



# AI, Generative AI, and Libraries

Bohyun Kim

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*INCONECSS Community Meeting No. 6. Artificial Intelligence: Impact on services, Online(/Europe). June 12, 2023*

# Recent Developments in AI/ML & Libraries

1. Wider adoption of AI/ML techniques in scientific research
2. The rise of generative AI tools
3. AI/ML products for researchers /library users

# 1. AI/ML for Scientific Research

## AlphaFold Protein Structure Database

Developed by DeepMind and EMBL-EBI

Search for protein, gene, UniProt accession or organism

BETA

Search

Examples: Free fatty acid receptor 2 At1g58602 Q5VSL9 E. coli

Help: AlphaFold DB search help

Feedback on structure: Contact DeepMind

<https://alphafold.ebi.ac.uk>

AlphaFold DB provides open access to over 200 million protein structure predictions to accelerate scientific research.

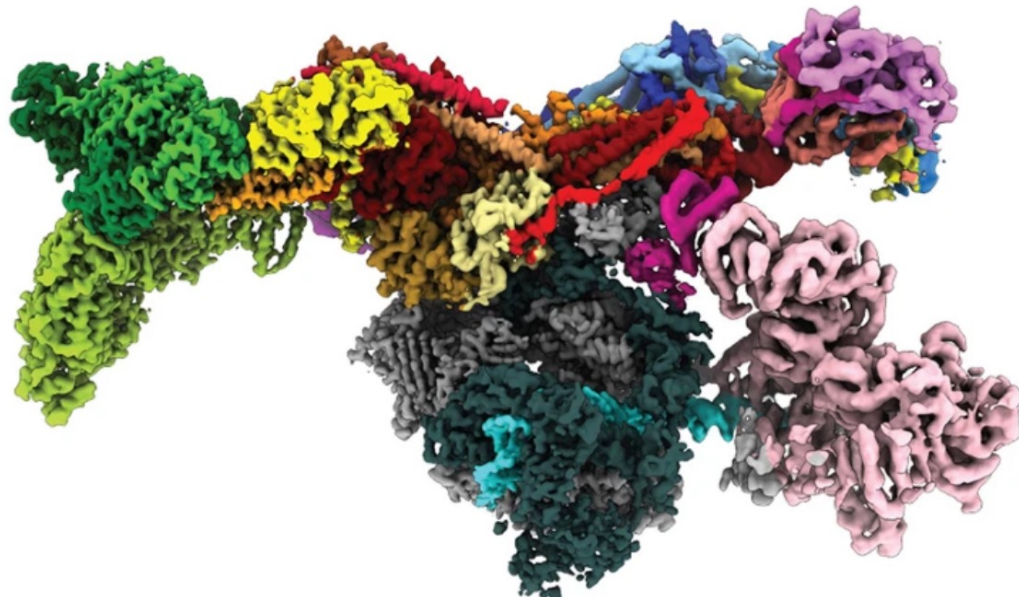
# DeepMind's AI predicts structures for a vast trove of proteins

AlphaFold neural network produced a 'totally transformative' database of more than 350,000 structures from *Homo sapiens* and 20 model organisms.

[Ewen Callaway](#)



<https://www.nature.com/articles/d41586-021-02025-4>



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University of Michigan Library

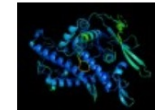
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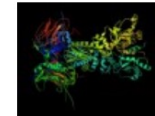
## Related Articles

[DeepMind's AI for protein structure is coming to the masses](#)

['It will change everything':  
DeepMind's AI makes gigantic  
leap in solving protein structures](#)



[AI protein-folding algorithms  
solve structures faster than ever](#)



## Subjects

[Proteomics](#)

[Structural biology](#)

[Machine learning](#)

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Designing robust machine learning classifiers

Atul Prakash, Associate Chair, Division of Computer Science and Engineering, Department of Electrical Engineering and Computer Science and Professor of Electrical Engineering and Computer Science, College of Engineering

+

Data Science in Space Weather Forecasting

Yang Chen, Assistant Professor of Statistics, College of Literature, Science, and the Arts

+

From AI to ET: Image Processing, Spectral Modeling, and Population Demographics to Study Planets Around Other Stars

Michael Meyer, Professor of Astronomy, College of Literature, Science, and the Arts

The AI Forest: Using deep learning to track wild monkeys

Jacinta Beehner, Professor of Psychology and Professor of Anthropology, College of Literature, Science, and the Arts  
Thore Bergman, Professor of Psychology and Professor of Ecology and Evolutionary Biology, College of Literature, Science,

Uncertainty and Decisions: Tools for Bayesian Inference and Uncertainty Quantification in Science

Alex Gorodetsky, Assistant Professor of Aerospace Engineering, College of Engineering

Integration of Artificial Intelligence in Manufacturing Systems

Kira Barton, Associate Professor of Robotics and Associate Professor of Mechanical Engineering, College of Engineering  
Dawn Tilbury, Associate Vice President for Research-Convergence Science, University of Michigan Office of Research, Ronald D and Regina C McNeil Department Chair of Robotics, Herrick Professor of Engineering, Professor of Robotics, Professor or Mechanical Engineering and Professor of Electrical Engineering and Computer Science, College of Engineering

Curriculum and Reinforcement Learning for Molecular Conformer Sampling

Paul Zimmerman, Professor of Chemistry, College of Literature, Science, and the Arts

chemistry, astrophysics,  
evolutionary biology ...

astronomy, meteorology,  
anthropology, engineering

Integration of Artificial Intelligence in Manufacturing Systems

Kira Barton, Associate Professor of Robotics and Associate Professor of Mechanical Engineering, College of Engineering  
Dawn Tilbury, Associate Vice President for Research-Convergence Science, University of Michigan Office of Research, Ronald D and Regina C McNeil Department Chair of Robotics, Herrick Professor of Engineering, Professor of Robotics, Professor or Mechanical Engineering and Professor of Electrical Engineering and Computer Science, College of Engineering

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Curriculum and Reinforcement Learning for Molecular Conformer Sampling

Paul Zimmerman, Professor of Chemistry, College of Literature, Science, and the Arts  
Ambuj Tewari, Professor of Statistics, College of Literature, Science, and the Arts and Professor of Electrical Engineering and Computer Science, College of Engineering

+

DEEP learning at the edge of the solar system

David Gerdes, Arthur F Thurnau Professor, Professor of Physics, Chair, Department of Physics and Professor of Astronomy, College of Literature, Science, and the Arts

+

Digital twin calibration

Eunshin Byon, Associate Professor of Industrial and Operations Engineering, College of Engineering

+

Data Analytics for the Internet of Things

Raed Al Kontar, Assistant Professor of Industrial and Operations Engineering, College of Engineering  
Judy Jin, Professor of Industrial and Operations Engineering, Professor of Integrative Systems and Design and Director Academic Program, Integrative Systems and Design, College of Engineering  
Eunshin Byon, Associate Professor of Industrial and Operations Engineering, College of Engineering

+

Summary and Closing Remarks

William Currie, Professor and Associate Dean for Research and Engagement of School for Environment and Sustainability; Schmidt AI in Science Program co-Director

+



# U-M Annual Data Science & AI Summit 2022

## AI in Science Program Introduction and Research Talks

**Session Chair: William Currie**, Professor and Associate Dean for Research and Engagement of School for Environment and Sustainability; Schmidt AI in Science Program co-Director

SCHEDULE

KEYNOTE SPEAKERS

RESEARCH TALKS

POSTER SESSION

PODS SHOWCASE

AI IN SCIENCE TALKS

## AI in Science Talks

<https://midas.umich.edu/midas-symposium-2022/>  
(<https://ai.engin.umich.edu/events/2022-ai-symposium/>)



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<https://www.science.org/doi/10.1126/sciadv.aaw0736>

**RESEARCH ARTICLE**[RESEARCH METHODS](#)

# Chimpanzee face recognition from videos in the wild using deep learning

[DANIEL SCHOFIELD](#)[, ARSHA NAGRANI](#)[, ANDREW ZISSERMAN](#)[, MISATO HAYASHI](#)[, \[...\], AND SUSANA CARVALHO](#)[+2 authors](#)[Authors Info &](#)[Affiliations](#)

**SCIENCE ADVANCES** • 4 Sep 2019 • Vol 5, Issue 9 • DOI: [10.1126/sciadv.aaw0736](https://doi.org/10.1126/sciadv.aaw0736)

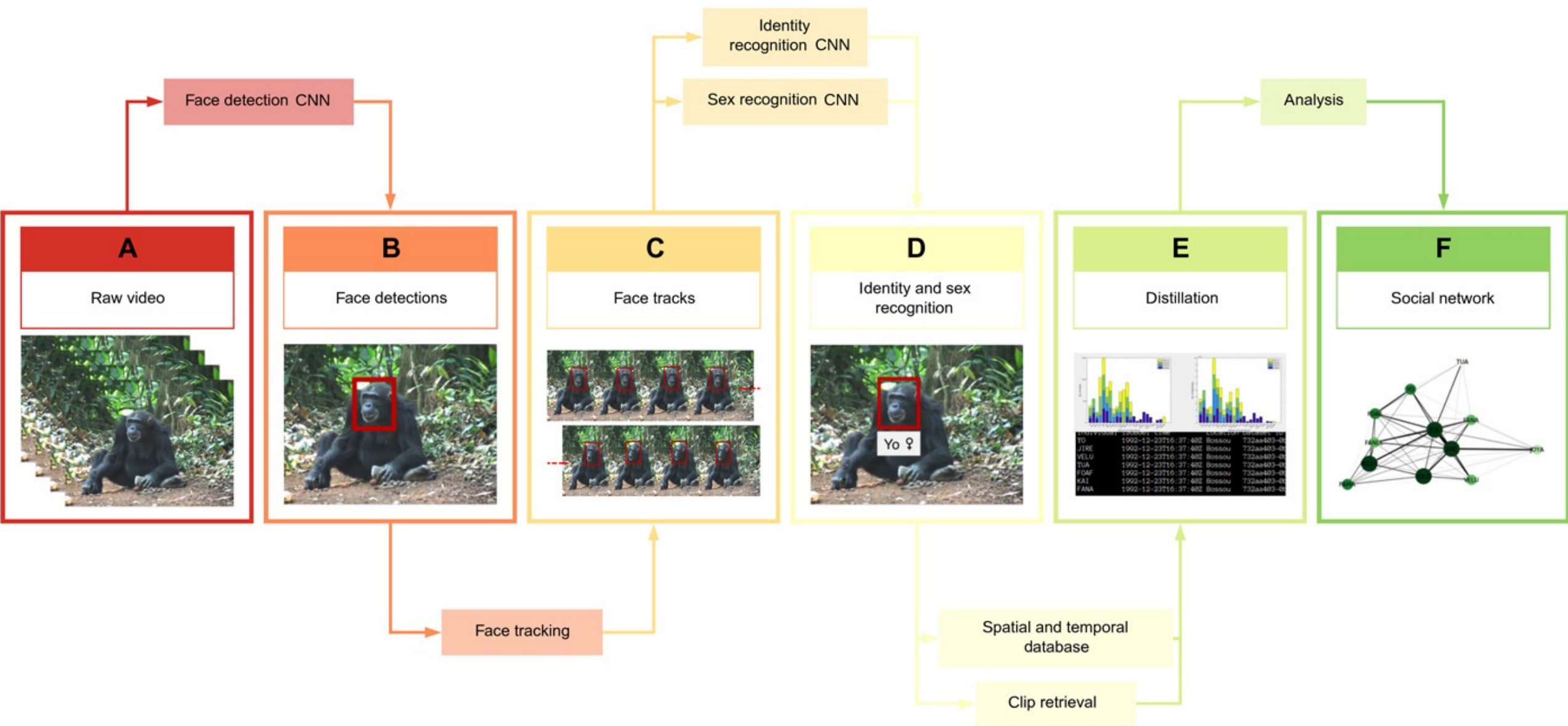
5,725 1



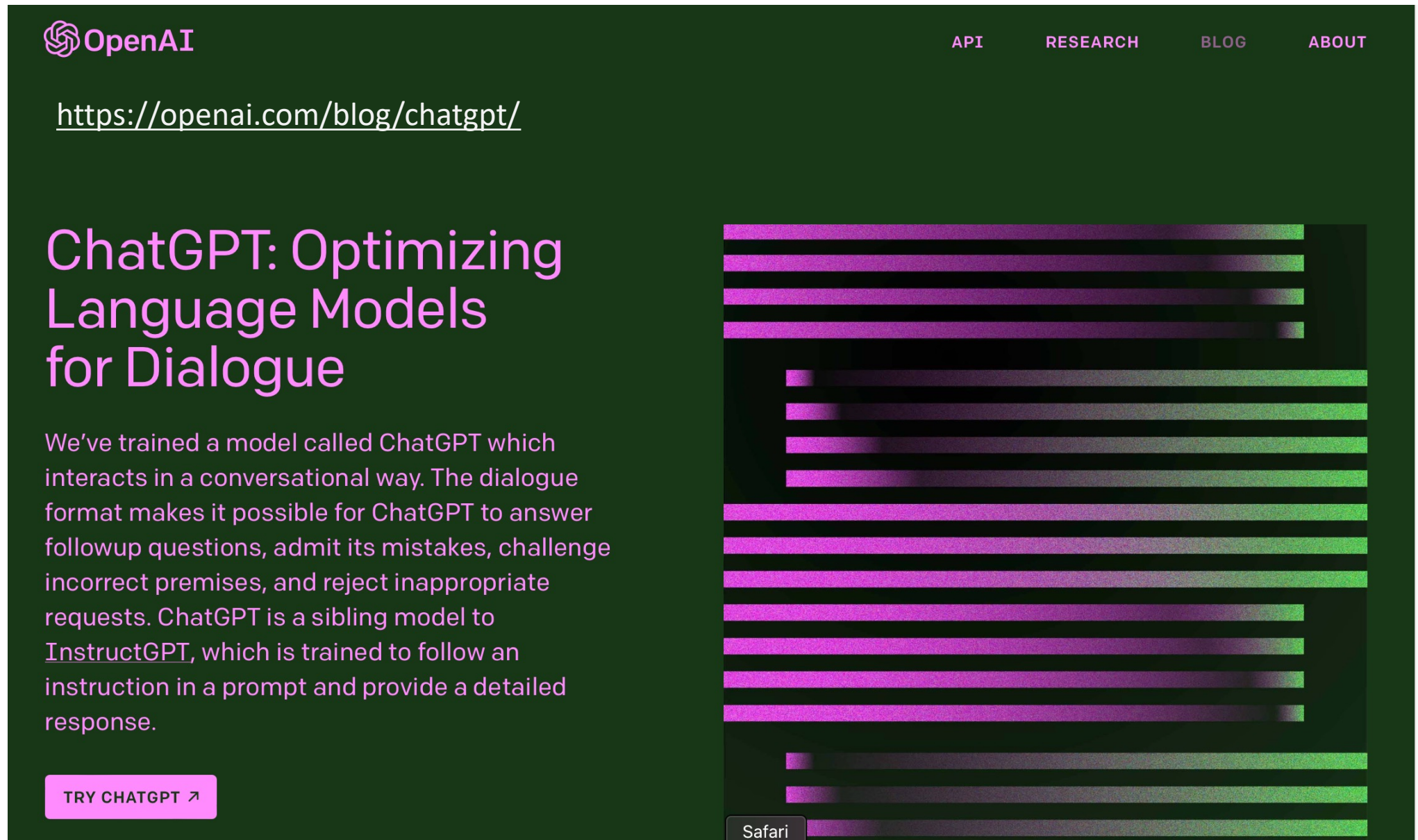
## Abstract

Video recording is now ubiquitous in the study of animal behavior, but its analysis on a large scale is prohibited by the time and resources needed to manually process large volumes of data. We present a





## 2. The Rise of Generative AI

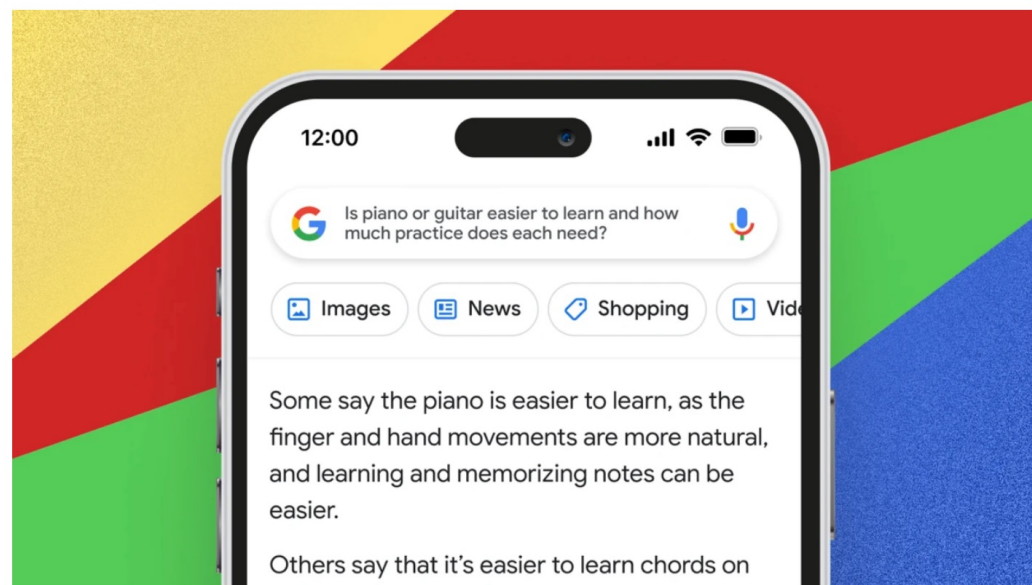




02-06-23

# Google announces new Bard chatbot to counter ChatGPT

Google's Sundar Pichai said its new chatbot will soon be released to a group of trusted testers outside the company.



[Image: courtesy of Google]



BY MARK SULLIVAN 3 MINUTE READ

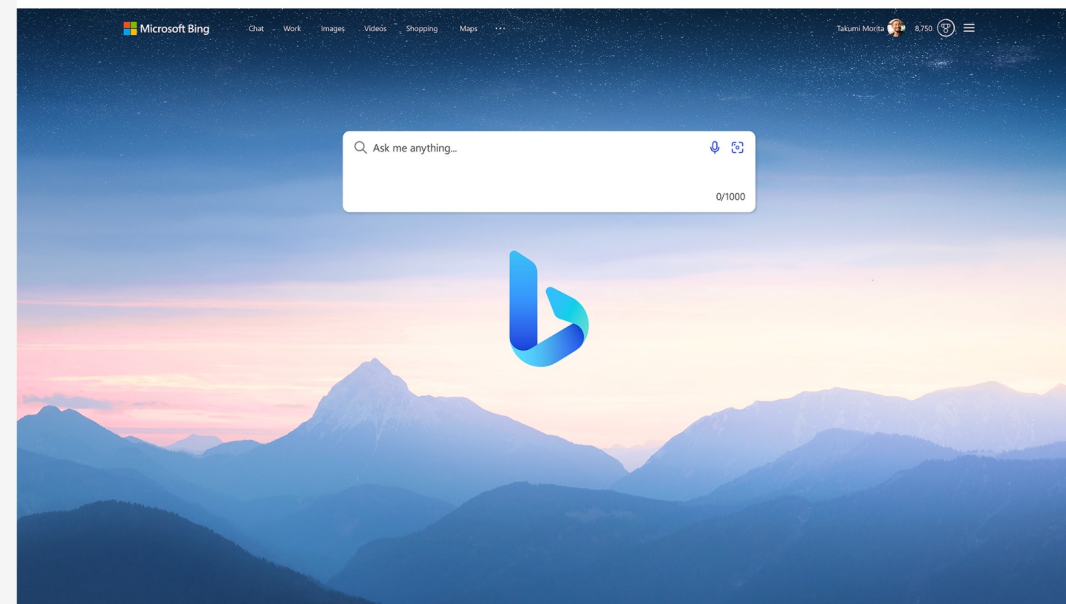


Google says it's moving quickly to roll out new generative AI

<https://www.fastcompany.com/90845691/google-announces-new-bard-chatbot-to-counter-chatgpt>

## Reinventing search with a new AI-powered Microsoft Bing and Edge, your copilot for the web

Feb 7, 2023 | Yusuf Mehdi, Corporate Vice President & Consumer Chief Marketing Officer



<https://blogs.microsoft.com/blog/2023/02/07/reinventing-search-with-a-new-ai-powered-microsoft-bing-and-edge-your-copilot-for-the-web/>

MICROSOFT / TECH / ARTIFICIAL INTELLIGENCE

## Microsoft limits Bing chat to five replies to stop the AI from getting real weird



Illustration: The Verge

/ Microsoft's new limits mean Bing chatbot users can only ask a maximum of five questions per session and 50 in total per day.

<https://www.theverge.com/2023/2/17/23604906/microsoft-bing-ai-chat-limits-conversations>

By TOM WARREN / @tomwarren

Feb 17, 2023, 6:27 PM EST | [11 Comments](#) / [11 New](#)



# What Is Generative AI?

- **Generative AI** refers to **ML(deep learning) algorithms that generate novel content in a variety of forms**—such as text, image, video, audio, computer code – instead of simply identifying, classifying, and predicting patterns in existing content.
- Thus-generated new content can be an answer to a reference question, a poem, a step-by-step how-to instruction , a computer code, an aisle-by-aisle shopping list, or a machine-generated artwork, just to name a few.
- Developing a generative AI model such as GPT-3 (= *Generative* Pretrained Transformer) is extremely resource-intensive. It requires a tremendous amount of data, computing power, energy, and money.

# Examples of Other Generative AI Products

- *ChatGPT, Bard, BING* [Text to Text; Chatbot]
- *DALL-E, Midjourney, Imagen* [Text to Image]
- *Make-A-Video* [Text to Video]
- MusicLM [Text to Music]
- GitHub CoPilot [Text to Code; Pair programming tool]








Quantum gravity is a theoretical framework that attempts to reconcile two of the most successful theories in modern physics, general relativity and quantum mechanics. General relativity describes the force of gravity as the curvature of spacetime, while quantum mechanics describes the behavior of particles at the subatomic level. However, when physicists try to apply these two theories to the same phenomenon, they get conflicting results that cannot be reconciled.

Quantum gravity attempts to solve this problem by developing a consistent theory of gravity that is compatible with quantum mechanics. One of the main challenges of quantum gravity is to describe the behavior of gravity at extremely small scales, where the effects of quantum mechanics become important.

String theory is one approach to quantum gravity. It suggests that the fundamental building blocks of the universe are not particles but tiny, one-dimensional strings that vibrate at different frequencies. These vibrations give rise to the different particles and forces in the universe. In string theory, gravity is not a force but rather the curvature of spacetime, similar to general relativity.

String theory also provides a consistent framework for unifying all four fundamental forces of nature: gravity, electromagnetism, the strong nuclear force, and the weak nuclear force. However, string theory remains a highly speculative and controversial area of research, and it has yet to be experimentally confirmed.

<https://makeavideo.studio>

80%


# Make-A-Video

Make-A-Video is a state-of-the-art AI system that generates videos from text.

[Read research paper](#)


## Make-A-Video


Make-A-Video research builds on the recent progress made in text-to-image generation technology built to enable text-to-video generation. The system uses





earing a Superhero outfit with red cape flying through the sky





Meta AI


 Hot

 New

 Oldest

 Top

AllGridsUpscales



`/imagine`6 months ago

a girl hunting with a dog in the woods



# MusicLM: Generating Music From Text

| paper | dataset |

Andrea Agostinelli, Timo I. Denk, Zalán Borsos, Jesse Engel, Mauro Verzetti, Antoine Caillon, Qingqing Huang, Aren Jansen, Adam Roberts, N Sharifi, Neil Zeghidour, Christian Frank  
Google Research

**Abstract** We introduce MusicLM, a model generating high-fidelity music from text descriptions such as *"a calming violin melody backed by a d* MusicLM casts the process of conditional music generation as a hierarchical sequence-to-sequence modeling task, and it generates music at 2 consistent over several minutes. Our experiments show that MusicLM outperforms previous systems both in audio quality and adherence to the Moreover, we demonstrate that MusicLM can be conditioned on both text and a melody in that it can transform whistled and hummed melodies

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```
ts sentiments.ts write_sql.go parse_expenses.py addresses.rb
1 #!/usr/bin/env ts-node
2
3 import { fetch } from "fetch-h2";
4
5 // Determine whether the sentiment of text is positive
6 // Use a web service
7 async function isPositive(text: string): Promise<boolean> {
8   const response = await fetch('http://text-processing.com/api/sentiment/', {
9     method: "POST",
10    body: `text=${text}`,
11    headers: {
12      "Content-Type": "application/x-www-form-urlencoded",
13    },
14  });
15  const json = await response.json();
16  return json.label === "pos";
17 }
```

Copilot

Replay

Trained on billions of lines of code, GitHub Copilot turns natural language prompts into coding suggestions across dozens of languages.

Explore docs >

## Audio Generation From Rich Captions

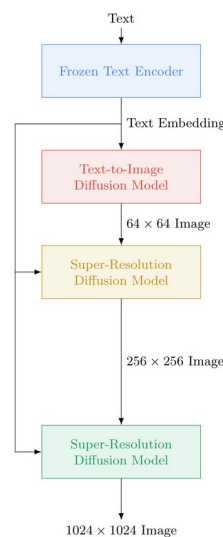
### Caption

### Generated audio

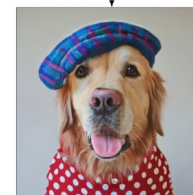
The main soundtrack of an arcade game. It is fast-paced and upbeat, with a catchy electric guitar riff. The music is repetitive and easy to remember, but with unexpected sounds, like cymbal crashes or drum rolls.



Imagen is an AI system that creates photorealistic images from input text



"A Golden Retriever dog wearing a blue checkered beret and red dotted turtleneck."



Visualization of Imagen. Imagen uses a large frozen T5-XXL encoder to encode the input text into embeddings. A conditional diffusion model maps the text embedding into a 64x64 image. Imagen further utilizes text-conditional super-resolution diffusion models to upsample the image 64x64→256x256 and 256x256→1024x1024.

Electronic dance  
worldly sound.  
being lost in  
be designed to  
d awe, while



arpeggio with a  
pads, sub bass  
ng is full of  
othing and  
may be playing  
gs for a buildup.



ns-led reggae  
tar. High-  
tones. Vocals  
feel, very



1 2 3

# 3. AI/ML Products for Researchers /Library Users

The New York Times

## *Here's What Happens When Your Lawyer Uses ChatGPT*

A lawyer representing a man who sued an airline relied on artificial intelligence to help prepare a court filing. It did not go well.

Give this article   1.1K



As an Avianca flight approached Kennedy International Airport in New York, a serving cart collision began a legal saga, prompting the question: Is artificial intelligence so smart? Nicolas Economou/NurPhoto, via Getty Images

www-chronicle-com.proxy.lib.umich.edu/article/im-a-student-you-have-...



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ALEX WILLIAMSON FOR THE CHRONICLE

**I'm a Student.  
You Have No  
Idea How Much  
We're Using  
ChatGPT.**

**No professor or software  
could ever pick up on it.**

THE REVIEW | OPINION

By *Owen Kichizo Terry* | MAY 12, 2023



**T**ook at any student academic-integrity policy, and you'll find the same message: Submit work that reflects your own thinking or face discipline. A year ago, this was

## RECENT POSTS

Update on Delivering the  
CORE Membership  
Programme

CORE-GPT: Combining Open  
Access research and AI for  
credible, trustworthy ques-  
tion answering

CORE welcomes 10 new  
members

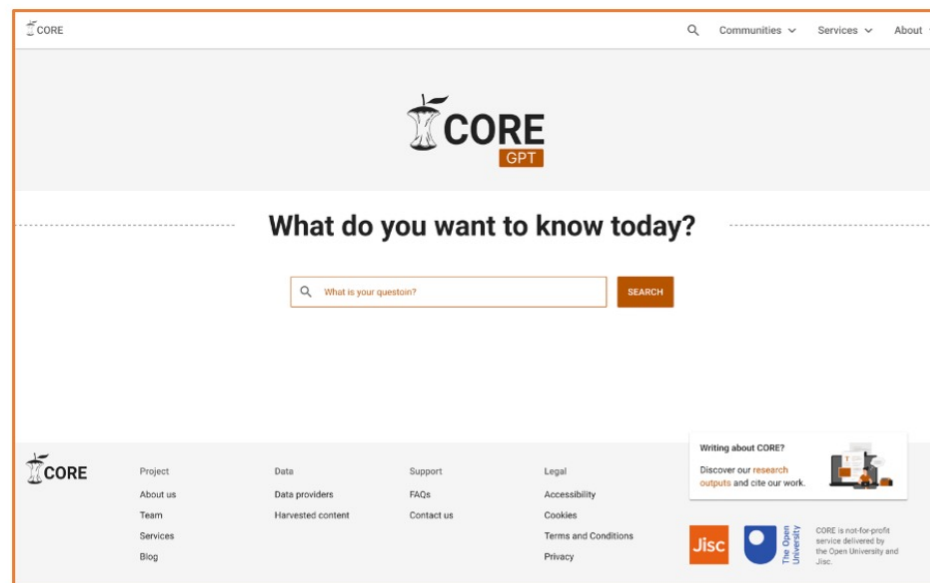
CORE to become an inde-  
pendent Open Access service  
from August 2023

CORE runner-up at Open  
University Research  
Excellence Awards 2022

<https://blog.core.ac.uk/2023/03/17/core-gpt-combining-open-access-research-and-ai-for-credible-trustworthy-question-answering/>

Search

# CORE-GPT: Combining Open Access research and AI for credible, trustworthy question answering

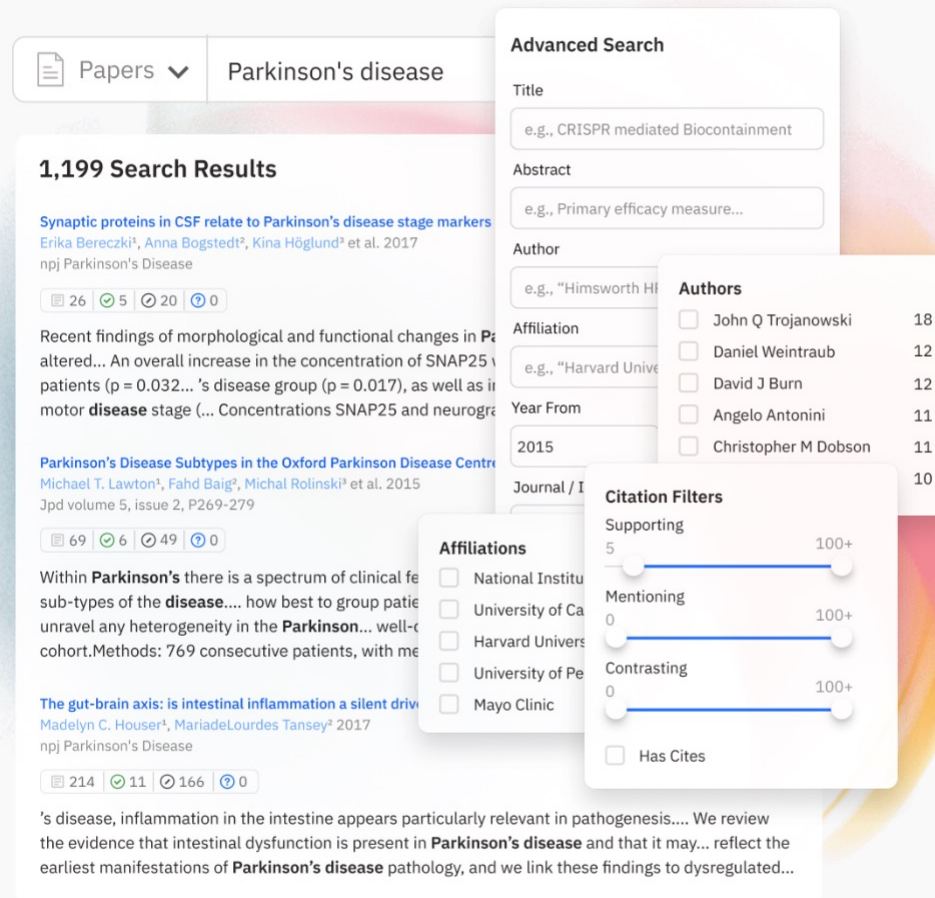


The public release of ChatGPT-3 in November last year captured the public's imagination and turned this technology into front



<https://scite.ai/>

# Find highly supported researchers in Parkinson's disease

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The screenshot displays the Scite.ai search interface. At the top, a search bar contains 'Parkinson's disease'. Below the search bar, the results are categorized into 'Papers' and 'Advanced Search'. The 'Papers' section shows 1,199 search results. The first result is 'Synaptic proteins in CSF relate to Parkinson's disease stage markers' by Erika Berezki<sup>1</sup>, Anna Bogstedt<sup>2</sup>, Kina Höglund<sup>3</sup> et al. 2017, published in npj Parkinson's Disease. It has 26 citations, 5 supporting, 20 mentioning, and 0 contrasting. The second result is 'Parkinson's Disease Subtypes in the Oxford Parkinson Disease Centre' by Michael T. Lawton<sup>1</sup>, Fahd Baig<sup>2</sup>, Michal Rolinski<sup>3</sup> et al. 2015, published in Jpd volume 5, issue 2, P269-279. It has 69 citations, 6 supporting, 49 mentioning, and 0 contrasting. The third result is 'The gut-brain axis: is intestinal inflammation a silent driver of Parkinson's disease?' by Madelyn C. Houser<sup>1</sup>, MariadeLourdes Tansey<sup>2</sup> 2017, published in npj Parkinson's Disease. It has 214 citations, 11 supporting, 166 mentioning, and 0 contrasting. The 'Advanced Search' panel on the right includes filters for Title, Abstract, Author, Affiliation, Year From, Journal / I, and Citation Filters. The 'Citation Filters' panel shows sliders for Supporting (5 to 100+), Mentioning (0 to 100+), and Contrasting (0 to 100+), with a checkbox for 'Has Cites'.

**1,199 Search Results**

**Synaptic proteins in CSF relate to Parkinson's disease stage markers**  
Erika Berezki<sup>1</sup>, Anna Bogstedt<sup>2</sup>, Kina Höglund<sup>3</sup> et al. 2017  
npj Parkinson's Disease

26 5 20 0

Recent findings of morphological and functional changes in P altered... An overall increase in the concentration of SNAP25 v patients (p = 0.032... 's disease group (p = 0.017), as well as in motor **disease** stage (... Concentrations SNAP25 and neurogra

**Parkinson's Disease Subtypes in the Oxford Parkinson Disease Centre**  
Michael T. Lawton<sup>1</sup>, Fahd Baig<sup>2</sup>, Michal Rolinski<sup>3</sup> et al. 2015  
Jpd volume 5, issue 2, P269-279

69 6 49 0

Within **Parkinson's** there is a spectrum of clinical fe sub-types of the **disease**.... how best to group patie unravel any heterogeneity in the **Parkinson**... well-c cohort.Methods: 769 consecutive patients, with me

**The gut-brain axis: is intestinal inflammation a silent driv**  
Madelyn C. Houser<sup>1</sup>, MariadeLourdes Tansey<sup>2</sup> 2017  
npj Parkinson's Disease

214 11 166 0

's disease, inflammation in the intestine appears particularly relevant in pathogenesis.... We review the evidence that intestinal dysfunction is present in **Parkinson's disease** and that it may... reflect the earliest manifestations of **Parkinson's disease** pathology, and we link these findings to dysregulated...

**Advanced Search**

Title  
e.g., CRISPR mediated Biocontainment

Abstract  
e.g., Primary efficacy measure...

Author  
e.g., "Himsworth H

Affiliation  
e.g., "Harvard Unive

Year From  
2015

Journal / I

**Authors**

Author	Citations
<input type="checkbox"/> John Q Trojanowski	18
<input type="checkbox"/> Daniel Weintraub	12
<input type="checkbox"/> David J Burn	12
<input type="checkbox"/> Angelo Antonini	11
<input type="checkbox"/> Christopher M Dobson	11
<input type="checkbox"/>	10

**Citation Filters**

Supporting  
5 100+

Mentioning  
0 100+

Contrasting  
0 100+

☐ Has Cites

**1.2b** citation statements extracted and analyzed  
**180m** articles, book chapters, preprints, and datasets

[See example publication report](#)

<https://consensus.app/search/>



Ask a question, get conclusions from research papers

Ask a research question

🔍

- Try Searching:
- does creatine help build muscle?
- what are benefits of mindfulness?
- do direct cash transfers reduce poverty?

## How to search?

Consensus uses AI to find answers in research papers. The best way to search is to ask a question.



### Ask about the relationship between concepts

- Does spanking impact childhood development?
- What predicts success as a startup founder?
- Does creatine improve cognition?



### Ask a simple yes/no question

- Can Zinc help treat depression?
- Does morning sunlight improve mood?
- Do home crowds impact referee bias?



### Ask about the effects of a concept

- What are the effects of gratitude practice?
- What are the mental health benefits of psychedelics?
- What are the effects of drug decriminalization?

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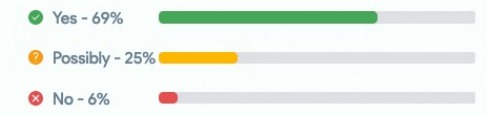
#### Summary ⓘ

Top 10 papers analyzed

These studies suggest that direct cash transfers are effective in reducing poverty, especially in rural areas and for poor children, but may require additional structural changes and developmental interventions for a more significant impact.

#### Consensus Meter ⓘ

16 papers analyzed



We find that direct cash transfers are well targeted and are especially effective in reducing extreme poverty in rural areas.

• Yes

The Incidence of Social Spending and Taxes in Peru  
Public Finance Review | M. Jaramillo et al. | 2014

Highly Cited ⓘ

Cite | Share

We find, in accordance with previous research, that direct taxes and cash transfers are overall progressive and reduce inequality and poverty.

• Yes

Revisiting the impact of direct taxes and transfers on poverty and inequality in South Africa  
WIDER Working Paper | Mashekwa Maboshe et al. | 2018

Cite | Share

It finds that, despite differences in design, cash transfer programmes targeting children in poor households are an effective way of reducing poverty.

• Yes

Reducing Child Poverty with Cash Transfers: A Sure Thing?  
Wiley-Blackwell: Development Policy Review | A. Barrientos et al. | 2006

Highly Cited ⓘ

Cite | Share



<https://elicit.org/>

## The AI Research Assistant

Elicit uses language models to help you automate research workflows, like parts of literature review.

Elicit can find relevant papers without perfect keyword match, summarize takeaways from the paper specific to your question, and extract key information from the papers.

While answering questions with research is the main focus of Elicit, there are also other research tasks that help with brainstorming, summarization, and text classification.

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Elicit

How effective is finasteride for reducing hair loss in women?

FAQTasksStarred

	Takeaway from abstract	PDF ↓	Year	Citations
of Finasteride 1.25 mg on Female Hair Loss; Pilot Study	Finasteride 1.25 mg/day for 28 weeks in female pattern hair loss patients shows some measurable efficacy but no objective clinical efficacy.	PDF	2012	10
the treatment of female pattern hair loss.	Sixty-two percent of patients showed some improvement of their hair loss with finasteride, 2.5 mg/d, while taking an oral contraceptive.	PDF	2006	81
effectiveness of finasteride and dutasteride 3 years in women with androgenetic	Finasteride 1.25 mg and dutasteride 0.15 mg given to women for 3 years effectively increased hair thickness and arrested further deterioration.	PDF	2014	35
the Treatment of Hair Loss in Women	Finasteride may be considered for treatment of female pattern hair loss in patients who fail topical minoxidil treatment.	-	2010	32
the and Its Potential for the Treatment of Pattern Hair Loss: Evidence to Date	Oral finasteride is potentially an alternative treatment to topical minoxidil for female pattern hair loss.	PDF	2020	19
efficacy of oral administration of at a dose of 2.5 mg/day in women with female pattern hair loss	Finasteride at a dose of 2.5 mg/day is effective for female pattern hair loss in women.	-	2018	17

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Paper titleTakeaway from abstract ×PDF ×Year ×Citations ×+ Add Column

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**Librari is an AI-powered reference app that assists students and library patrons with a wide range of research and creative pursuits.**

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WHAT CAN LIBRARI DO?

<https://librari.com/#about>

# To Wrap Up,

- While generative AI products have achieved some remarkable feats in their performance so far, they are yet hardly mature.
- Nevertheless, the overwhelming amount of interest in these tools suggest that these tools and products will be rather quickly adopted and utilized for a wide variety of scholarly and research activities.
- I think we will get to soon discover more about
  - (i) for which tasks these generative AI tools are better suited;
  - (ii) at which tasks we humans perform better.

# Thank you!

Bohyun Kim

Associate University Librarian for Library Information Technology,  
University of Michigan Library, USA.

Twitter: @bohyunkim | Web: <http://www.bohyunkim.net/blog/>

*INCONECSS Community Meeting No. 6. Artificial Intelligence: Impact on services, Online(/Europe). June 12, 2023*