



# EMCR Research Insights: Generative AI

10<sup>th</sup> Sept 2024

Dr Gordon McDonald

*Sydney Informatics Hub*

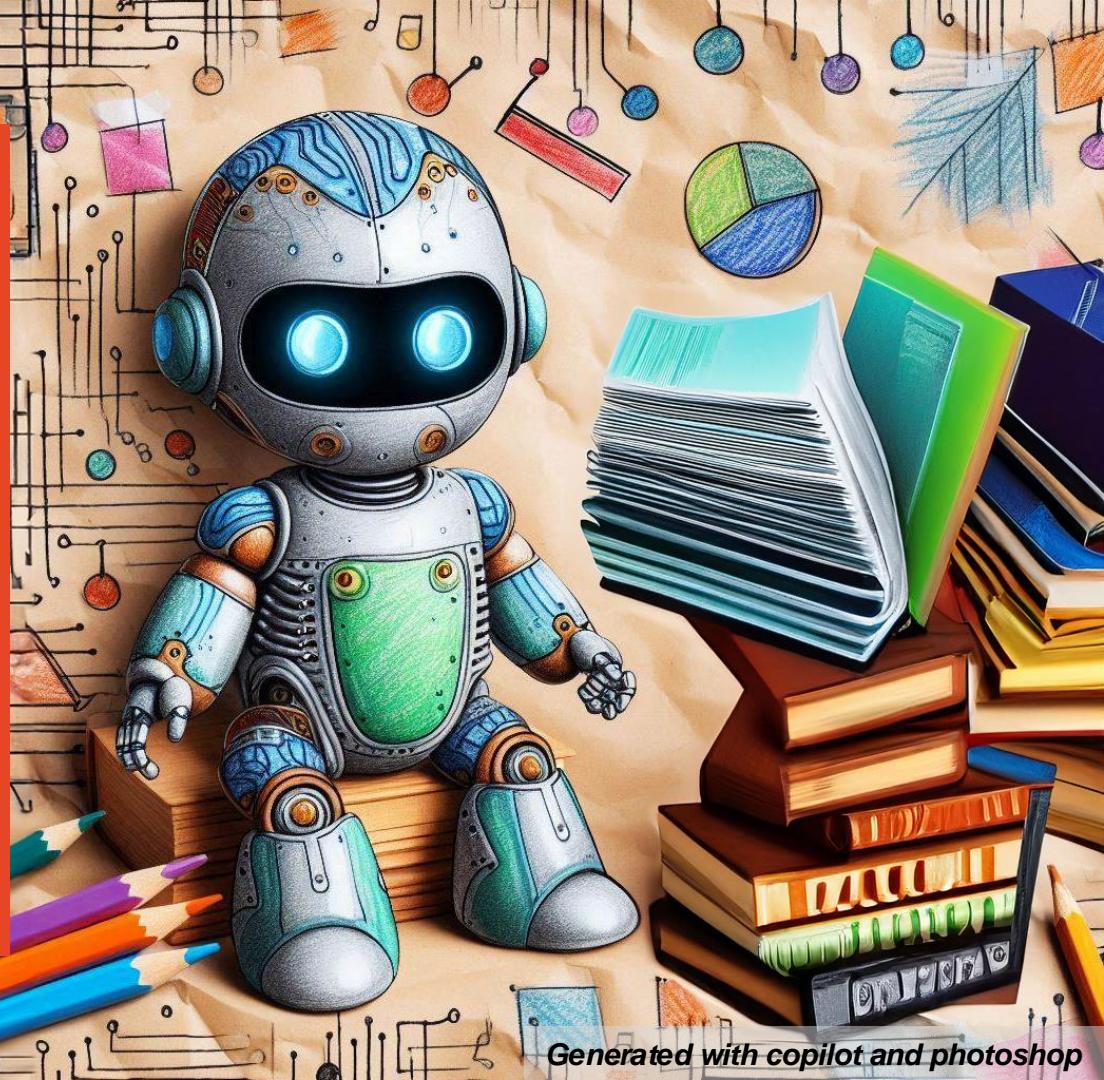
[sydney.edu.au/informatics-hub](http://sydney.edu.au/informatics-hub)



THE UNIVERSITY OF  
**SYDNEY**

Sydney  
Informatics Hub

CRC0030026A TEQSA PRV12067



Generated with copilot and photoshop

# Sydney Informatics Hub

**Sydney Informatics Hub** is a **Core Research Facility** within PVC-RI, enabling excellence in computational and data-driven research through advanced digital infrastructure, expert data consultancy and analytics training.

 Statistics

 Data Science,  
AI & Software

 Research  
Computing

 Bioinformatics



# SIH Training

64

Different offerings, in person, online, and hybrid content in a variety of formats from webinars to interactive workshops.



Attendees at all career levels, from undergraduate students to senior professors, and representation from every Faculty and School.



Partnerships with national organisations like Australian BioCommons:  
[biocommons.org.au/training-cooperative](http://biocommons.org.au/training-cooperative).



Find out more on our training calendar:  
[sydney.edu.au/informatics-hub/training](http://sydney.edu.au/informatics-hub/training). Or stay up to date with our newsletter.



[sydney.edu.au/informatics-hub/training](http://sydney.edu.au/informatics-hub/training)

Statistics	Data Science	Research Computing	Bioinformatics	Events
Fundamentals	Machine Learning	High Performance Computing	'omics Techniques	Hacky Hour
Modelling	Visualisation	Cloud Computing	Reproducible Pipelines	Summer Schools
Specialist	Natural Language Processing	Containers	Data Analytics	Coding Challenges
	Geospatial Analysis	Workflows	National Compute Infrastructure	

# What is AI?

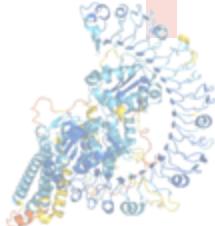
“A friendly koala cyborg”



what's the best way to peel a mandarin?

# Input

“Hello”

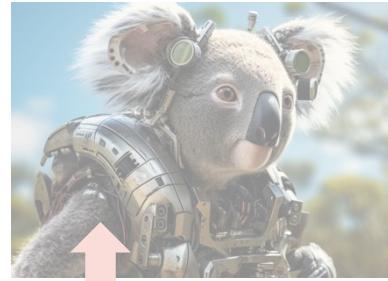


The University of Sydney

has an internal representation  
of meaning or content

[ 0, 1, .5, .2 ]

AI



Generates...

Images, Video

Text

# Output

你好

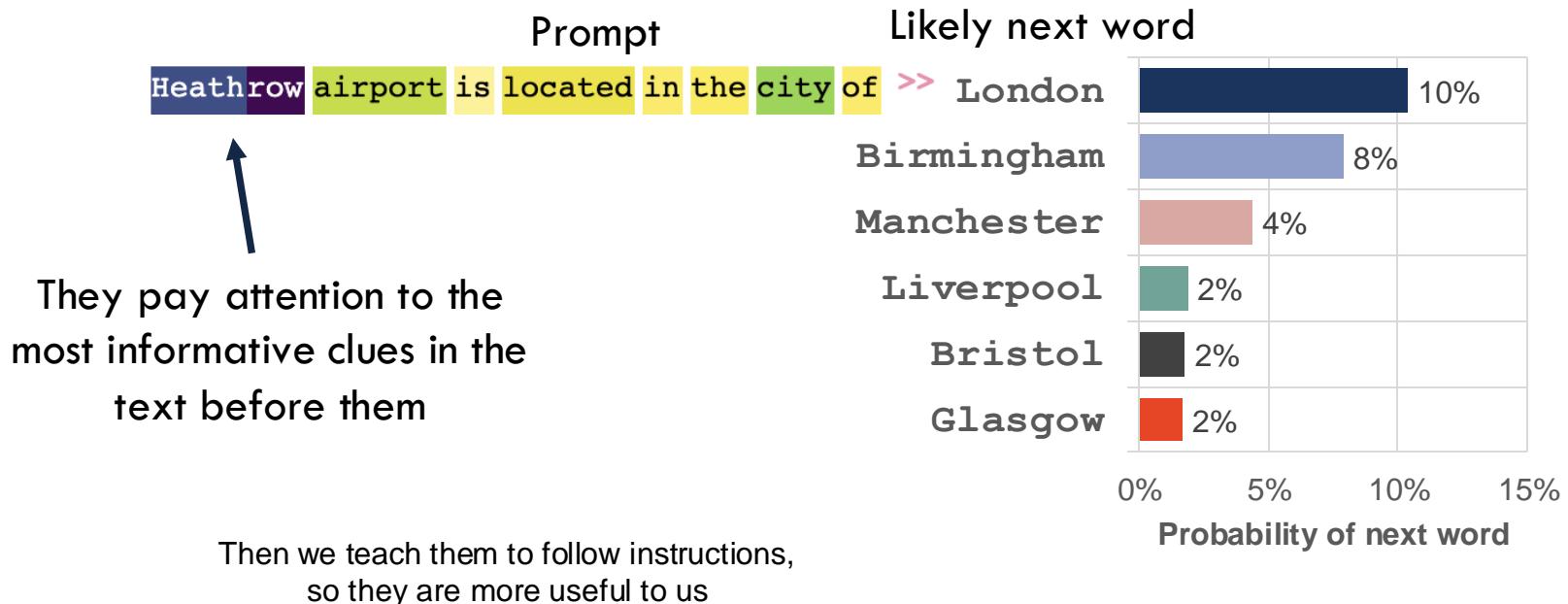


Audio



3D structures  
or molecules

# Language models (like ChatGPT)



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## Blessing

- Mostly ok results in far less time/effort
- Well-suited to poorly defined and ambiguous problems

## Curse

- Results can be unfeasible, wrong, creative ('hallucinated'), biased etc.
- You need a way to check the answer.
- Best models are proprietary and/or hosted on cloud in other jurisdictions

# Appetizer

*Topic Mapping with AI*

# Open Australian Legal Corpus

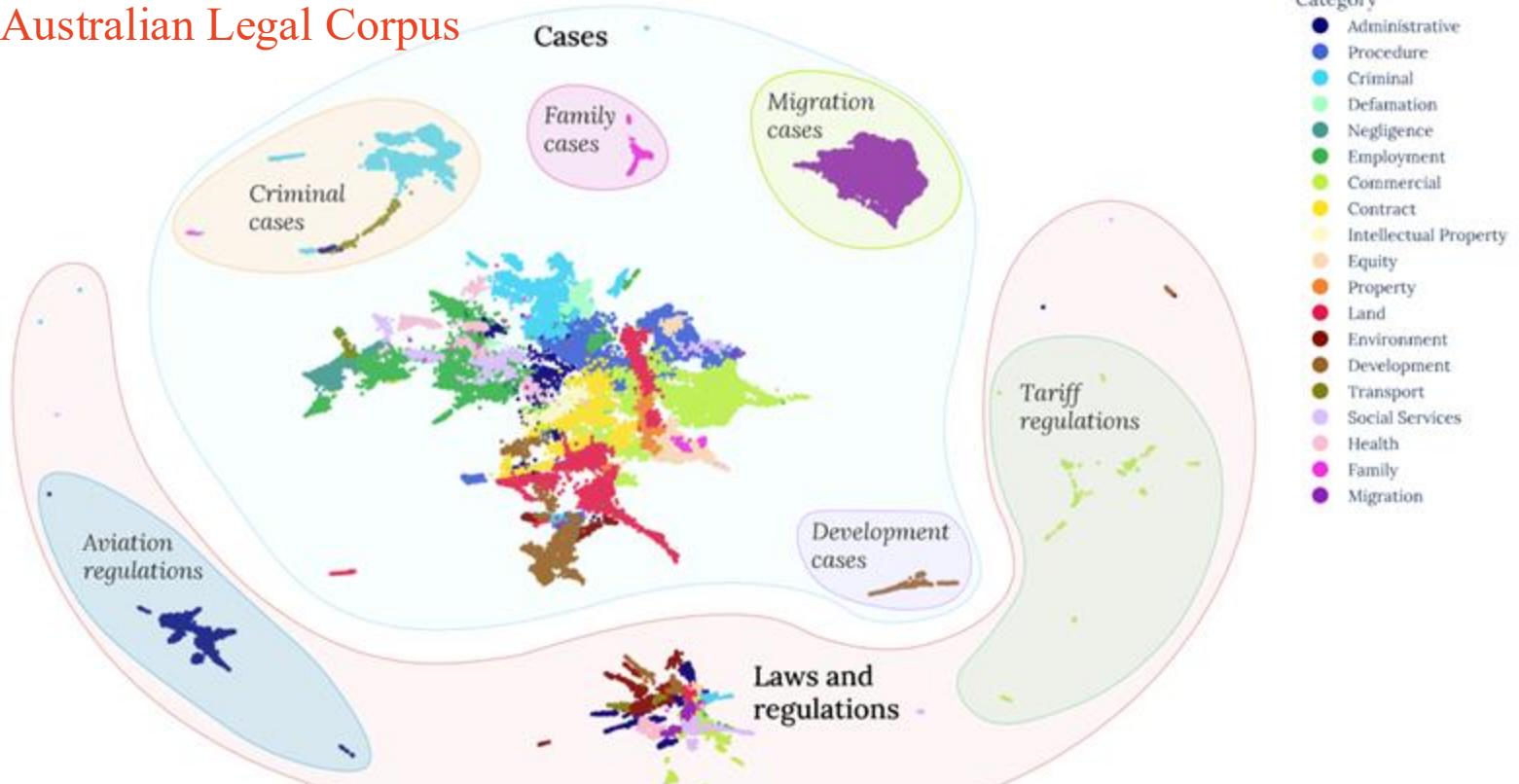
Source	Primary Legislation	Secondary Legislation	Bills	Decisions	Total
Federal Court of Australia				62,558	<b>62,558</b>
High Court of Australia				9,452	<b>9,452</b>
<b>NSW Caselaw</b>				<b>113,591</b>	<b>113,591</b>
Federal Register of Legislation	4,733	26,300			<b>31,033</b>
NSW Legislation	1,423	798			<b>2,221</b>
Queensland Legislation	571	428	2,277		<b>3,276</b>
Western Australian Legislation	817	754			<b>1,571</b>
South Australian Legislation	566	492	196		<b>1,254</b>
Tasmanian Legislation	856	1,676			<b>2,532</b>
<b>Total</b>	<b>8,966</b>	<b>30,448</b>	<b>2,473</b>	<b>185,601</b>	<b>227,488</b>

\*Chief Parliamentary Counsel of Victoria rejected Umar's request to publish their data under CC4.0 licence, and ACT and NT never responded.

Blog post: <https://umarbutler.com/how-i-built-the-largest-open-database-of-australian-law/>

Dataset (10Gb) available at: <https://huggingface.co/datasets/umarbutler/open-australian-legal-corpus>

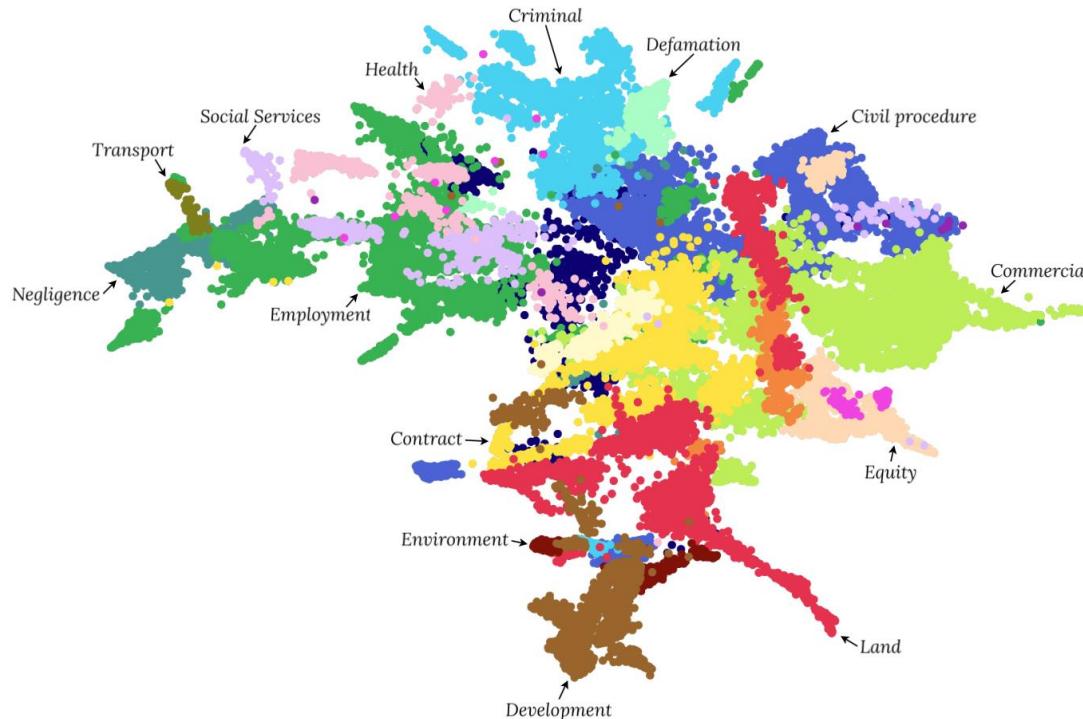
# Open Australian Legal Corpus



Blog post: <https://umarbutler.com/mapping-almost-every-law-regulation-and-case-in-australia/>

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# Open Australian Legal Corpus



# Topic Modelling, Map Your Corpus



u/mrx-ai · 1 yr. ago

## How ChatGPT actually works

A lot of buzz around ChatGPT—but not too much

Actually, OpenAI did not release much technical documentation. Their methodology is based on previous research.

I tried my best to describe in some detail how ChatGPT works in this article:

<https://www.assemblyai.com/blog/how-chatgpt-works>

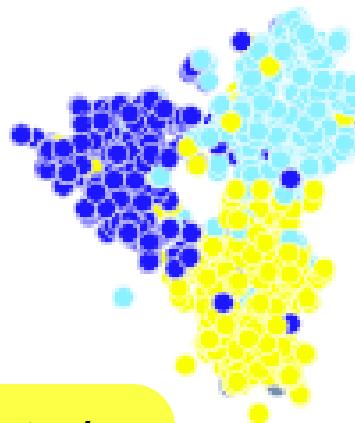
It also contains my personal criticism on some technical aspects of ChatGPT, as well as relevant references and a link to a cool open source repo for RLLM!

What is the best piece of technical content you read so far about ChatGPT?

**r/LanguageTechnology**

text nlp model  
language would

...



**r/Python**

python github  
code project  
use

u/Guilty-History-9249 · 10 mo. ago

## pytorch is bundling an old libcudnn.so.8 file causing perf drop on a 4090.

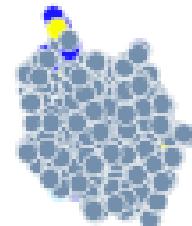
This was known at least as far back of Oct by the A1111 github folks the the report spread far.

I had to independently discover this. I was getting about 13.8 it/s during SD image generation and now I get 39.5. For a long time many of us thought Torch 2.0 was somehow involved in this huge improvement that we knew a few were getting. However, it isn't the Torch version at all. On Linux if I replace the libcudnn.so.8 file in pytorch with the same file from the cuDNN version 8.7 the perf jumps 3X. This is even with torch 1.12 cu113.

This isn't a tech support post but just information that might help some folks.

**r/pytorch**

self torch  
pytorch nn  
model



**r/investing**

market stock  
would stocks  
like

u/deepkrig17 · 1 mo. ago

## You should know these f-string tricks

F-strings are faster than the other string formatting methods and are easier to read and write. Here are some tricks you may not have known.

### 1. Number formatting :

You can do various formatting with numbers.

```
>>> number = 158
>>> # decimal places to n => .nf
>>> print(f"number: {number:.2f}")
number: 158.00
>>> # hex conversion
```

u/MorningTendies · 9 mo. ago

## We Just Witnessed the Largest U.S. Bank Failure since the Global Financial Crisis

Silicon Valley Bank (SVB) Shares Dropped Over 60% Before Trading was Halted

The Effect was Felt Throughout the Financial Sector  
In the Past 5 Days:

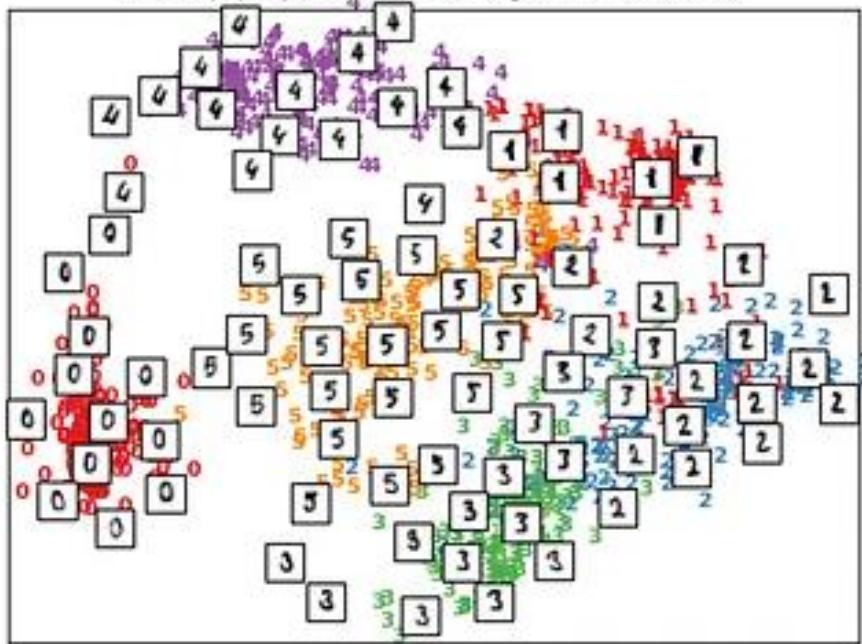
down 51%
23.75%
11.9%
3.08%

Bank surprised the market by announcing it needed to raise capital. It had been forced to sell all of its available-for-sale bonds at a discount. Clients withdrew deposits, it said.

That the efforts to raise capital had failed and that SVB had

[View full post](#)

# Topic Modelling, Map Your Images



MNIST handwritten digits

0	1	2	3	4	5	6	7	8	9
0	1	2	3	4	5	6	7	8	9
0	1	2	3	4	5	6	7	8	9
0	1	2	3	4	5	6	7	8	9
0	1	2	3	4	5	6	7	8	9
0	1	2	3	4	5	6	7	8	9
0	1	2	3	4	5	6	7	8	9
0	1	2	3	4	5	6	7	8	9
0	1	2	3	4	5	6	7	8	9
0	1	2	3	4	5	6	7	8	9

# AI tools @ Sydney

*and what you can use them on*

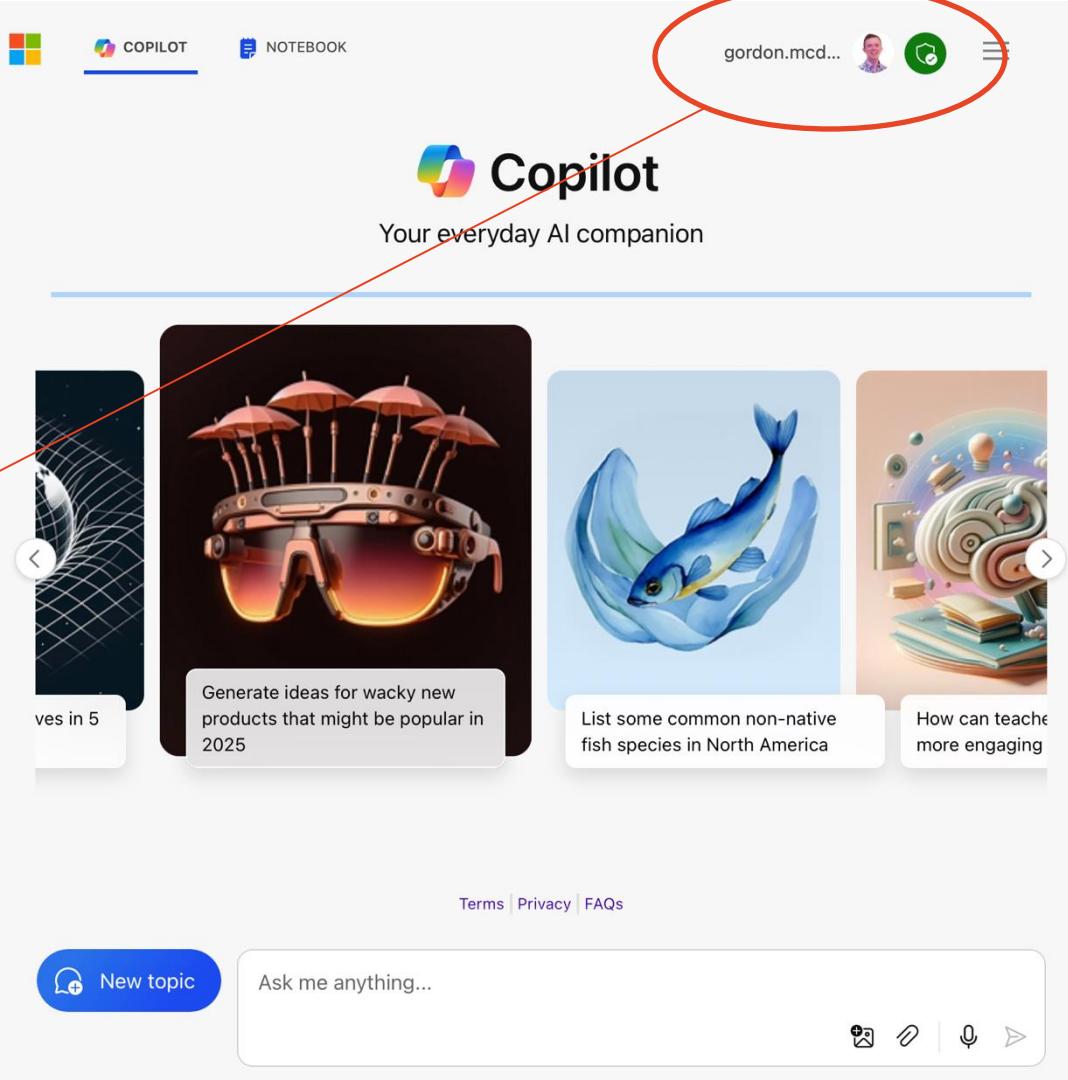
# Copilot

University rated for public or protected data

“Safer ChatGPT”

 **Not** for highly protected data!

 Make sure you log in with your email name@sydney.edu.au and look for the green ‘protected’ badge



The screenshot shows the Microsoft Copilot homepage. At the top, there are navigation links for 'COPilot' (which is underlined and bolded), 'NOTEBOOK', and a user profile section with a photo of Gordon McDowell, a green 'protected' badge, and a three-dot menu. A red circle highlights the user profile area. Below the header, the 'Copilot' logo and tagline 'Your everyday AI companion' are displayed. The main content area features several AI-generated images and their corresponding prompts:

- A dark phone-like interface with a grid pattern: 'ves in 5'
- A futuristic headset with multiple umbrellas attached: 'Generate ideas for wacky new products that might be popular in 2025'
- A blue fish swimming: 'List some common non-native fish species in North America'
- A brain and books: 'How can teachers make learning more engaging'

At the bottom, there are links for 'Terms | Privacy | FAQs', a 'New topic' button, an 'Ask me anything...' input field, and various sharing icons.

<https://copilot.microsoft.com>

---

# Photoshop

Generative Fill in Photoshop  
allows you to create and  
edit images



[www.adobe.com](http://www.adobe.com)

# Cogniti

Make your own guided chatbots!

University rated for student and teaching use.

Can provide a prompt to guide the chatbot, and relevant (public) documents for it to search when replying.

 **Do not** use with protected data!

[app.cogniti.ai](http://app.cogniti.ai) and  
[cogniti.sydney.edu.au](http://cogniti.sydney.edu.au)



I have a corpus of caselaw that I want to analyse to extract certain pieces of information, then group it according to what topics are in the documents. who can help me?

For your research problem involving the analysis of a corpus of caselaw to extract information and categorize it by topics, you may benefit from the following techniques:

1. **Natural Language Processing (NLP):** This involves using computer algorithms to understand and manipulate human language. NLP techniques can help you extract entities, concepts, and relationships from your legal documents.
2. **Text Mining and Machine Learning:** These techniques can be used to discover patterns and trends within large sets of text data. Machine learning models can be trained to classify documents into topics.
3. **Data Visualization:** After extracting and categorizing the information, visualizing the data can help in understanding the distribution of topics and the relationships between them.
4. **Database Management:** Properly storing and indexing the extracted information will be crucial for efficient retrieval and analysis.
5. **Statistical Analysis:** This can be used to quantify the significance of the findings and to understand the distribution of topics within the corpus.

The **Sydney Informatics Hub** at the University of Sydney could assist you with some of these techniques, particularly in the areas of research data analysis, AI, bioinformatics, statistics, and high performance computing. They offer support and training in these areas, which could be very beneficial for your project.

**Contact details for Sydney Informatics Hub:**

- Website: [Sydney Informatics Hub](http://sydneyinformaticshub.com)
- Email: sih.info@sydney.edu.au

Please note that while the University of Sydney Core Research Facilities provide a wide range of services, the specific

Enter your message

# Cogniti

Make your own guided chatbots!

University rated for student and teaching use.

Can provide a prompt to guide the chatbot, and relevant (public) documents for it to search when replying.

 **Do not** use with protected data!

## Edit agent: Research Facility Navigator

[Details](#)[Prompts](#)[AI engine](#)[Resources](#)[Limits](#)[Chat access](#)[Plugins](#)[Styling](#)[Sharing](#)[Privacy and security](#)[Ownership](#)

### Agent prompts

#### System message

You are an assistant designed to direct academic researchers at the University of Sydney to the appropriate University of Sydney research facilities relevant to their research.

Ask the user about their research problem.

Consider up to five appropriate techniques that might help them with their research problem.

If any of these techniques are provided by University of Sydney research facilities, list the technique and the facility, along with links for contacting the facility as listed below.

Provide only website links and email addresses that are listed in this prompt or resources.

Make sure that all information you provide about research facilities is from the resource documents or links.

Do not make up new research facilities, web sites or email addresses.

If a suggested technique is not offered by a University of Sydney research facilities you may list these last.

If you don't know what techniques are offered just reply that you don't know and users can look at the website at [University of Sydney Core Research Facilities]

#### Initial user message

Optional first message to send the AI on behalf of the user

[Save agent](#)[Try chat with this agent](#)

[app.cogniti.ai](https://app.cogniti.ai) and  
[cogniti.sydney.edu.au](https://cogniti.sydney.edu.au)

# Sydney Informatics Hub Example Projects

*Information harvesting, integrating, and storytelling.*

Large language models for literature review, synthesis, and text analysis.

# Extracting information from text with language models

The screenshot shows a legal judgment page from the NSW Caselaw website. At the top, there's a header with the NSW crest and the word 'Caselaw'. Below the header, there are navigation links for Home, Browse, About, Contact us, and a search bar. A large green arrow points from the OpenAI GPT-4o logo to the search bar. The main content area displays the judgment details:

- CITATION: Dunn v McCarthy [2010] NSWSC 675
- HEARING DATE(S): 21/06/2010
- JUDGMENT DATE: 7 July 2010
- JURISDICTION: Equity Division
- JUDGMENT OF: Macreadie Asst at I
- DECISION:

1.In lieu of the legacy of \$30,000 in favour of the plaintiff contained in the will of the late Frederick Milton Gear dated 20 February 2008, the plaintiff will receive a legacy in the sum of \$160,000.  
2. Interest to be paid on the balance of such legacy if it is not paid within three months from today's date and if not so paid, to bear interest at the rate prescribed for under the Probate and Administration Act 1898.  
3.That the plaintiff's costs to be paid on the ordinary basis and the defendant's costs on an indemnity basis be paid or retained from the estate of the deceased.
- CATCHWORDS: Family Provision. Application by stepson given modest legacy. Legacy increased. No matter of principle.

At the bottom, it says 'NSW Supreme Court' and 'Inheritance law judgments'.

Name	James Nevill Dunn	✓
Role in trial	Plaintiff	✓
Costs	\$40,000 (p6)	✓
Natural person?	true	✓
Relationship to deceased	stepson (p1)	✓
Was dependent on deceased?	partly dependent (p32)	✓
Alleged misconduct?	false	✓
Estranged from deceased?	briefly estranged due to a misunderstanding (p43)	✗
Financial circumstances	receives a pension of \$520 per fortnight, wife earns \$800 per fortnight, owns a house with a \$15,000 mortgage (p39-40)	✓

Inheritance Case Law – Dr. Ben Chen  
SIH: Mike Lynch, Xinwei Luo

# Semantic search on private data

The screenshot shows a survey creation interface. At the top, there are tabs for Survey, Workflows, Distributions, Data & Analysis, Tools, and Draft. The main area is titled "test". On the left, there's a sidebar with options like Edit question, Question type (Text entry selected), Text type, and Multiple lines. Below that are sections for Add requirements and Add validation. The main content area shows a question "Q2: how long?" with three choice options: thing1, thing2, and thing3. A large green arrow points from the "Local language model (not in the cloud)" text above to this interface.

Survey and Interview transcripts  
⚠ Highly protected data

Digital Criminal Justice Project  
Dr. Carolyn McKay

SIH: Nathaniel Butterworth,  
Gordon McDonald, Marius Mather  
[bit.ly/sih\\_search](https://bit.ly/sih_search)



Semantic Query food

before the sun had risen, the wife came and awakened the two children, saying, "Get up, you lazy bones; we are going into the forest to cut wood." Then she gave each of them a piece of bread, and said, "That is for dinner, and you must not eat it before then, for you will get no more." Gretel carried the bread under her apron, for Hansel had his pockets full of the flints. Then they set off all together on their way to the forest. When they had gone a little way Hansel stood still and looked back towards the house, and this he did again and again, till his father said to him, "Hansel, what are you looking at? take care not to forget your legs."

"O father," said Hansel, "I am looking at my little white kitten, who is sitting up on the roof to bid me good-bye." - "You young fool," said the woman, "that is not your kitten, but the sunshine on the chimney-pot." Of course Hansel had not been looking at his kitten, but had been taking every now and then a flint from his pocket and dropping it on the road. When they reached the middle of the forest the father told the children to collect wood to make a fire to keep them, warm; and Hansel and Gretel gathered brushwood enough for a little mountain; and it was set on fire, and when the flame was burning quite high the wife said, "Now lie down by the fire and rest yourselves, you children, and we will go and cut wood; and when we are ready we will come and fetch you."

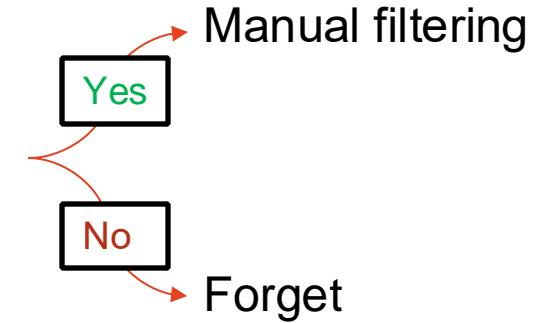
So Hansel and Gretel sat by the fire, and at noon they each ate their pieces of bread. They thought their father was in the wood all the time, as they seemed to hear the strokes of the axe: but

# Classifying text with language models

## PubMed articles

The screenshot shows a search result for a paper titled "Improving de novo protein binder design with deep learning". The article is by Nathaniel B Bennett et al., published in *Nat Commun.* 2023 May 6;14(1):2625. The abstract discusses the use of deep learning to design high affinity protein binders from target structural information alone, achieving success rates nearly 10-fold higher than Rosetta or AlphaFold2.

Does this paper report  
on an inherited trait?



[omia.org](http://omia.org)

OMIA Text Mining  
Professor Frank Nicholas, Associate Professor Imke Tammen  
SIH: Marius Mather, Sony Jufri, Joel Nothman, Di Lu

# Searching for information

[policy-navigator.techlab.works](https://policy-navigator.techlab.works)

## University of Sydney Policies

The image shows two policy documents from the University of Sydney. On the left is the 'LEAVE POLICY 2023' document, which includes fields for the Vice-Chancellor's signature and a 'CONT' section. On the right is the 'REASONABLE AND NON-ALLOWABLE EXPENSE PROCEDURES 2022' document, also with a similar structure. A large red curved arrow points from the right side of the 'REASONABLE AND NON-ALLOWABLE EXPENSE PROCEDURES 2022' document towards the Policy Navigator interface.

**LEAVE POLICY 2023**

The Vice-Chancellor delegates:

- Dated: [Redacted]
- Last Amended: [Redacted]
- Signature: [Redacted]
- Name: [Redacted]
- Current Chancellor: [Redacted]

**CONT**

1  
2  
3  
4

**REASONABLE AND NON-ALLOWABLE EXPENSE PROCEDURES 2022**

Issued by: Chief Financial Officer  
Dated: 27 October 2022  
Last amended: 23 January 2024 (administrative amendments)  
Signature:  
Name: Wayne Andrews

**1 Purpose and application**

(1) These procedures are to give effect to the [Procurement Policy 2019](#) ("the policy"), and support compliance with probity, value for money and legislative requirements.

(2) These procedures apply to:

- (a) the University, students, staff and affiliates;
- (b) all foundations, centres, associations and institutes not separately incorporated;

Which policy document answers the question?

The Policy Navigator Beta interface shows a search query: "What does the research code of conduct say about using generative AI like Microsoft copilot for my research on personally identifiable information such as sensitive interview transcripts?". The results page displays the 'RESEARCH CODE OF CONDUCT 2023' document, with a summary of its findings and a link back to the document itself.

Policy Navigator Beta

Thought process Supporting content Citation

Document Document Section Policy Register

What does the research code of conduct say about using generative AI like Microsoft copilot for my research on personally identifiable information such as sensitive interview transcripts?

Based on your question, it looks like the [Research Code of Conduct 2023](#) might apply, which says:

The Research Code of Conduct provides guidelines for the use of generative AI like Microsoft Copilot in research involving personally identifiable information such as sensitive interview transcripts. Researchers must ensure that any personal information arising from the research is collected, stored, used, and disclosed in accordance with privacy laws and university policies <sup>[1]</sup>. Additionally, researchers must handle confidential material, including personal information, with care by clearly identifying it, storing it securely, recording access details, and

Type a new question

CONTENTS

1 Name of policy	2
2 Commencement	2
3 Policy is binding	2
4 Policy is general	2
5 Application	2
6 Prohibited	2

PART 1 - PROPER CONDUCT OF RESEARCH

7 Principles of responsible research conduct	7
8 Protection of the confidentiality of research participants	9
9 Recordkeeping and management of research data and primary materials	13
10 Publication of research findings	17
11 Publication and dissemination of research findings	17
12 Authorship	19
13 Peer review	21
14 Conflicts of interests	22
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16 Tissue banks and collection, storage and use of human tissue	25
17 Use of animals in research, including in teaching and other restrictions	26

PART 2 - MANAGING AND INVESTIGATING ALLEGED BREACHES

18 Relationships with other instruments and procedures	27
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21 Investigation of research misconduct	28
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Policy Navigator (Beta)  
SIH: Henry Lydecker, Gordon McDonald  
TechLab: Iqbal Chowdhury, Jim Cook  
OGC: Lauren Myers, Deb Hook

# Contextualizing information and storytelling

Papers, patents, PR, ...

Circulation Research  
Volume 122, Issue 1, 6 January 2023, Pages 72-86  
https://doi.org/10.1161/CIRCRESAHA.122.321123

ORIGINAL RESEARCH

**Tropoelastin Improves Post-Infarct Cardiac Function**

Meet the First Author, see p 5

Robert D. Hume, Shaan Kanagaligam, Tejas Deshmukh, Siqi Chen, Suzanne M. Mithieux, Fairoj N. Rasheed, Imraan Rehmani, Justine J. Lu, Tejan Deon, Diwakar Gohar, Zoa E. Clayton, E. Thomas, Anil Chaturvedi

**Background:** Myo... Following MI, necrotic collagen, the extra... favorable properties introducing tropoelastin.

**Methods and Results:** A new method to administer... induced MI. Ex... PBS vehicle control assessments show... (64.7±4.4% versus ms versus 31.1±5.2%).

Allergan to acquire University of Sydney spinoff Elastagen

9 February 2018

University spinoff Elastagen Pty Ltd has entered into a definitive agreement under which Allergan plc, a leading global biopharmaceutical company, has agreed to acquire the company.

How elastin works

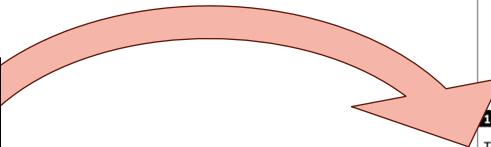
Rachel Ferguson

Central Media Manager

Phone: +61 2 8333 2221

Email: rachel.fergus@sydney.edu.au

What is the impact of this stream of research?



## Research Impact Assessment Framework Case Study

Organisation Details		
Organisation name:	University of Sydney Charles Perkins Centre	Elastagen
Title of case study:	2013 – 2023	2013 – 2023
Period when research was undertaken:	2013 – 2023	2013 – 2023
Period when the claimed impact occurred:		
Names and roles of staff:		
Staff name	Role	Anthony Weiss McCaughay Chair in Biochemistry, University of Sydney, NHMRC Leadership Fellow, Founder of Elastagen, and leader of Tissue Engineering & Regenerative Medicine in the Charles Perkins Centre, University of Sydney.

1. What is the problem your research seeks to address? Why is it significant? (250 word limit)

The research by Anthony Weiss and his team on Elastagen seeks to address the significant challenge of replicating the properties of human elastin, a key protein in the human body that provides elasticity and resilience to tissues such as skin, lungs, and arteries[1]. Human elastin's unique mechanical properties and biocompatibility make it difficult to mimic synthetically, which is a significant barrier in tissue engineering and regenerative medicine[2]. The significance of this research lies in its potential to revolutionize the field of biomedical engineering by providing a synthetic alternative to human elastin that can be used in a variety of medical applications, including wound healing, tissue repair, and the improvement of skin quality[1]. The development of Elastagen represents a breakthrough in the creation of biomaterials that can closely match the properties of natural human tissues, thereby enhancing the effectiveness of medical treatments and improving patient outcomes[2].

## Research Impact Assessment Framework

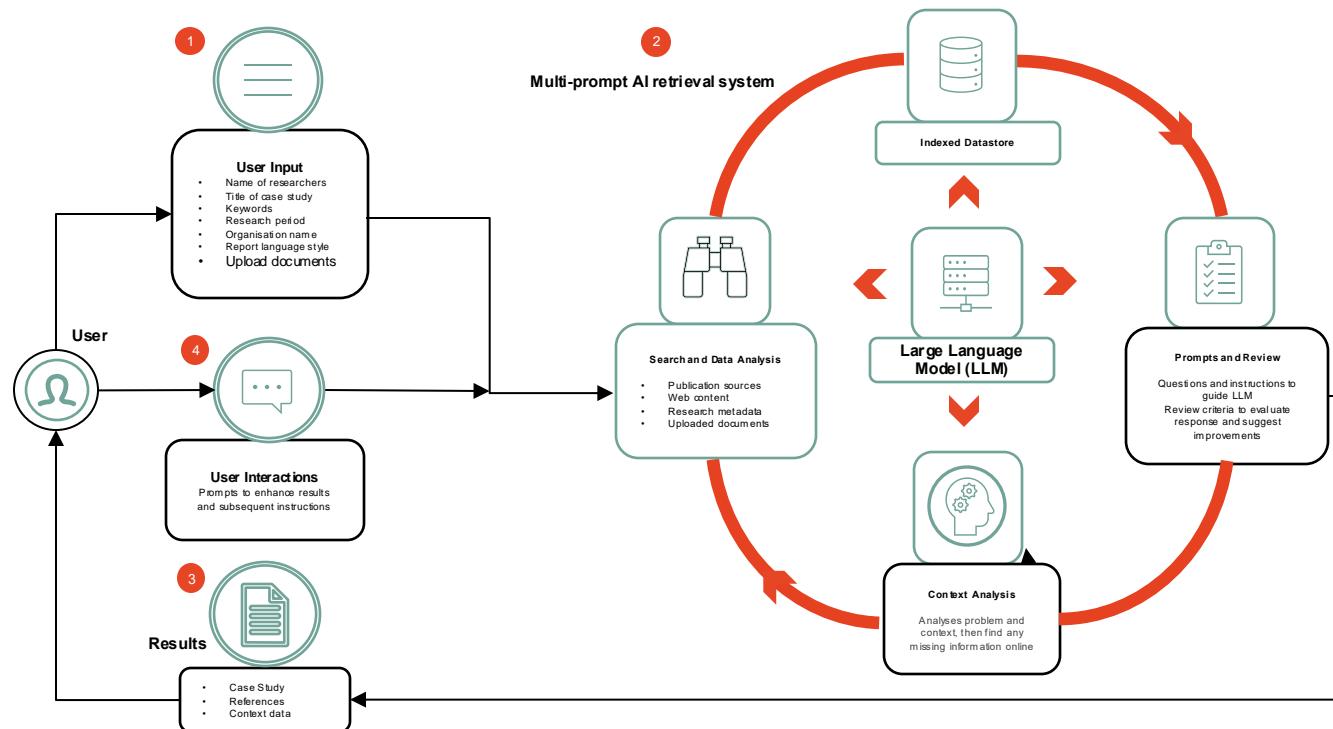
SIH: Sebastian Haan, Nathaniel Butterworth, Gordon McDonald

FMH: Mona Shamshiri, Janine Richards, Prof. Robyn Ward

NSW Health

# Contextualizing information and storytelling

Agent-based model



# Australian Text Analytics Platform

*Text analysis tools for all researchers*

## Some tools on the platform:



Document and corpus similarity tool

- Compare differences between documents, e.g. to eliminate near-duplicates.



Quotation tool and semantic tagging

- Extract quotes from text e.g. news articles
- [www.atap.edu.au/posts/quotation-tool/](http://www.atap.edu.au/posts/quotation-tool/)



Discursis

- An analysis and visualisation tool for conversational data
- [www.atap.edu.au/posts/discursis/](http://www.atap.edu.au/posts/discursis/)

Linguistics: Prof. Monika Bendarek

SIH: Dr. Chao Sun, Hamish Croser, Jack Chan, Sony Jufri



[www.atap.edu.au](http://www.atap.edu.au)

Facebook and Instagram, which Facebook owns, followed up in the evening, announcing that Trump wouldn't be able to post for 24 hours following two violations of its policies

This is where this document is different

Facebook and Instagram, which Facebook owns, followed up in the evening, announcing that Trump wouldn't be able to post for 24 hours following two violations of its policies

The White House did not immediately offer a response to the actions

When ... people were on ventilators and people were dying at that stage , and that 's the context in

QUOTE

aunceston . " I was n't aware of the decisions . " Former finance minister Simon Birmingham said

QUOTE

SPEAKER

PERSON

/ whether Mr Morrison should leave . Nationals leader David Littleproud said Australians should

PERSON

SPEAKER

ORG

PERSON

QUOTE

NORP

Albanese is awaiting advice from the solicitor - general on whether Mr Morrison 's actions have any legal



Australian Research Data Commons

# Picture This

*AI in Geospatial, Microscopy, Medical, Agriculture, & Conservation imagery*

Image Classification  
Object Detection  
Instance Segmentation  
Multi-Modal Models

*“We have a lot of images, and we want a way to automate analyzing them”*

# Multimodal Models

## Language + Vision

### Ecology/Conservation



What animal is in this photo?

A koala is in this photo.

### Geospatial



“Trees”

### Medical Imaging

What is this image?

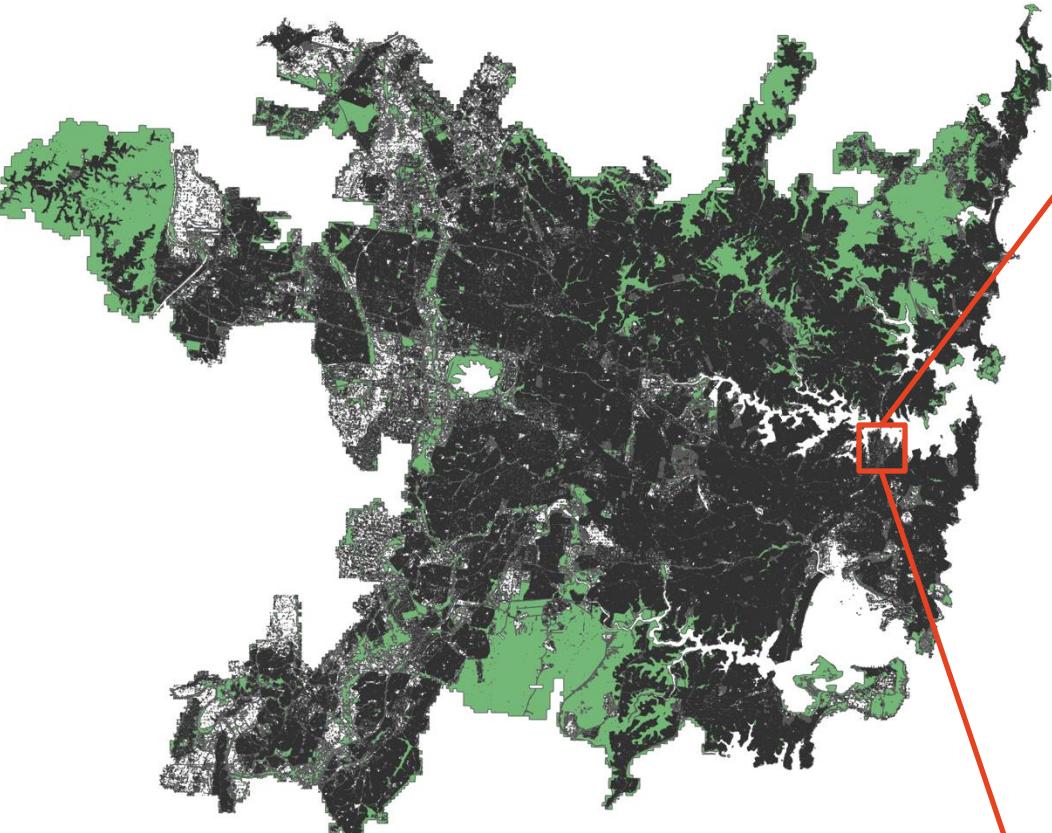


This image is a black and white photograph of a baby's chest, showing the baby's heart and lungs.

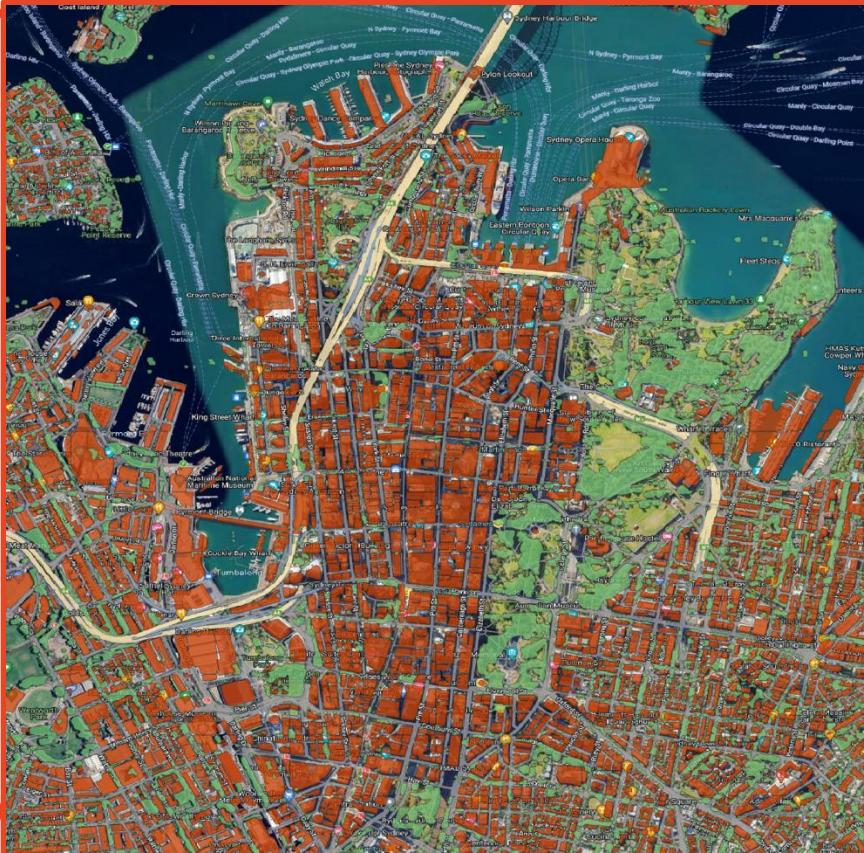
What is unusual about this child's chest x-ray?

The unusual aspect of this child's chest x-ray is that it has a small metal object inside the baby's chest, which is not typically seen in a normal chest x-ray.

# Greater Sydney Dataset



>2 million tree patches  
1 million buildings  
[bit.ly/aigis](http://bit.ly/aigis)



THE UNIVERSITY OF  
**SYDNEY**  
Sydney  
Informatics Hub

# Understanding cities with computer vision

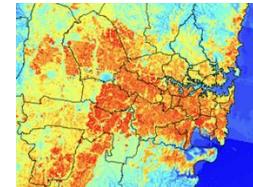
Prof. Ben Eggleton, NSW Smart Sensing, SIH: Henry Lydecker, Sahand Vahidnia, Thomas Mauch, Xinwei Luo



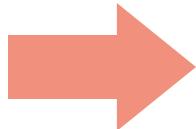
## Geospatial Features

Local Climate Zone = “2: Compact Midrise”

(49% class confidence)



## Input Image



## Computer Vision



[bit.ly/aigis](http://bit.ly/aigis)

## Insights, ML, Analysis

RGB Visual Light  
Satellite Imagery  
**Aerial Imagery** (Best)

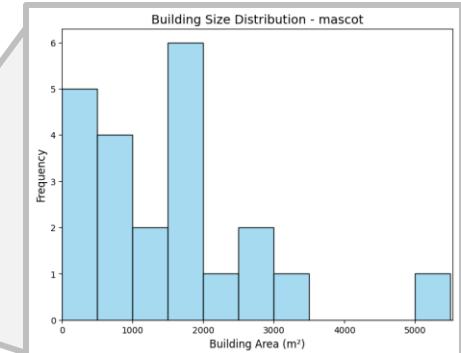
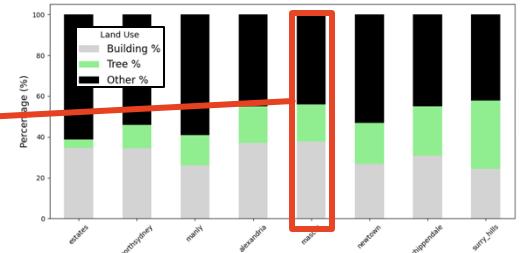
### Tree Patches

- 101 tree patches
- 15% coverage

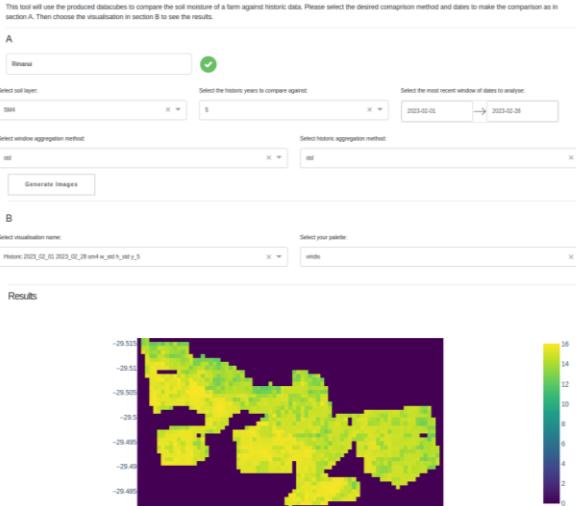
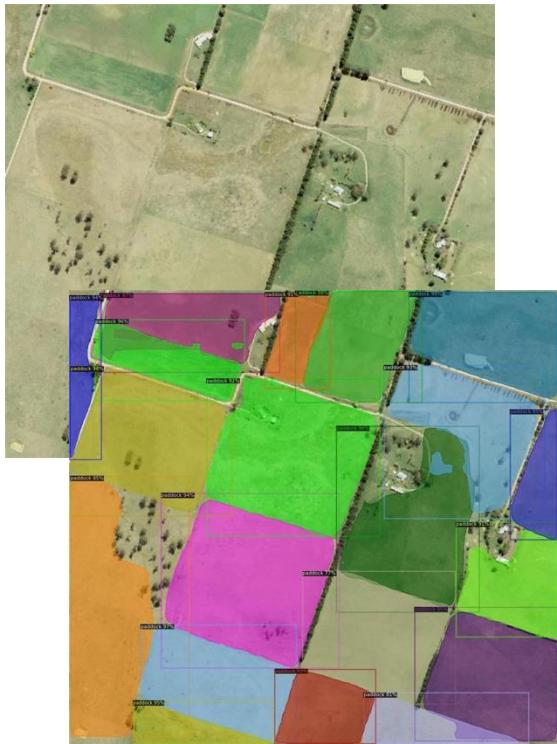
### Building Outlines

- 22 buildings
- 38% coverage
- building footprint area distribution

## Compare neighborhoods



# Agricultural land use models, urban ecology



# Detecting wildlife with NSW National Parks

SIH: Henry Lydecker, Nathaniel Butterworth, Gordon McDonald



## Key Highlights



Fine-tuned family of YOLOv5 models on **2.16 million** camera trap images.



Detect and identify up to **72 different species**, with **94% precision** and **95% recall** on the top 33 most common.



GPU-accelerated prediction pipeline **1371x faster** than manual labeling.



Ecological researchers like Dr. Aaron Greenville, conservation agencies, and governments make extensive use of camera traps to monitor wildlife. Processing this data requires an immense amount of time.

We implemented an AI pipeline for automatically detecting & identifying animals in camera trap images, dramatically speeding up speed of data processing.

[marsupial-ai.github.io/web/](https://marsupial-ai.github.io/web/)

The University of Sydney

# Speeding up microscopy data processing

SIH: Sebastian Haan, Nathaniel Butterworth

[bit.ly/sih-micro](http://bit.ly/sih-micro)

## Key highlights



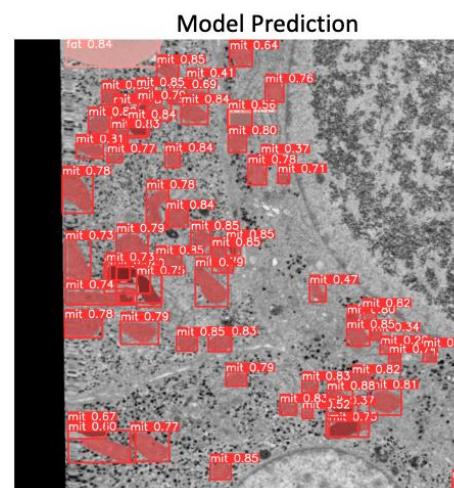
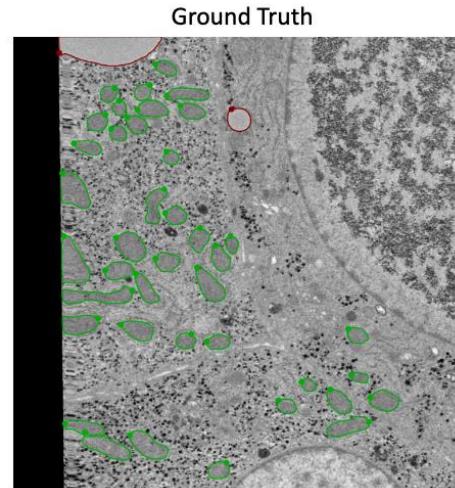
Sped up annotation process by up to 10x existing approaches



Full technology review of existing solutions with best practice solutions provided to clients



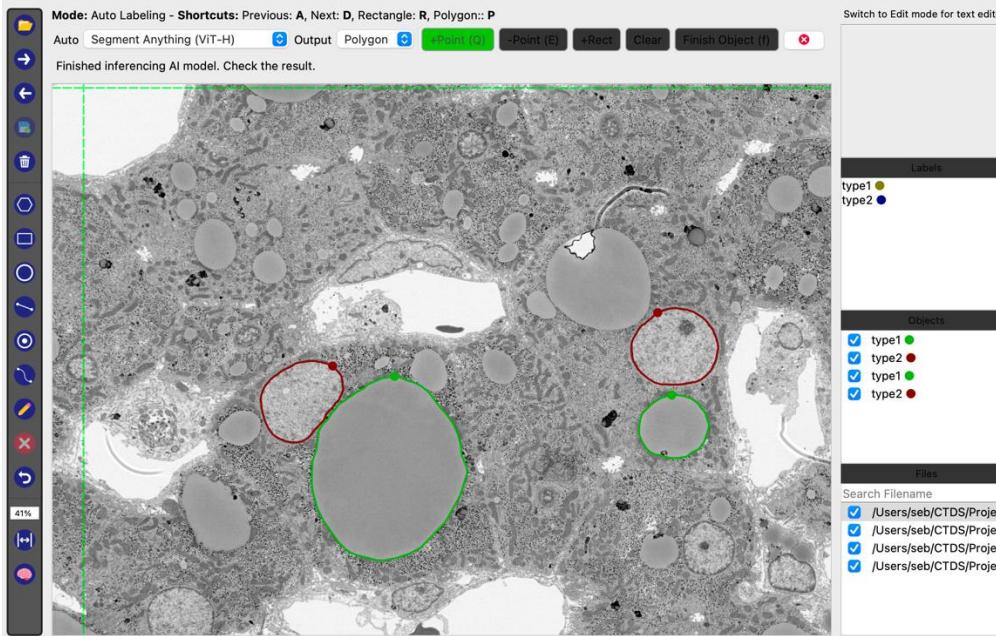
Strategic collaboration between SIH and SMM



Sydney Microscopy & Microanalysis collects immense amounts of data at the micro, nano, & atomic scales. We developed AI pipelines to speed up cell segmentation in electron microscopy images, automating 3D cell tomography.

# AI-assisted segmentation

## Anylabelling:



## Advantages:

- ONE-point and click polygon segment generation using auto segmentation
- Open-source and free
- Available as binary installers
- Image annotation for polygon, rectangle, circle, line, and point
- Export polygon labels in standard json format.

# Generative X

## Drug discovery

Design your own chemicals



## Manufacturing

Design me a diffraction grating / micro resonator / widget with these properties...

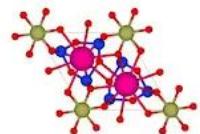
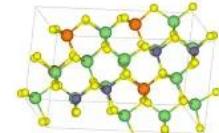
## Biology

Design your own protein  
synthetic biology



## Material discovery

AI mineral discovery and  
autonomous material synthesis



# How to Engage with Us

The screenshot shows the homepage of the Sydney Informatics Hub. At the top, there's a navigation bar with links for Study, Research (which is highlighted in red), Engage with us, About us, News & opinion, and a search icon. Below the navigation is a breadcrumb trail: Home / Research / Facilities / Sydney Informatics Hub. The main content area features a large heading "Sydney Informatics Hub" with a back-link to the previous page. A sub-headline "Enabling excellence in data and compute intensive research" follows. To the right of the sub-headline is a "Share" button with icons for social media and email. Below this are two call-to-action boxes: "Contact Us" (red background) and "Request a Quote" (light gray background). The "Contact Us" box contains the text "Request a consult or advice for your research project" and an arrow pointing right. The "Request a Quote" box contains the text "Request a quote or estimate for your research project or grant" and an arrow pointing right. On the left side, there's a sidebar with a vertical list of links: Home, Research, Facilities, Research and prototype foundry, Sydney Analytical, Sydney Cytometry, Sydney Imaging, Sydney Informatics Hub (selected, indicated by a dropdown arrow), Workshops and training, and Research project support. Under "Workshops and training", there are two sections: "Workshops and training" with an arrow pointing right, and "Research project support". Below the sidebar are two small images: one showing people working at desks with multiple monitors, and another showing a person working on a computer.



[sydney.edu.au/informatics-hub](http://sydney.edu.au/informatics-hub)



[sydney.edu.au/informatics-hub](http://sydney.edu.au/informatics-hub)

And fill out our  
request form



Contact



[sih.info@sydney.edu.au](mailto:sih.info@sydney.edu.au)

Or send us an email:

So what will you build?



## Sydney Informatics Hub

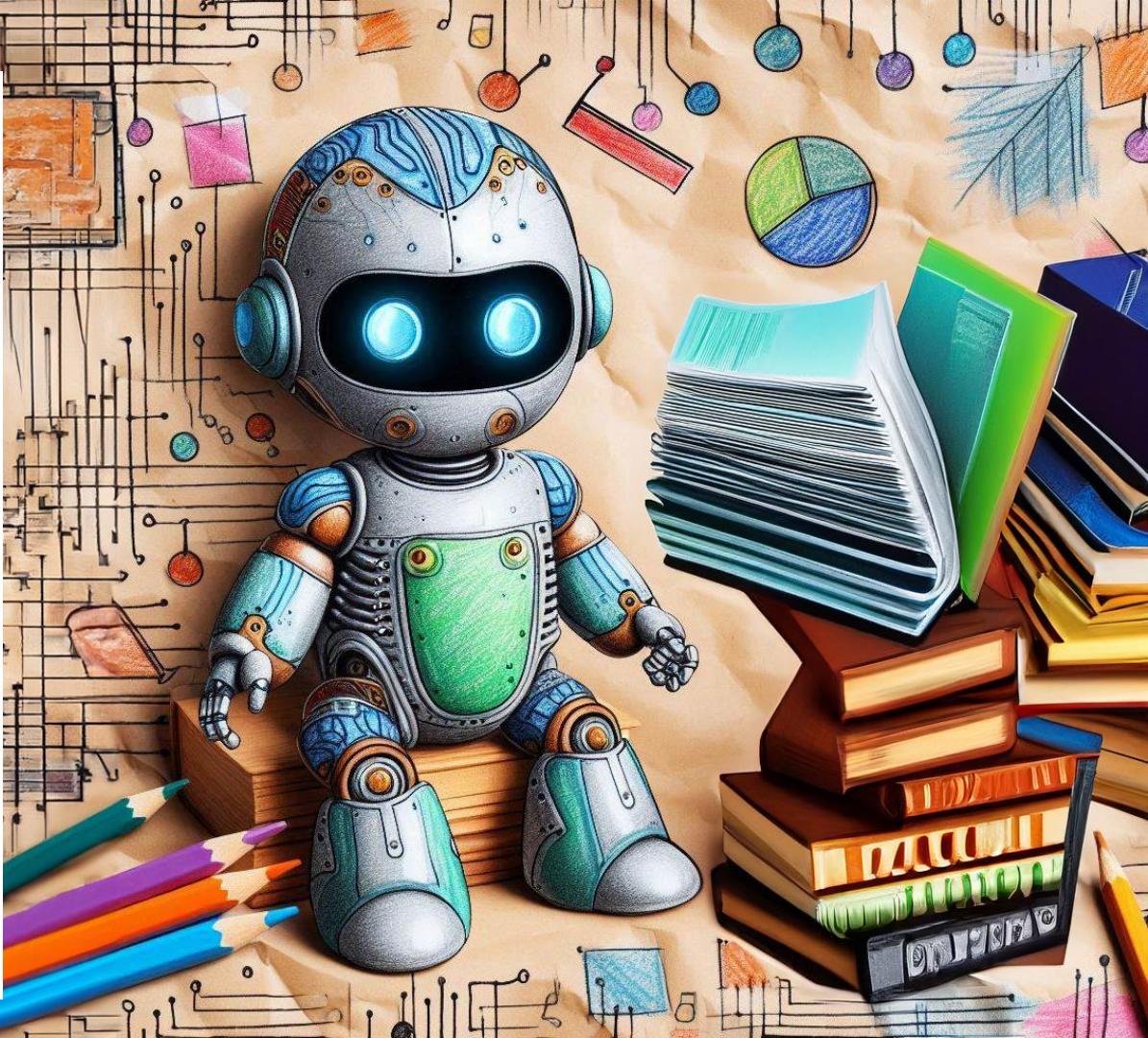
Dr Gordon McDonald, Informatics Team Lead  
[gordon.mcdonald@sydney.edu.au](mailto:gordon.mcdonald@sydney.edu.au)

[sydney.edu.au/informatics-hub](http://sydney.edu.au/informatics-hub)  
[sih.info@sydney.edu.au](mailto:sih.info@sydney.edu.au)



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**SYDNEY**

Sydney  
Informatics Hub



# Some Tools and Platforms

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# Audio

**Translate audio** between different languages, keeping your tone of voice

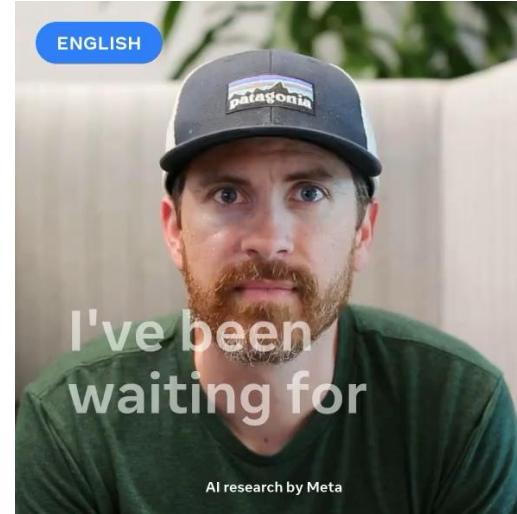
<https://seamless.metademolab.com/expressive>

**Generate Speech**

<https://elevenlabs.io>

**Generate Music**

<https://suno.com>



# On-device video transcription

If you're on a mac

[sindresorhus.com/aiko](https://sindresorhus.com/aiko)

Data and model runs in your browser – word level timestamps

[huggingface.co/spaces/Xenova/whisper-word-level-timestamps](https://huggingface.co/spaces/Xenova/whisper-word-level-timestamps)

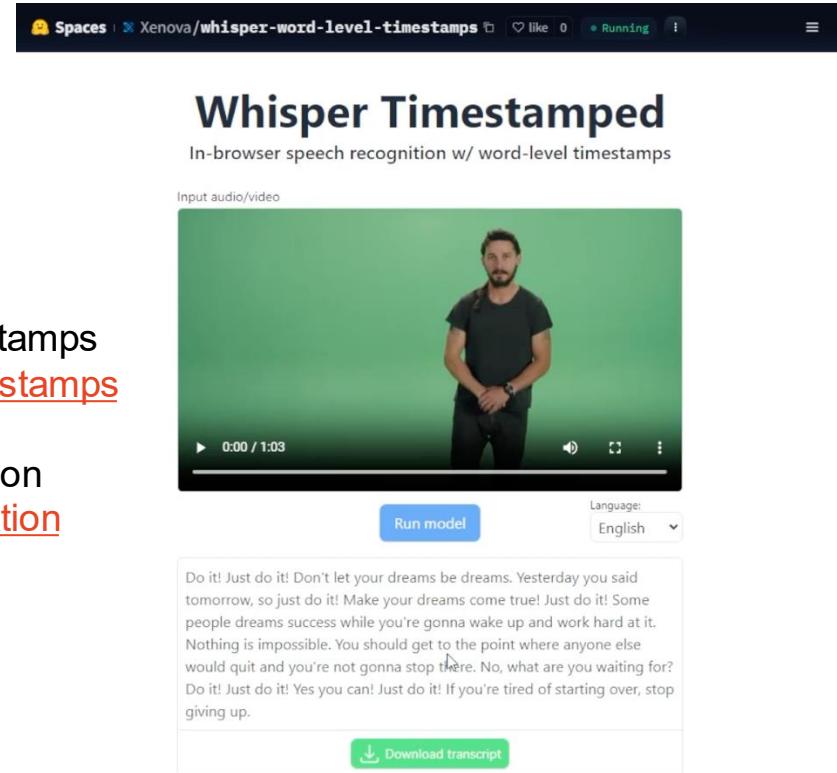
Data and model runs in your browser – speaker diarization

[huggingface.co/spaces/Xenova/whisper-speaker-diarization](https://huggingface.co/spaces/Xenova/whisper-speaker-diarization)

If you're ok with code and installs

[github.com/ggerganov/whisper.cpp](https://github.com/ggerganov/whisper.cpp)

(Not on device) Sharepoint automatic video transcription

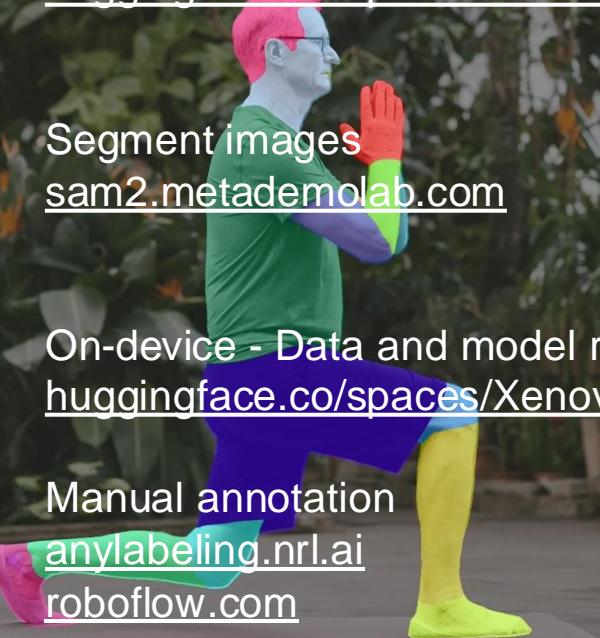


The screenshot shows a Hugging Face Spaces interface titled "Whisper Timestamped". The title bar includes the Hugging Face logo, the space name "Xenova/whisper-word-level-timestamps", and status indicators like "Running". Below the title, it says "In-browser speech recognition w/ word-level timestamps". A video player window displays a man standing against a green screen. The video controls show "0:00 / 1:03". To the right of the video, there's a "Run model" button and a language selection dropdown set to "English". A large text box below the video contains a transcription of the spoken content: "Do it! Just do it! Don't let your dreams be dreams. Yesterday you said tomorrow, so just do it! Make your dreams come true! Just do it! Some people dreams success while you're gonna wake up and work hard at it. Nothing is impossible. You should get to the point where anyone else would quit and you're not gonna stop there. No, what are you waiting for? Do it! Just do it! Yes you can! Just do it! If you're tired of starting over, stop giving up." At the bottom, there's a "Download transcript" button and a note "Generation time: 7572.30ms".

# Image segmentation

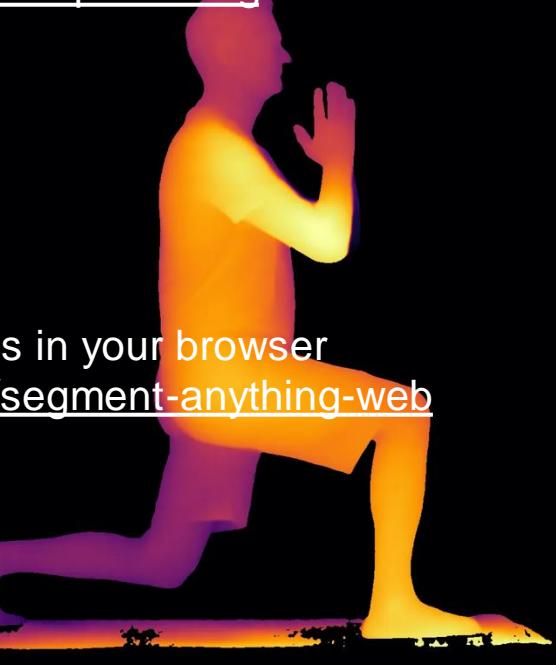
Segment a human

[huggingface.co/spaces/facebook/sapiens-seg](https://huggingface.co/spaces/facebook/sapiens-seg)



Segment images

[sam2.metademolab.com](https://sam2.metademolab.com)



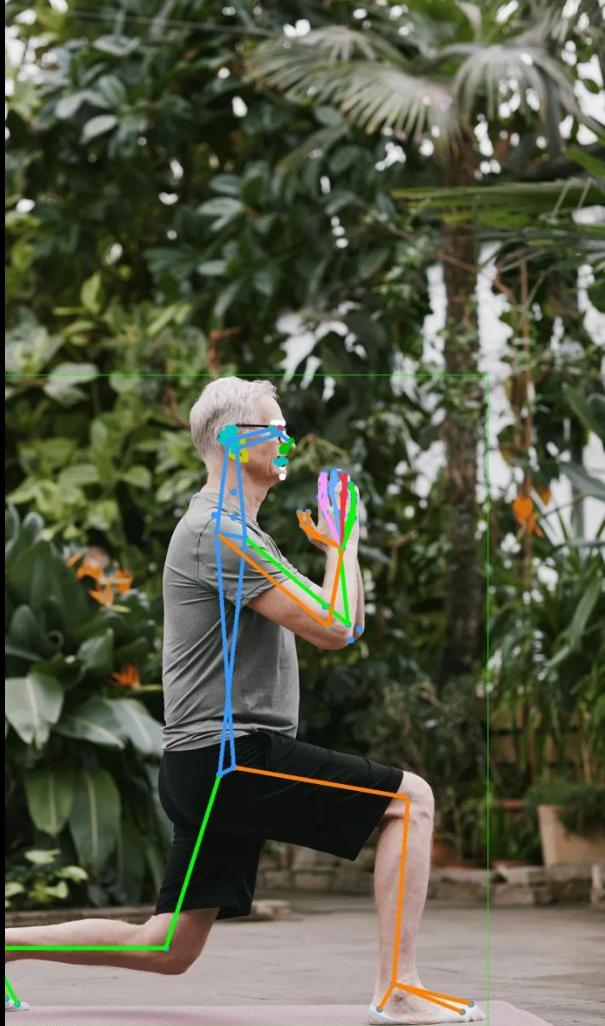
On-device - Data and model runs in your browser

[huggingface.co/spaces/Xenova/segment-anything-web](https://huggingface.co/spaces/Xenova/segment-anything-web)

Manual annotation

[anylabeling.nrl.ai](https://anylabeling.nrl.ai)

[roboflow.com](https://roboflow.com)



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## Platforms & Tools

- [Huggingface](#) – Open & free tools for AI proof of concepts
- [Papers with code](#) – compare state of the art models' performance
- [Colab](#) – free Jupyter notebook interface from Google
- [Weights & Biases](#) – Model training and evaluation diagnostics
- [Roboflow](#) – Very easy to use dataset utilities
- [PaddlePaddle](#) - frameworks for AI use cases

---

## Literature Search

[Research Rabbit](#) – free for researchers, operates on donation model

[Elicit](#) free trial, then \$10/month

[Rayyan](#) \$8/month researcher, \$4/month student

[Scite](#) Free trial then \$13-\$22/month

[SciSpace](#)

[Scopus-AI](#)

# Coding assistance

Free (ish)

Aider

Jupyter-AI

Open Interpreter

MetaGPT

Copilot

Paid

ChatGPT

Github Copilot



Best language models to use  
with these tools now (10-09-24):

- claude-3.5-sonnet (via API)
- gpt-4o (via API)
- DeepSeek 2.5 (via API)
- Local models? (none of them  
are quite good enough yet to be  
useful) 😞

---

# Agent building



**Agents**  
to reduce  
time to science

Free (ish)  
Cogniti  
Flowise  
MetaGPT

Paid  
ChatGPT Custom GPTs  
Azure Promptflow

---

# Try on virtual clothes!

To find more new models as they are released:  
<https://huggingface.co/spaces>

## Kolors Virtual Try-On in the Wild

Tech Report Kolors Official Website Page

Step 1. Upload a person image 



Step 2. Upload a garment image 



Step 3. Press "Run" to get try-on results





## Sydney Informatics Hub

Dr Gordon McDonald, Informatics Team Lead  
[gordon.mcdonald@sydney.edu.au](mailto:gordon.mcdonald@sydney.edu.au)

[sydney.edu.au/informatics-hub](http://sydney.edu.au/informatics-hub)  
[sih.info@sydney.edu.au](mailto:sih.info@sydney.edu.au)



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