

Effectiveness of Generative Artificial Intelligence for Scientific Content Analysis



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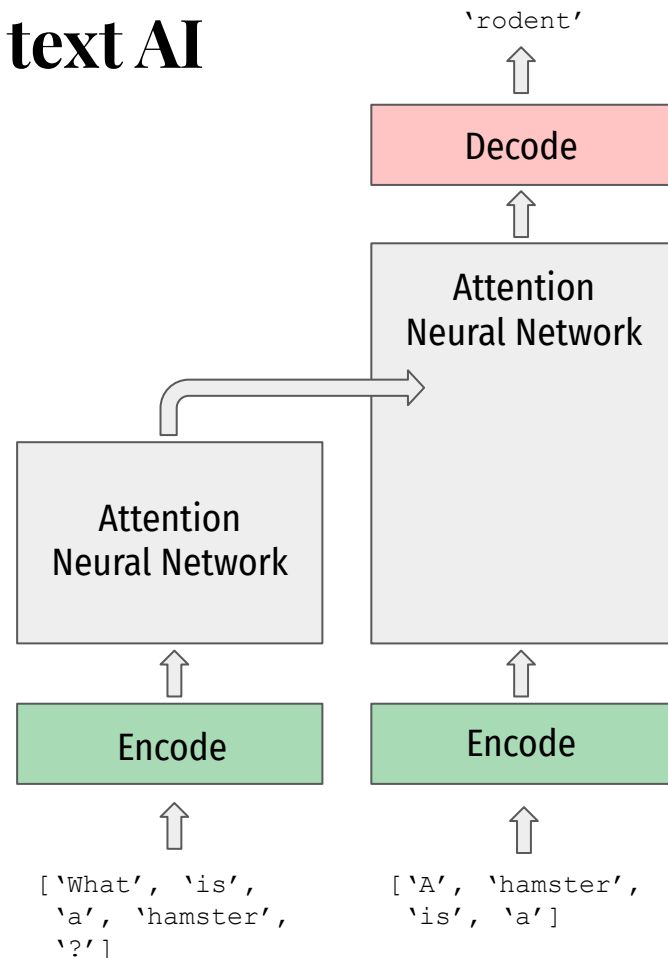
Generative AI

- LLMs are particularly large artificial neural networks
- ANNs have historical precedence going back to studies conducted in the 1940s
- Later commercial LLMs have intuitive chat interfaces through which the models could be prompted (an idea that goes back to the 1960s)

Technical Background: Generative text AI

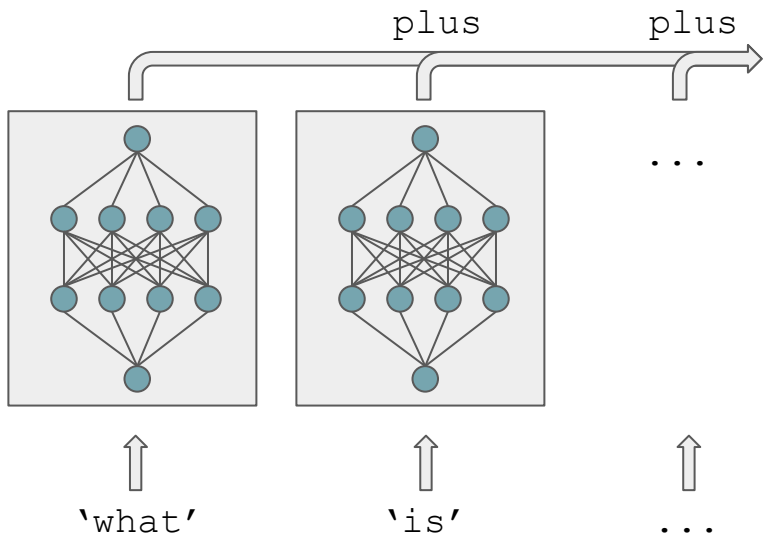
- Large transformer neural network
- Prompt → Response
- E.g.: ChatGPT, Llama 2, text-bison via Google Vertex AI

```
model = TextGenerationModel.  
  
from_pretrained("text-bison@001")  
response = model.predict("What is  
a  
hamster?")
```



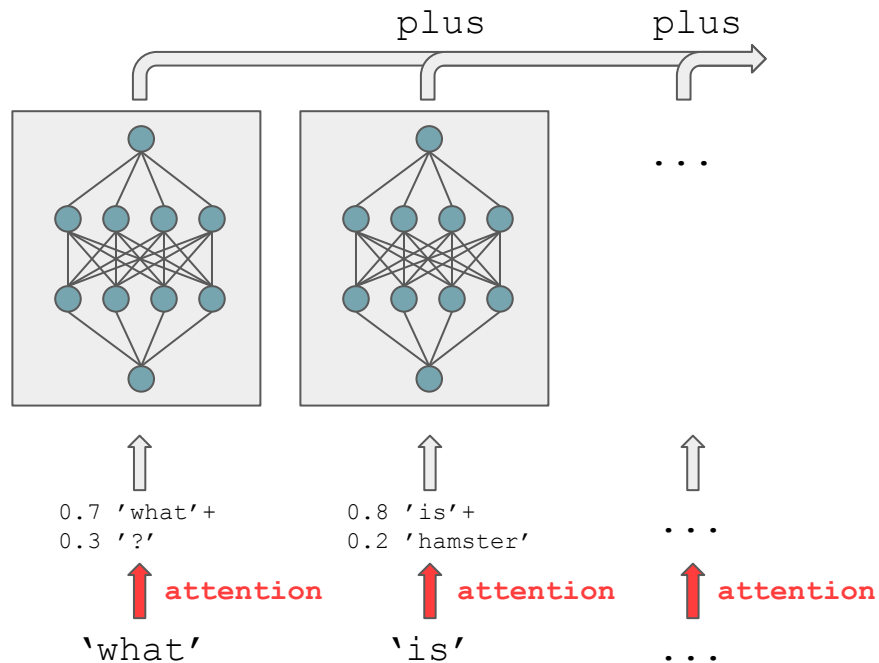
Attention is all you need?

Fully connected neural network



Word position: does not matter

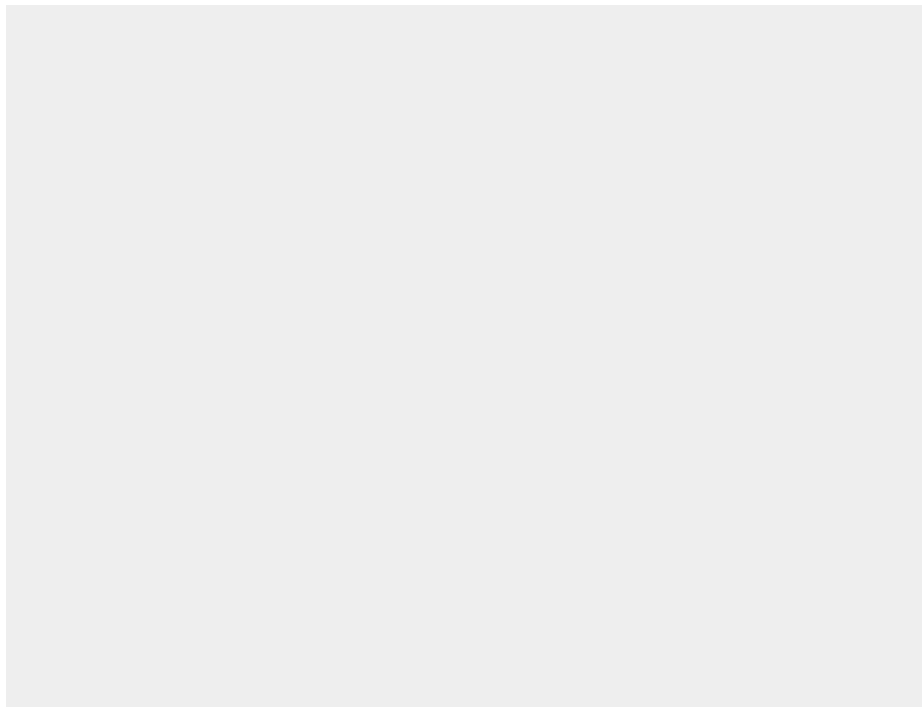
Neural network with self-attention



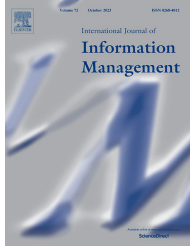
Transformer=many self-attention layers

Model Size Development

- LLMs' size-performance: a complex relationship
- More parameters capture more intricate patterns
- Larger LLMs improve performance generally
- Diminishing returns as size increases



A Case Study from the ICT Literature



M. Al-Emran, V. Mezhyuev, A. Kamaludin, and K. Shaalan, **'The impact of knowledge management processes on information systems: A systematic review'**, International Journal of Information Management, vol. 43. Elsevier, pp. 173–187, Dec. 2018.

- A systematic review for knowledge management process studies
- Capture: country/research method/participant type
- N≈35

Table 5 (continued)

Source	Study Purpose and KM Processes	Information System Type	Methods	Country	Participants	Database	Findings
Maditinos et al. (2011)	The effect of 'knowledge transfer' on the ERP system implementation.	ERP system	Survey	Greek	IT managers	Emerald	Results indicated that ERP system implementation is positively affected by knowledge transfer.
Shao et al. (2012)	The influence of 'ERP knowledge sharing' on ERP success.			China	IS executives + ERP end users	ScienceDirect	Results revealed that ERP success is significantly influenced by ERP knowledge sharing.
Hsu and Lin (2008)	The influence of 'knowledge sharing factors' on the attitude towards utilizing blogs.	Blog		Taiwan	Blog users	ScienceDirect	Results indicated that knowledge sharing factors positively affect the attitude towards using blogs.
Iglesias-Franco et al. (2015)	The effect of the 'attitude towards collaborative knowledge sharing' on the intention to use corporate wikis.	Wiki		Spain	IS Employees	ScienceDirect	Results showed that the attitude towards collaborative knowledge sharing significantly affects the intention to use corporate wikis.
Hew and Kadir (2016)	The influence of the 'attitude toward knowledge sharing' on the VLE behavioral intention.	Cloud-based Virtual Learning Environment (VLE)		Malaysia	Primary and Secondary School Teachers	ScienceDirect	Results showed that the VLE behavioral intention is significantly affected by the attitude toward knowledge sharing.
Koh and Kim (2004)	The influence of 'knowledge sharing activity' on the community participation and community promotion.	Virtual Communities and e-business	Interviews + Survey	Korea	Members from 691 virtual communities	ScienceDirect	Results indicated that knowledge sharing activity positively influences the community participation and community promotion.
Cepgari-Navarro et al. (2014)	The effect of 'technology knowledge' on citizen engagement.	E-government Services	Survey	Spain	Citizens	ScienceDirect	Results revealed that citizen engagement is positively influenced by technology knowledge.
Park et al. (2013)	The effect of 'knowledge sharing' on performance.			Mongolia	Government Employees	Sage	Results indicated that knowledge sharing is a strong factor that affects the employees' performance.
Arpaci (2017)	The impact of 'knowledge creation & discovery', 'knowledge storage', 'knowledge sharing', and 'knowledge application' on perceived usefulness which in turn affect the attitude toward cloud computing services.	Cloud Computing		Turkey	Undergraduate students	ScienceDirect	Results indicated that knowledge creation & discovery, knowledge storage, and knowledge sharing have a positive impact on perceived usefulness which in turn affects the attitude toward cloud computing services. However, knowledge application doesn't support the relationship.
Alenabi et al. (2013)	The effect of the 'attitude toward knowledge share technology' on the behavioral intention to share knowledge technology.	Web Technologies	Interviews + Survey	Not Specified	Academics	ACM Digital Library	Not Specified.
Soto-Acosta et al. (2017)	The influence of 'social web knowledge sharing' on the innovation performance.	Social web knowledge sharing	Interviews + Survey	Spain	CEOs	Springer	Results showed that social web knowledge sharing significantly affects the innovation performance.
Chuang and Vogel (2013)	The impact of 'knowledge sharing' on perceived usefulness, attitude, behavioral intention, and system usage.	Google Applications	Survey	China	University Students	ScienceDirect	Results indicated that knowledge sharing has a positive effect on perceived usefulness, attitude, behavioral intention, and system usage.
Kim (2012)	The impact of 'knowledge sharing' on perceived usefulness and perceived ease of use which are both, in turn, affect the intention to use social software.	Social Software		Korea	Employees in government agencies	Emerald	Results indicated that knowledge sharing positively affects the perceived usefulness and perceived ease of use.
Lee et al. (2016)	The influence of 'Software Process Improvement (SPI) knowledge sharing' on the SPI success.	Software Process Improvement		Taiwan	Managers and Practitioners	ScienceDirect	Results revealed that SPI success is significantly affected by the SPI knowledge sharing.
Garrido-Moreno et al. (2014)	The influence of 'knowledge management processes (acquisition, sharing, and utilization)' on CRM success.	Customer Relationship Management (CRM)	Interviews + Survey	Spain + UK	General Managers	ScienceDirect	Results showed that CRM success is positively influenced by KM processes (acquisition, sharing, and utilization).

Detection of Study Country

RQ4:

How are the KM processes studies considering information systems are distributed across the countries of implementation and the years of publication?

Prompt:

Given this text on a research study related to knowledge management, identify and extract the country of implementation where the study was conducted. Prioritize accuracy and avoid making assumptions not present in the text. Answer with the country name only.

Detection of the Research Method

RQ2:

What are the main research methods and research outcomes addressed in the collected studies?

Prompt:

Carefully analyze the scientific text provided. Determine and classify if the research study described in the text uses: only a survey method, both a survey and interview methods, or neither of the methods.

Detection of Participant Type

RQ1:

What are the main KM processes studied considering their relationship with information systems?

Prompt:

Analyze the text provided about a knowledge management research study. Identify the role and corporate level of the participants. Respond in one word.

Results

I. Named entity extraction: study country

prompt = article_text + "Identify and extract the country of implementation where the study was conducted. Answer with the country name only."

Accept synonyms, e.g. "U.S." ≈ "USA"

II. Classification: research method

III. Information extraction: who are the participants?

Small scope for interpretation, e.g. "Firms' top management" ≈ "top management"

	n	Accuracy	Majority
I	30	90%	20%
II	35	80%	70%
III	32	68.75%	37.5%

Ethical Challenges

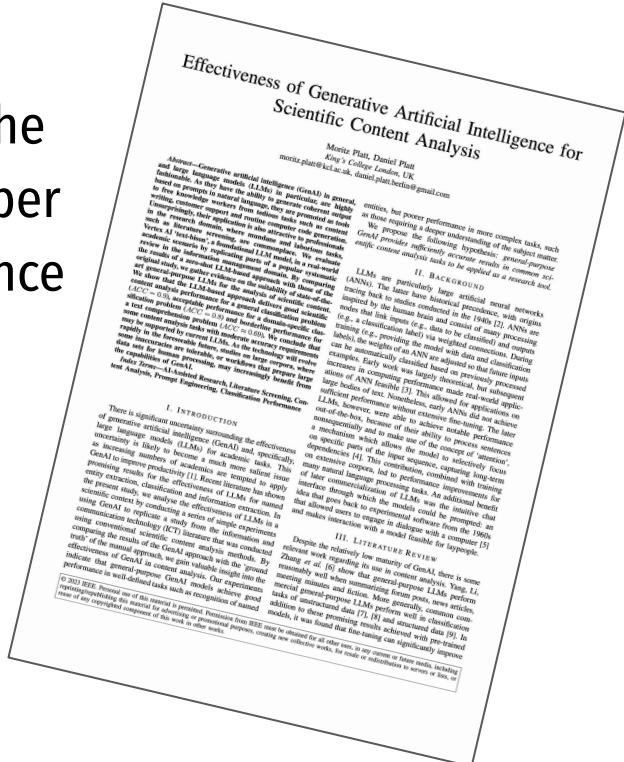
- You can't put toothpaste back into the tube: GenAI is here to stay and academics will use it
- Firm rules need to be established around disclosure of GenAI use to account for accuracy challenges
- GenAI has great potential to ease mundane tasks

Outlook

- Model accuracy might improve—still achieving the quality of a human subject matter expert seems far off
- When compared to conventional information retrieval techniques, GenAI is computationally expensive—optimisations and advances in hardware design might lower cost
- General purpose models for specific domains may be developed—initiatives similar to Meta’s ‘Galactica’ for scientific use may emerge
- Training models with private data (e.g. university text repository, arXiv preprints, etc.) may yield better results at lower costs
- Explainability is key for use in science

Summary? Let's ask GenAI!

Me:
Summarize the following paper in one sentence as a concise take-home message:



Bard:
Generative artificial intelligence (GenAI) has the potential to reduce workloads in academia by automating tasks such as literature review and screening, but should be used responsibly.

<https://g.co/bard/share/4bf8585d3d25>



Thank You!

