transport Infrastructure Value Uplift

SCENARIO SUMMARY

TRAIN STATIONS IN MAROUBRA

Created 10 Nov 2022

Infrastructure Added

3 Heavy Railway Station's

SCENARIO SUMMARY

No. Properties Effected

5,343

Base Value \$9,476,067,699

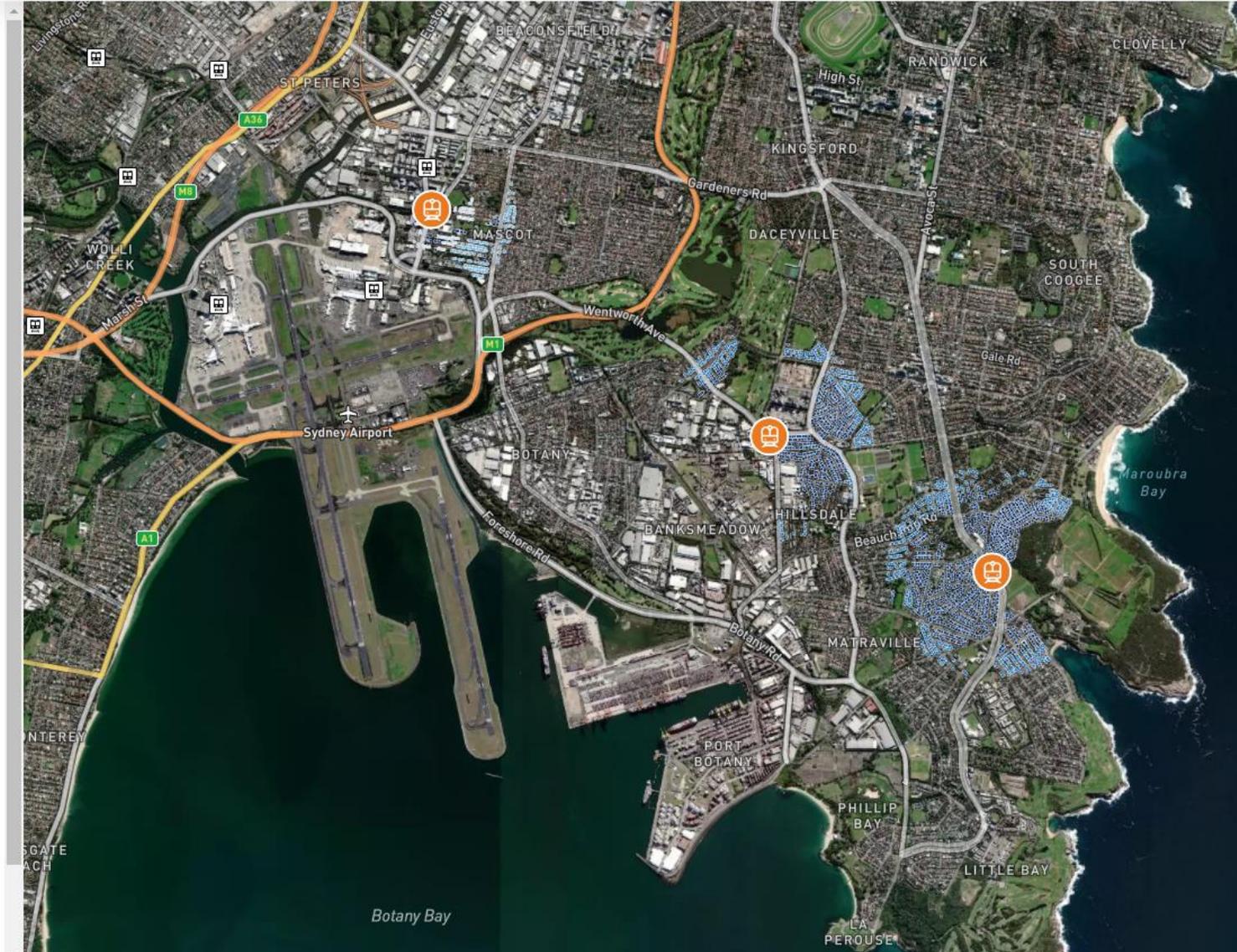
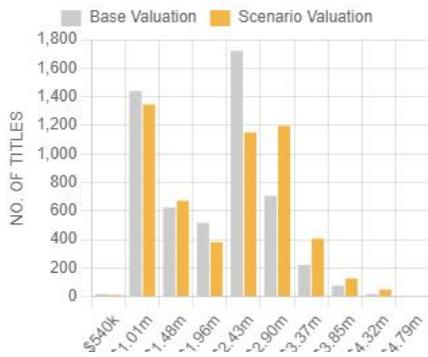
Scenario Value \$10,203,179,872

TOTAL UPLIFT \$727.11M

Percentage uplift 7.67%

CHANGE IN TITLE VALUATIONS

Show count change



% Change - Parcel Valuation

- More than 6%
- 3% to 6%
- 2% to 3%
- Less than 2%
- No change

SYMBOLISE BY

% Change - Parcel Va...

School Infrastructure Value Uplift

SCENARIO SUMMARY

SCHOOL

Created 13 Oct 2022

Infrastructure Added

1 Top Secondary School Catchment

SCENARIO SUMMARY

No. Properties Effected

18,575

Base Value \$32,448,093,509

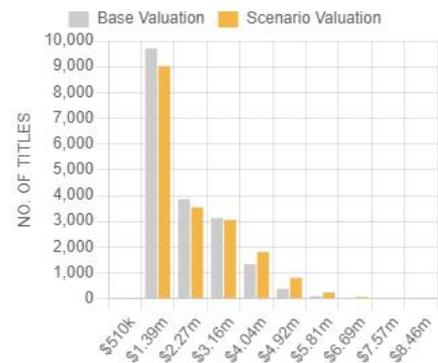
Scenario Value \$35,889,862,858

TOTAL UPLIFT \$3.44B

Percentage uplift 10.61%

CHANGE IN TITLE VALUATIONS

Show count change



% Change - Parcel Valuation

- More than 6%
- Less than 6%
- No change

Planning Control Value Uplift

SCENARIO SUMMARY

RANDWICK TEST

Created 15 Dec 2022

SCENARIO SUMMARY

Number of Parcels assessed	157
Number of Parcels with an Increased Valuation	28
Base Value	\$1,540,614,583
Scenario Value	\$1,593,503,137
TOTAL UPLIFT	\$52,888,554
Gross Realisation Value	\$527,694,200
Local Infrastructure Contributions	\$17,206,674
Transfer Duty	\$6,731,844
Total Development Costs	\$399,768,333



Exploring value uplift around metro stations



NSW Premier Chris Minns and Planning Minister Paul Scully

Unlocking value in property

Value Australia is a next-generation property valuation platform that uses enriched data and advanced artificial intelligence (AI) to provide highly accurate and fast property valuations.

Find out more



<https://value-australia.com.au/>

AI for planning better cities

THE SPECTRUM OF ARTIFICIAL INTELLIGENCE

Artificial Intelligence (AI) is the computerized ability to perform tasks commonly associated with human intelligence, including reasoning, discovering patterns and meaning, generalizing, applying knowledge across spheres of application, and learning from experience. The growth of AI-based systems in recent years has garnered much attention, particularly in the sphere of Machine Learning. A subset of AI, Machine Learning (ML) systems "learn" from the success or accuracy of their outputs, and can change their processing over time, with minimal human intervention. But there are non-ML types of AI that, alone or in combination, lie behind the real-world applications in common use. General AI — a human-level computational system — does not yet exist. But Narrow AI exists in many fields and applications where computerized systems greatly enhance human output or outperform humans at defined tasks. This chart explains the main types of AI, their relationships to each other, and provides specific examples of how they are currently appear in our day-to-day lives. It also demonstrates how AI exists within the timeline of human knowledge and development.



AI USE CASES AND CONTEXTS

FINANCE TAX COMPLIANCE

A software platform that distills tax laws into a program, creates a personalized decision system, and enables individuals to quickly and accurately file their taxes.

Value of AI: Tax compliance requires complete accuracy. This efficient, interactive system that provides precise and logically connected results allows taxpayers to understand, confirm, and have confidence in the outcome. KE provides transparent and clear explanations.

Types of AI: KE, NN, NLP

HEALTHCARE AMBIENT CHARTING

The use of background voice-to-text processing during a patient/medical provider exchange to record those interactions into the patient's chart, along with extracting tasks, symptoms, and recommendations for further action as required.

Value of AI: Medical providers spend significant time documenting, with uneven outputs, as well as difficulty in correlating between providers. Ambient systems encode conversations, target key phrases, and present a summary for provider edit/acceptance.

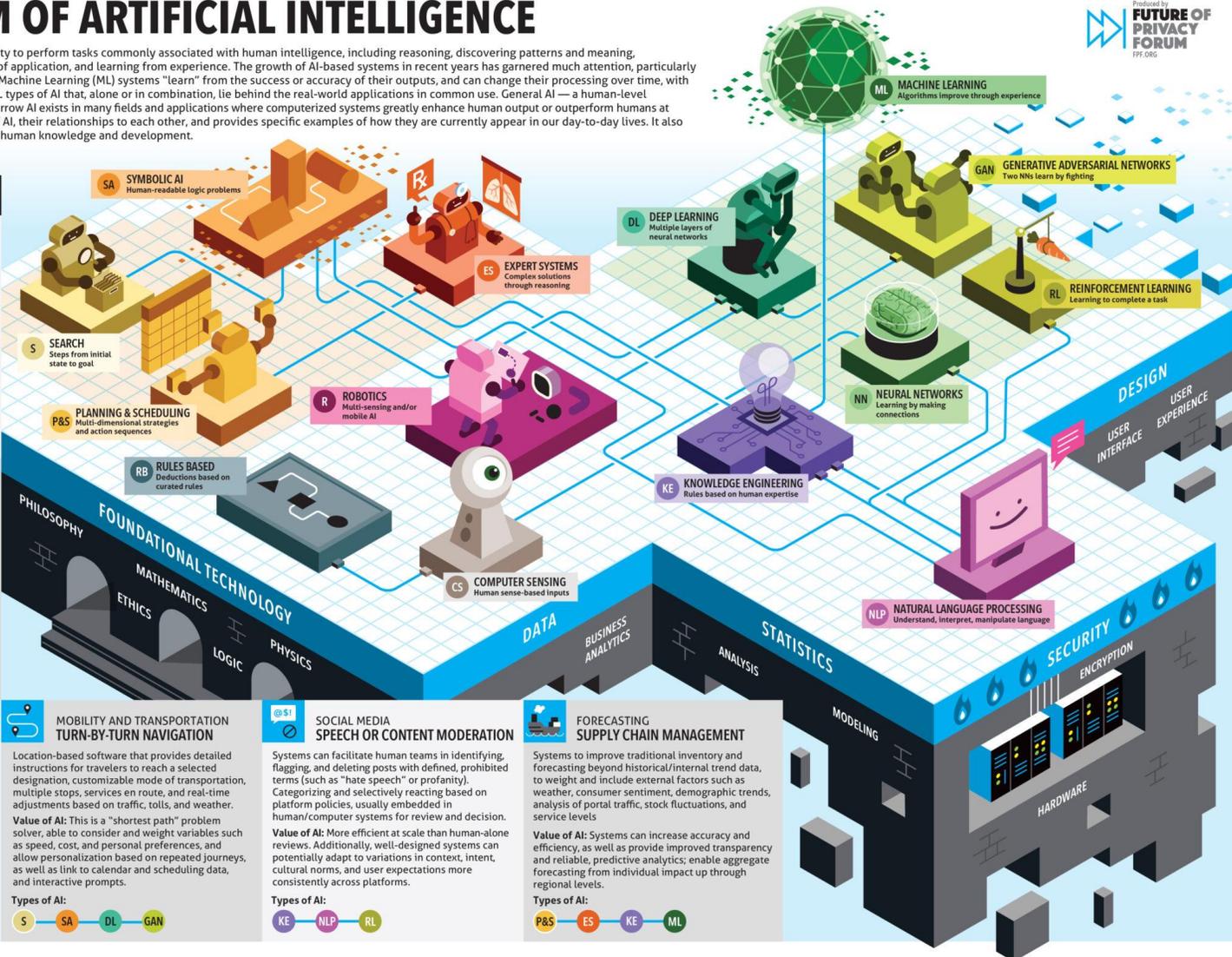
Types of AI: SA, DL, NLP

TRACKING WORKPLACE MONITORING

Embedded systems can monitor physical and digital traffic, data usage, device management, and some employee behaviors for efficiency and security management of time, assets, and resources.

Value of AI: Monitoring enables necessary enforcement of data security policies and protocols. Also, systems can monitor and manage time reporting and project management tools, as well as ensuring appropriate supervision, training, and support, including for remote workers

Types of AI: RB, CS, NN



MOBILITY AND TRANSPORTATION TURN-BY-TURN NAVIGATION

Location-based software that provides detailed instructions for travelers to reach a selected destination, customizable mode of transportation, multiple stops, services en route, and real-time adjustments based on traffic, tolls, and weather.

Value of AI: This is a "shortest path" problem solver, able to consider and weight variables such as speed, cost, and personal preferences, and allow personalization based on repeated journeys, as well as link to calendar and scheduling data, and interactive prompts.

Types of AI: S, SA, DL, GAN

SOCIAL MEDIA SPEECH OR CONTENT MODERATION

Systems can facilitate human teams in identifying, flagging, and deleting posts with defined, prohibited terms (such as "hate speech" or profanity). Categorizing and selectively reacting based on platform policies, usually embedded in human/computer systems for review and decision.

Value of AI: More efficient at scale than human-alone reviews. Additionally, well-designed systems can potentially adapt to variations in context, intent, cultural norms, and user expectations more consistently across platforms.

Types of AI: KE, NLP, RL

FORECASTING SUPPLY CHAIN MANAGEMENT

Systems to improve traditional inventory and forecasting beyond historical/internal trend data, to weight and include external factors such as weather, consumer sentiment, demographic trends, analysis of portal traffic, stock fluctuations, and service levels.

Value of AI: Systems can increase accuracy and efficiency, as well as provide improved transparency and reliable, predictive analytics; enable aggregate forecasting from individual impact up through regional levels.

Types of AI: P&S, ES, KE, ML

AI for planning better cities

THE SPECTRUM OF ARTIFICIAL INTELLIGENCE

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Types of AI:

KE NN NLP

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Types of AI:

SA DL NLP

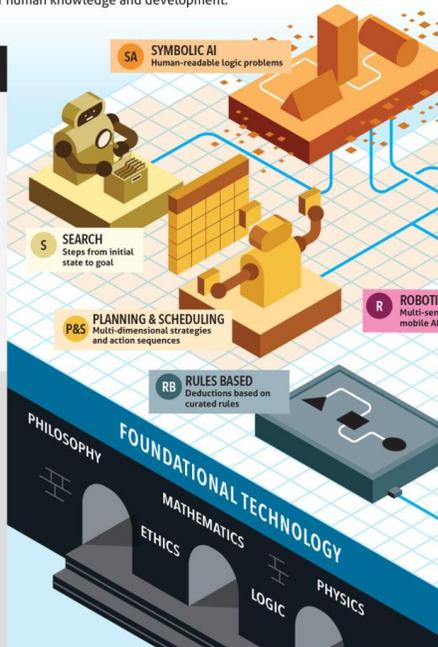
TRACKING WORKPLACE MONITORING

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RB CS NN



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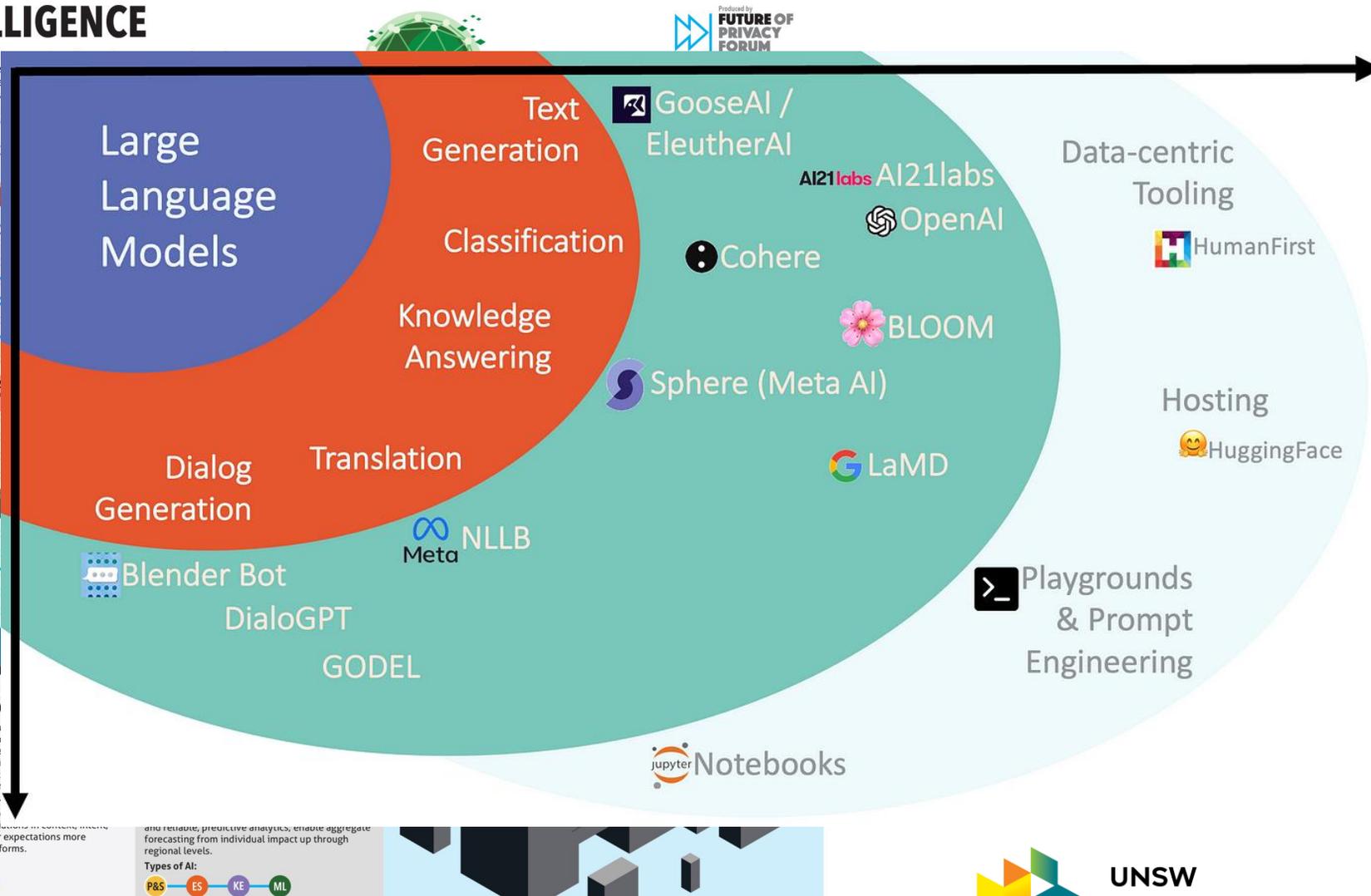
SOCIAL MEDIA SPEECH OR

Systems can facilitate hate speech flagging, and deleting platform policies, usual human/computer system

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Types of AI:

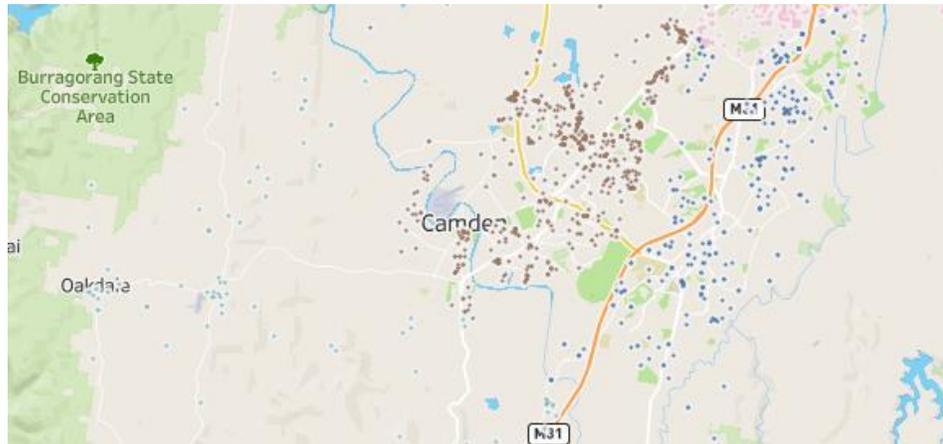
KE NLP RL



Planning Applications AI Classifier

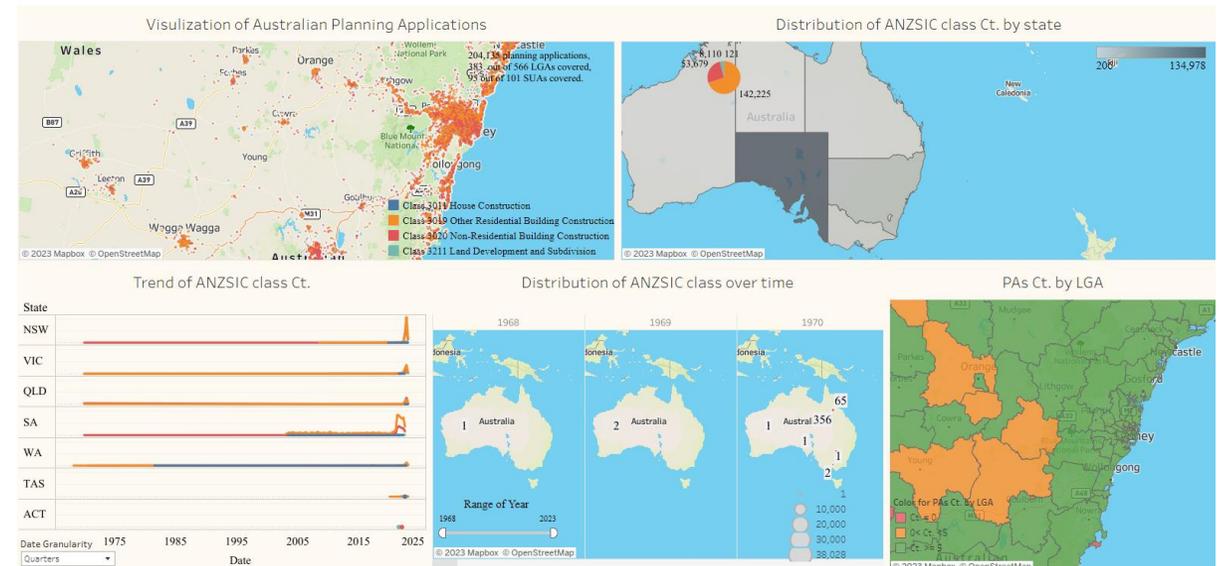
Solution: Proof of Concept

- A database
 - 200k+ PAs from 383 LGAs/95 SUAs
- An AI classifier
 - Classify PA with 4 ANZSIC code
 - An API to classify PAs in real-time
- An interactive Dashboard
 - Visualize data to analyze pattern

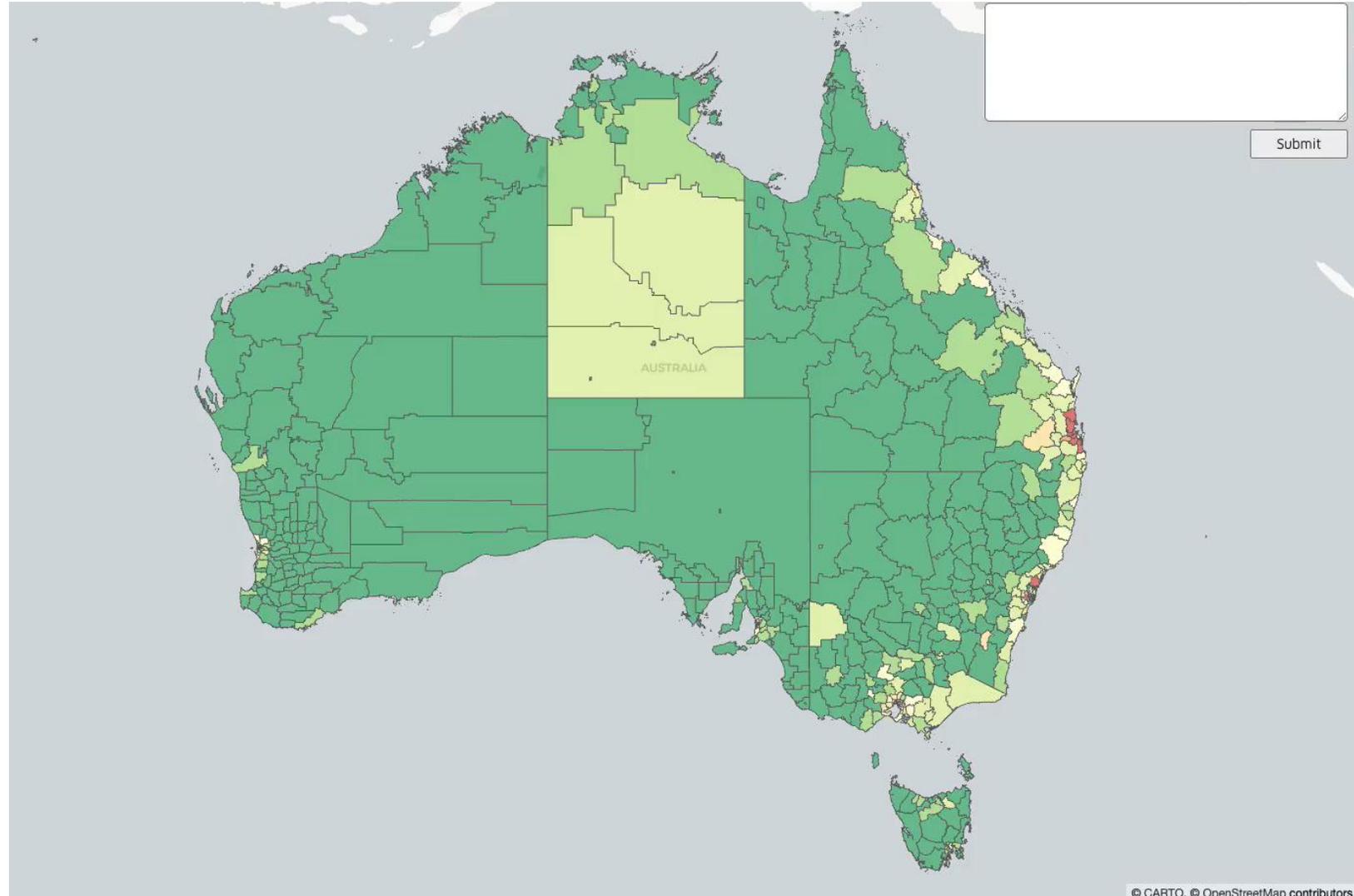


Techniques Employed

- State-of-the-art AI text classification models (DeBERTaV3)
- Best industry practice (DataOps + MLOps)
 - Auto-scrape data and update the database weekly
 - Auto-deploy AI/ML model to integrate ANZSIC code into database
 - Auto-improve AI/ML model when new data available



A platform using
generative AI &
NLP to improve
user experience
working with
Spatial Data



Conclusions

- Low levels of adoption of data and technology solutions for planning.
- Open data products more widely adopted to support planning low cost / high accessibility.
- Scenario Planning tools such as RAISE & What if? offer much promise.
- AI now offers real potential to support efficient and effective city planning
- Need for *useful* and *useable* data and technology solutions tools to make our cities more resilient, sustainable, productive, equitable and liveable.

References

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Thank-you

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