Research Activities in Generative AI, Large Language Models, ChatGPT, and Conversational AI at the University of Nottingham

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Generative artificial intelligence refers to AI models that are designed to produce new data instances that resemble their training data [1]. These models identify patterns within extensive datasets and subsequently generate novel content such as text, images, and audio [1]. Large language models (LLMs) represent a specific category of generative AI, focusing on the generation and comprehension of human language [1]. These models utilise prompts to generate text-based outputs [3]. ChatGPT stands out as a prominent example of a text-based generative AI tool, powered by an underlying large language model [1]. Conversational AI encompasses AI systems engineered to simulate human-like dialogue, frequently leveraging the capabilities of LLMs [4]. This report outlines the research activities and contributions of the University of Nottingham in these rapidly advancing domains.

Generative AI Research Activities

The advent of generative AI technologies, including ChatGPT and Midjourney, has spurred extensive discussions within artistic and creative sectors [1]. A British Academy discussion paper highlights concerns regarding AI models being trained on artists' work without authorisation, alongside anxieties about potential job losses for creative professionals [1]. This paper defines generative AI as models that synthesise new text, visual, and audio content, achieved through deep learning on pre-existing datasets [1]. The ethical and practical considerations surrounding generative AI in these industries form a significant area of debate and likely influence academic research directions.

A PhD studentship at the George Green Institute for Electromagnetics Research within the Faculty of Engineering is dedicated to developing energy-efficient and high-speed solutions for generative AI applications using neuromorphic photonics [6]. This research addresses the challenge of processing the nonlinear and probabilistic operations demanded by generative AI tasks, which pose difficulties for traditional digital computing systems [6]. The project aims to create a photonic reservoir computing system on a silicon chip, utilising chaotic nonlinear dynamics for computations [6]. While the specific researcher is not named in the provided material, this project signifies the University of Nottingham's exploration of innovative hardware to enhance generative AI efficiency.

Research in the Faculty of Engineering involves a PhD project focused on employing AI diffusion models for generative design within additive manufacturing [7]. This project, supervised by Prof Ricky Wildman, Dr Mirco Magnini, and Prof Ender Ozcan, aims to generate designs for complex structures with optimal or novel functionalities, thereby overcoming traditional manufacturing limitations [7]. The approach involves using recent advancements in generative design to identify designs that meet user requirements, with the design being provided through numerical and computational models validated by experiments [7]. This work demonstrates the application of generative AI in engineering design for creating intricate objects through additive manufacturing. While led by Nottingham Trent University, a collaborative research project involving Chelsea College of Arts and Liberty investigates the integration of Artificial Intelligence into art and design

education [9]. This project explores how AI tools can assist and influence the design process, examining the capabilities and limitations of AI within a designer's toolkit [9]. It also addresses ethical concerns, copyright, and the impact on the creative process [9]. Although the lead institution is Nottingham Trent University, this partnership indicates related research interests within the broader academic community in Nottingham concerning the impact of generative AI on creative disciplines.

Researchers in the Faculty of Engineering have developed an AI model to accurately predict the amount of solar energy that can be generated in different climates [10]. This research utilises very-short-term solar energy forecasting based on ground-based fisheye images to predict rapid changes in solar irradiance [10]. The model, initially trained in California's sunny climate, has shown effectiveness in predicting solar output in Nottingham, known for its humid and rainy conditions [10]. This application of AI, potentially involving generative aspects for data augmentation or model creation, highlights its utility in the renewable energy sector.

Large Language Model Research Activities

A significant area of research explores the convergence of large language models (LLMs) and DNA, drawing parallels between DNA as a sequential coded language and human language [2]. This interdisciplinary field involves the development of "genomic language models" capable of "learning to speak DNA" [2]. These models analyse large datasets of DNA sequences to understand the 'language of proteins' and predict biological configurations, similar to how LLMs predict the next word in a sentence [12]. This innovative approach could lead to significant advancements in understanding and manipulating biological systems.

Hongye An, A Narechania, E Wall, and K Xu have published research titled "VITALITY 2: Reviewing Academic Literature Using Large Language Models" [13]. This work demonstrates an investigation into the potential of LLMs to assist in academic tasks, specifically the process of reviewing scholarly literature [13]. This research explores how these advanced language models can be leveraged to streamline and enhance the efficiency of literature reviews, a critical component of academic research.

A scoping review titled "Large Language Models (LLMs) for Legal Advice" has been conducted by J Krook, E Schneiders, T Seabrooke, Natalie Leesakul, and J Clos [14]. This research examines the potential and implications of employing LLMs within the legal domain [14]. The review likely explores the capabilities of LLMs in tasks such as legal information retrieval, document analysis, and the generation of legal advice, while also considering the associated challenges and ethical considerations.

Further research by T Seabrooke, E Schneiders, L Dowthwaite, J Krook, Natalie Leesakul, and J Clos investigates lay people's willingness to utilise Large Language Models (LLMs) for generating legal advice [14]. This study delves into public perception and the potential adoption of AI-powered tools for professional tasks, specifically in the context of legal services [14]. The findings of this research could provide valuable insights into the future role of LLMs in democratising access to legal information and assistance.

E Schneiders, T Seabrooke, J Krook, R Hyde, Natalie Leesakul, and J Clos have found that while lay people can differentiate between legal advice provided by Large Language Models (LLMs) and human lawyers, they might still favour advice from an LLM [14]. This finding reveals significant

aspects of public trust and perception concerning AI-generated professional advice [14]. It suggests that factors beyond mere accuracy, such as accessibility or perceived impartiality, could influence individuals' preferences for AI-driven guidance.

A PhD project supervised by Dr Walter van Heuven, Dr Matias Ison, and Dr Ruediger Thul explores bilingual language processing by using advanced large language models to enhance decoding accuracy [7]. This research aims to understand how the brain represents and processes multiple languages by decoding neural activity obtained through EEG [7]. The project leverages the capabilities of LLMs to improve the accuracy of this decoding process, contributing to the field of cognitive neuroscience [7].

Peer-Olaf Siebers is conducting research at the intersection of Large Language Models (LLMs) and Agent-Based Modelling and Simulation (ABMS) [16]. This work investigates how LLMs can be used across the entire simulation study lifecycle, potentially improving the design and analysis of agent-based models [16]. By integrating the natural language understanding and generation capabilities of LLMs with the simulation power of ABMS, this research aims to simplify and automate aspects of creating complex social and ecological models.

ChatGPT Research Activities

Research by Dan Heaton, E Nichele, Jeremie Clos, and JE Fischer has analysed Twitter discourses following the release of ChatGPT, focusing on themes of agency, trust, and blame [18]. This work examines the immediate societal responses and perceptions surrounding a highly prominent generative AI tool [18]. The analysis of social media data provides insights into public sentiment, concerns, and expectations regarding advanced AI technologies like ChatGPT.

Further analysis by Dan Heaton, Jeremie Clos, E Nichele, and JE Fischer has specifically examined the topics, sentiment, and emotions expressed on Twitter in relation to ChatGPT [18]. This research provides a more granular understanding of the specific aspects of public discourse surrounding ChatGPT, identifying key themes and the emotional tone of the conversation [18]. Such analysis is crucial for understanding the broader societal impact and implications of this technology.

As part of their research, Dan Heaton, E Nichele, Jeremie Clos, and JE Fischer have also created "ChatGPT Concordances" [18]. This suggests the development of a tool or resource designed to analyse the language patterns and usage characteristics of ChatGPT [18]. Concordances can be valuable for researchers seeking to understand how ChatGPT generates text and the linguistic features of its output.

The University of Nottingham is involved in the UKRI-funded Responsible AI UK (RAI UK) project, which addresses topics including Generative AI in teaching and learning [20]. Dr Alan Chamberlain, Professor Elvira Perez Vallejos, and Dr Virginia Portillo are among the researchers involved [20]. This project aims to ensure the safe and responsible use of AI, including generative AI tools like ChatGPT, within educational contexts [20]. This involvement highlights the university's commitment to addressing the ethical and practical implications of AI in education.

The University of Nottingham has developed resources and guidance for students on the responsible use of AI, including ChatGPT [3]. This includes a dedicated Artificial Intelligence SharePoint site and learning materials created by the Libraries' Learning Development team [22].

These initiatives aim to educate students on the appropriate and ethical use of AI tools in their studies, acknowledging the increasing prevalence of such technologies [3].

ChatGPT has become a significant topic of discussion within the University of Nottingham, as evidenced by various articles and expert opinions [4]. Academics have provided insights into the origins, capabilities, and potential implications of ChatGPT, highlighting its impact across different disciplines [23]. This internal discourse reflects the pervasive influence of ChatGPT and its relevance to the academic community.

Conversational AI Research Activities

A PhD project at Nottingham Trent University, with potential connections to the University of Nottingham's AI research, focuses on creating an AI discussion partner for contemporary art gallery visitors with sight loss [25]. This project, supervised by Kevin Hunt, Lars Erik Holmquist, Rebekah Pickering Wood, and Kayode Owa, explores the feasibility of using AI as a conversational assistant to support the interpretation of contemporary art [25]. It aims to develop an AI model using generative AI layered onto an expert system to stimulate insights through discussion based on reliable facts, empowering users with sight loss to form personal interpretations [25].

The University of Nottingham is a partner in the Responsible Innovation Advantage in Knowledge Exchange (RAKE) project, alongside the University of Oxford and the University of Warwick [20]. This project, involving researchers such as Dr Alan Chamberlain, Professor Elvira Perez Vallejos, and Dr Virginia Portillo from the University of Nottingham, focuses on embedding Responsible Innovation (RI) practices in AI development and deployment [20]. A key component of the project involves delivering RI training sessions to various stakeholders, including businesses and research teams [20]. This initiative demonstrates the university's commitment to the ethical advancement of AI, including conversational agents.

The University of Nottingham hosts the CHAIR (Connecting Human/AI Interaction Researchers) workshop, a research cluster that connects researchers working on various aspects of Human/AI Interaction, including conversational AI [26]. Funded by the Faculty of Arts Collaborative Research and KE Seed Corn Award, this initiative aims to foster knowledge exchange and promote interdisciplinary research in this area [26]. The workshops provide a platform for researchers from different disciplines to collaborate and share insights on the design, development, and impact of human-AI interactions.

Researchers at the University of Nottingham have engaged in conversations with various AI platforms, such as Claude and NotebookLM [4]. These experiences, while perhaps informal, provide valuable insights into the current capabilities and limitations of conversational AI technologies [4]. By interacting directly with these platforms, researchers can gain a better understanding of their strengths and weaknesses, informing future research directions in this field.

Early explorations involved chatting with AI chatbots to understand their ability to comprehend and generate metaphors [5]. These interactions provided initial insights into the linguistic capabilities of these early forms of conversational AI [5]. By prompting chatbots with questions about metaphor creation and analysis, researchers could assess the extent to which these systems could understand and manipulate abstract linguistic concepts.

AI Research Groups and Key Personnel

Several research groups within the University of Nottingham are actively engaged in research relevant to generative AI, large language models, ChatGPT, and conversational AI. These groups span multiple schools and departments, reflecting the interdisciplinary nature of this field [27].

The **Intelligent Modelling and Analysis (IMA) Group**, based in the School of Computer Science, focuses on end-to-end data modelling and analysis, employing techniques such as AI-based data mining, machine learning, and computational modelling [28]. This interdisciplinary group includes researchers from computer science, biomedical sciences, operational research, mathematics, statistics, and complexity science [28]. Key personnel in this group include Dr Jamie Twycross (Group Leader), Dr Xin Chen, Dr Peer-Olaf Siebers, and Dr Chao Chen [28]. Notably, Dr Peer-Olaf Siebers' current research explores the role of Generative AI (Large Language Models) in advancing agent-based model design [17].

The Visualization, Text Analytics, and Graphics Group (VisTAG), also within the School of Computer Science, conducts internationally leading research in text analytics, natural language processing, and human-AI teaming [27]. This group focuses on generating meaningful insights from large collections of data through visualisation, text analytics, and computer graphics [32]. Their expertise in natural language processing directly aligns with the research areas of LLMs, ChatGPT, and conversational AI.

The **Mixed Reality Lab**, part of the School of Computer Science, is involved in the RAKE project on responsible AI [20]. Key researchers associated with this lab and their work in Human-Computer Interaction related to AI include JE Fischer and Gisela Reyes Cruz [34]. Their research takes a human-centred view on AI-infused technologies to understand and support human activities and reasoning.

At the University of Nottingham Malaysia Campus, the **Artificial Intelligence (AI) and Advanced Data Analysis Group** focuses on AI, machine learning, computer vision, and human-computer interaction [36]. Professor (Assistant) Tissa Chandesa, with research interests in Generative AI, is a key member of this group [37]. This indicates that significant research in these areas is also conducted at the university's international campuses.

The **AIOP Research Group** at the University of Nottingham Ningbo China conducts multi-disciplinary research in AI and optimisation, including natural language processing [39]. Professor Guoping Qiu, an internationally recognised expert in AI and image processing, leads a research team within this group exploring new applications of AI [40]. This further demonstrates the global reach of the university's AI research activities.

Other relevant researchers identified through their publications and project involvement include Dr Walter van Heuven, Dr Matias Ison, and Dr Ruediger Thul from the School of Psychology and School of Mathematical Sciences, who are collaborating on research involving large language models in bilingual language processing [7]. Additionally, Hongye An and Natalie Leesakul are involved in research concerning large language models for academic literature review and legal

advice, respectively [13]. Jeremie Clos and Ricky Wildman are also conducting research related to ChatGPT and generative AI in additive manufacturing [7].

Table 1: Key Research Groups in Generative AI and Related Fields at the University of Nottingham

Research Group Name	School/Department	Brief Description of Research Focus	Example Key Researchers
Intelligent Modelling and Analysis (IMA) Group	School of Computer Science	End-to-end data modelling and analysis using AI-based data mining, machine learning, and computational modelling.	Dr Jamie Twycross, Dr Xin Chen, Dr Peer-Olaf Siebers, Dr Chao Chen
The Visualization, Text Analytics, and Graphics Group (VisTAG)	School of Computer Science	Text analytics, natural language processing, computer graphics, and human-AI teaming.	
Mixed Reality Lab	School of Computer Science	Human-Computer Interaction research with a focus on AI-infused technologies.	JE Fischer, Gisela Reyes Cruz
Artificial Intelligence (AI) and Advanced Data Analysis Group	University of Nottingham Malaysia	AI, machine learning, computer vision, and human-computer interaction.	Professor (Assistant) Tissa Chandesa
AIOP Research Group	University of Nottingham Ningbo China	Multi-disciplinary research in AI and optimisation, including natural language processing.	Professor Guoping Qiu

Table 2: Selected Research Projects in Generative AI, LLMs, ChatGPT, and Conversational AI at the University of Nottingham

Project Title	Brief Description	Relevant AI Field	Lead Researcher(s)	Funding Source (if available)	Publication/Link (if available)
Neuromorphic Photonic Processor for Scalable Generative AI Applications	Developing energy-efficient and high-speed solutions for generative AI using neuromorphic photonics.	Generative AI			[6]
AI for additive manufacture of complex flow devices	Utilising AI diffusion models for generative design in additive manufacturing to create designs with optimal functionality.	Generative AI	Prof Ricky Wildman, Dr Mirco Magnini, Prof Ender Ozcan		[7]
VITALITY 2: Reviewing Academic Literature Using Large Language Models	Exploring the use of LLMs for academic literature review.	Large Language Models	Hongye An, A Narechania, E Wall, K Xu		[13]
Large Language Models (LLMs) for Legal Advice: A Scoping Review	Examining the potential and implications of using LLMs in the legal domain.	Large Language Models	J Krook, E Schneiders, T Seabrooke, Natalie Leesakul, J Clos		[14]
AI-based decoding of evoked neural activity to study bilingual language processing	Using advanced large language models to improve decoding accuracy in studying how the brain processes multiple languages.	Large Language Models	Dr Walter van Heuven, Dr Matias Ison, Dr Ruediger Thul		[7]
Analysis of Twitter Discourses on ChatGPT	Analysing public sentiment, trust, and blame related to ChatGPT on Twitter.	ChatGPT	Dan Heaton, E Nichele, Jeremie Clos, JE Fischer		[18]
Responsible AI UK (RAI UK) Project on Generative AI in Teaching and Learning	Ensuring the safe and responsible use of generative AI in educational contexts.	ChatGPT	Dr Alan Chamberlain, Professor Elvira Perez Vallejos, Dr Virginia Portillo	UKRI	[20]
AI & the Art of Conversation: Creating an AI Discussion Partner for Contemporary Art Gallery Visitors with Sight Loss	Developing an AI discussion partner using generative AI for art gallery visitors with sight loss.	Conversational AI	Kevin Hunt, Lars Erik Holmquist, Rebekah Pickering Wood, Kayode Owa (Nottingham Trent University)		[25]
Responsible Innovation Advantage in Knowledge Exchange (RAKE) Project	Embedding Responsible Innovation (RI) practices in	Conversational AI	Dr Alan Chamberlain, Professor Elvira Perez	UKRI	[20]

	AI development and deployment.		Vallejos, Dr Virginia Portillo		

Conclusion

The University of Nottingham demonstrates a strong and diverse engagement in research activities across the fields of generative AI, large language models, ChatGPT, and conversational AI. Research spans fundamental investigations into the capabilities and ethical implications of these technologies to practical applications in areas such as engineering design, renewable energy prediction, education, and accessibility. The interdisciplinary nature of this research is evident through collaborations across the Schools of Computer Science, Engineering, Psychology, and Mathematical Sciences, as well as partnerships with other universities and institutions. A clear emphasis is placed on addressing the societal impact and responsible development of AI, as highlighted by the university's involvement in national initiatives like the RAI UK project. The ongoing work and the presence of dedicated research groups and expert personnel position the University of Nottingham as a significant contributor to these rapidly evolving and impactful areas of artificial intelligence.

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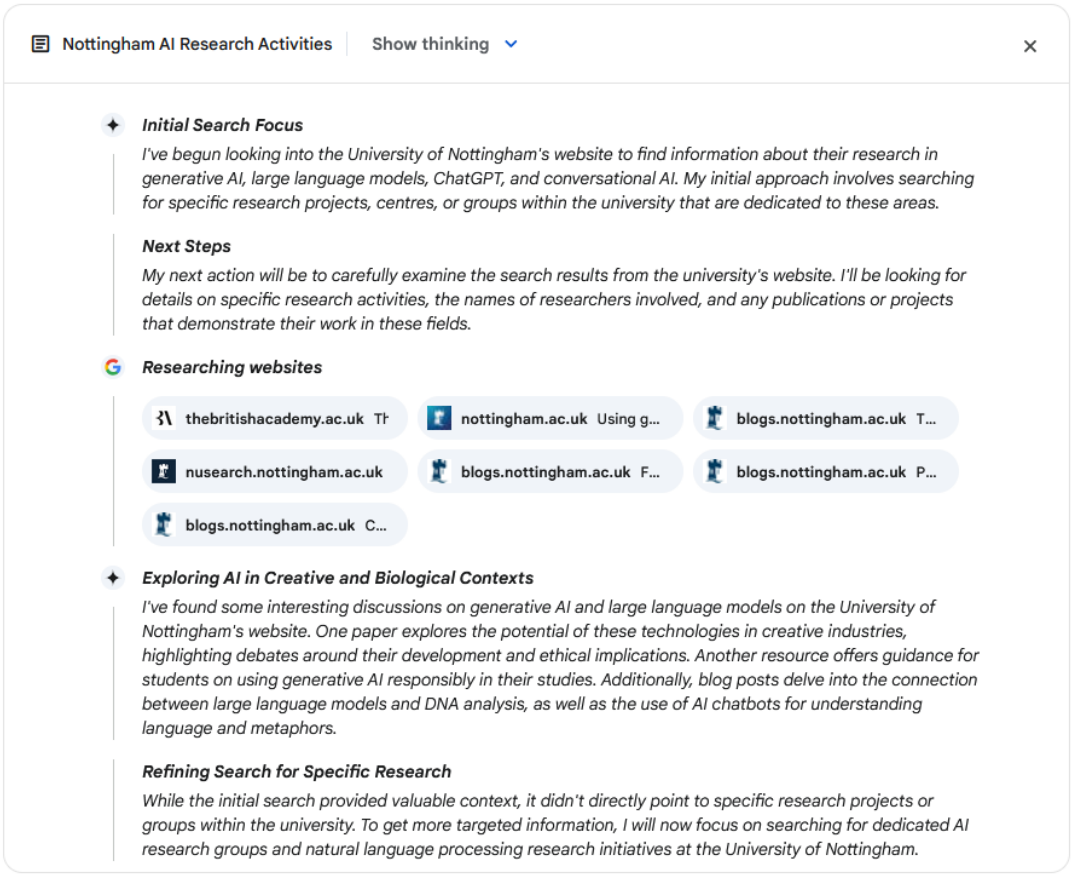
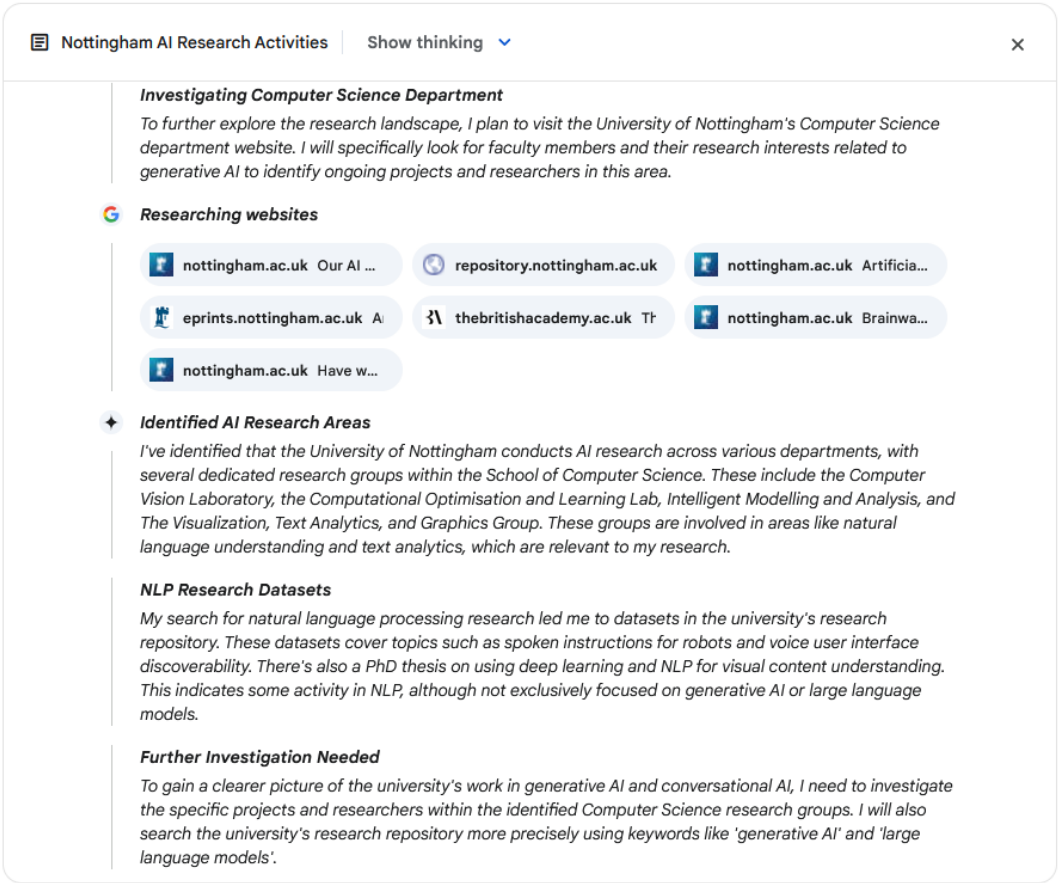
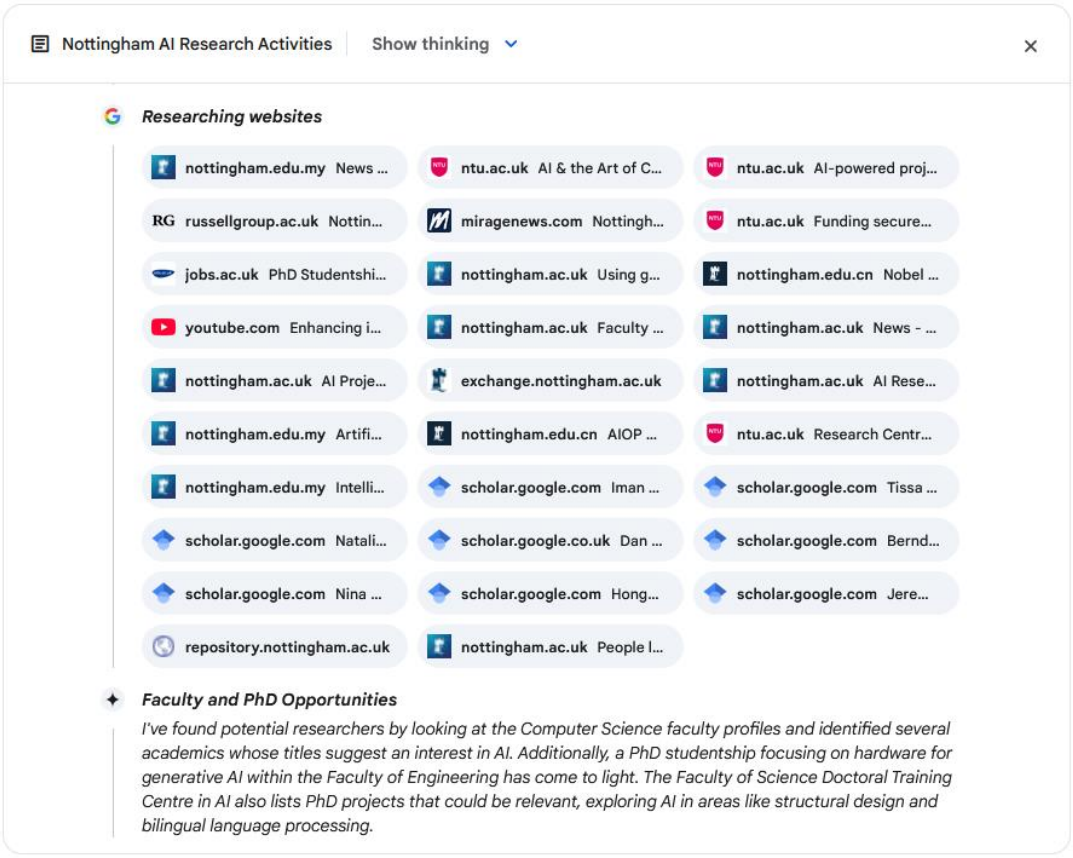
[13] An, H. (n.d.). *Hongye An*. Google Scholar. Retrieved from https://scholar.google.com/citations?user=XXWeUGIAAAAJ&hl=en

Appendix 1: Gemini's Reasoning Process



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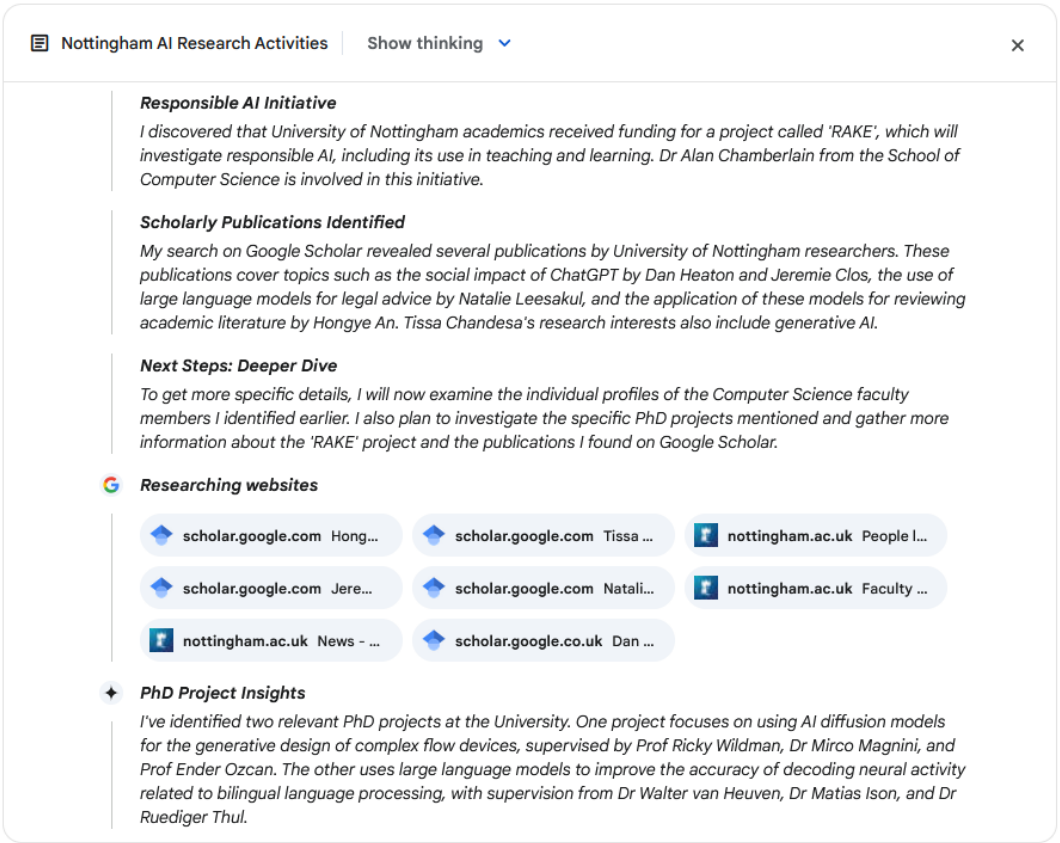
Faculty and PhD Opportunities
I've found potential researchers by looking at the Computer Science faculty profiles and identified several academics whose titles suggest an interest in AI. Additionally, a PhD studentship focusing on hardware for generative AI within the Faculty of Engineering has come to light. The Faculty of Science Doctoral Training Centre in AI also lists PhD projects that could be relevant, exploring AI in areas like structural design and bilingual language processing.


Nottingham AI Research Activities
Show thinking
Responsible AI Initiative
I discovered that University of Nottingham academics received funding for a project called 'RAKE', which will investigate responsible AI, including its use in teaching and learning. Dr Alan Chamberlain from the School of Computer Science is involved in this initiative.
Scholarly Publications Identified
My search on Google Scholar revealed several publications by University of Nottingham researchers. These publications cover topics such as the social impact of ChatGPT by Dan Heaton and Jeremie Clos, the use of large language models for legal advice by Natalie Leesakul, and the application of these models for reviewing academic literature by Hongye An. Tissa Chandesa's research interests also include generative AI.
Next Steps: Deeper Dive
To get more specific details, I will now examine the individual profiles of the Computer Science faculty members I identified earlier. I also plan to investigate the specific PhD projects mentioned and gather more information about the 'RAKE' project and the publications I found on Google Scholar.
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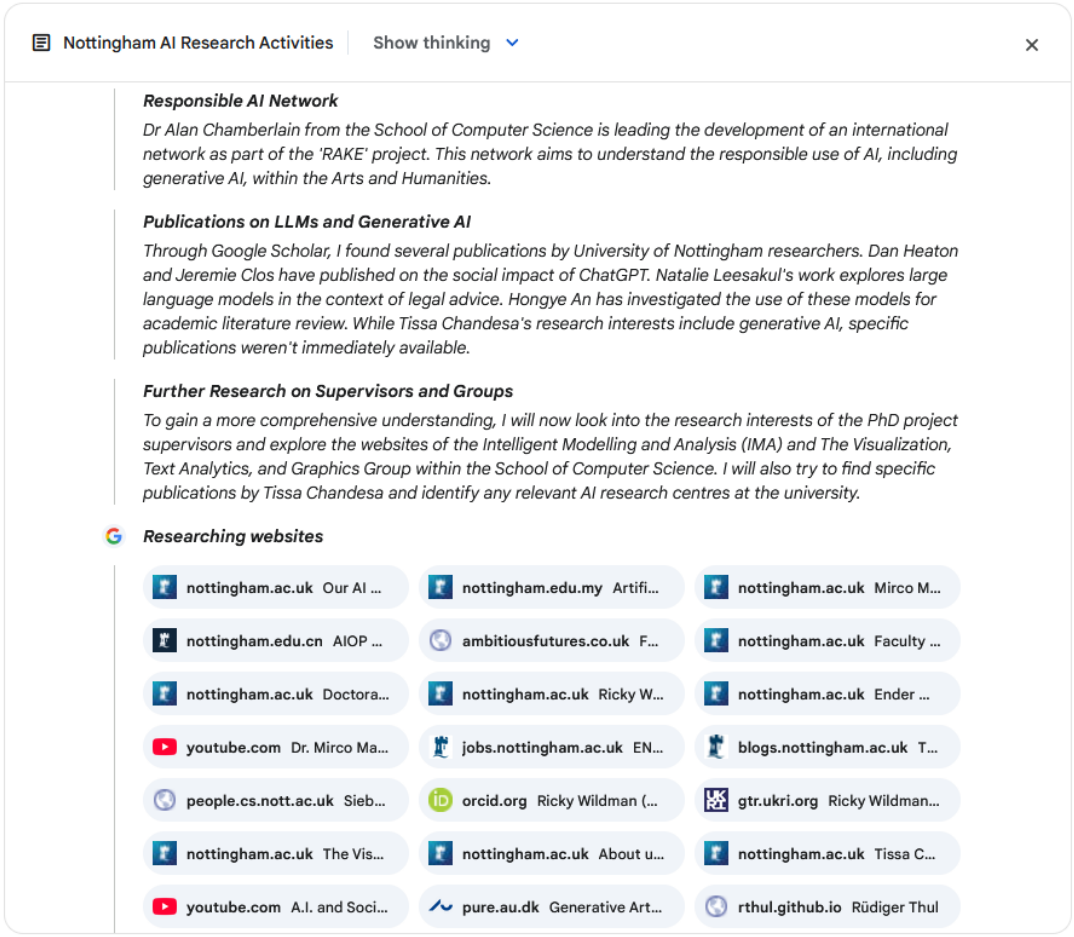
PhD Project Insights
I've identified two relevant PhD projects at the University. One project focuses on using AI diffusion models for the generative design of complex flow devices, supervised by Prof Ricky Wildman, Dr Mirco Magnini, and Prof Ender Ozcan. The other uses large language models to improve the accuracy of decoding neural activity related to bilingual language processing, with supervision from Dr Walter van Heuven, Dr Matias Ison, and Dr Ruediger Thul.


Nottingham AI Research Activities
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Responsible AI Network
Dr Alan Chamberlain from the School of Computer Science is leading the development of an international network as part of the 'RAKE' project. This network aims to understand the responsible use of AI, including generative AI, within the Arts and Humanities.
Publications on LLMs and Generative AI
Through Google Scholar, I found several publications by University of Nottingham researchers. Dan Heaton and Jeremie Clos have published on the social impact of ChatGPT. Natalie Leesakul's work explores large language models in the context of legal advice. Hongye An has investigated the use of these models for academic literature review. While Tissa Chandesa's research interests include generative AI, specific publications weren't immediately available.
Further Research on Supervisors and Groups
To gain a more comprehensive understanding, I will now look into the research interests of the PhD project supervisors and explore the websites of the Intelligent Modelling and Analysis (IMA) and The Visualization, Text Analytics, and Graphics Group within the School of Computer Science. I will also try to find specific publications by Tissa Chandesa and identify any relevant AI research centres at the university.
Researching websites
nottingham.ac.uk Our AI ...
nottingham.edu.my Artifi...
nottingham.ac.uk Mirco M...
nottingham.edu.cn AIOP ...
ambitiousfutures.co.uk F...
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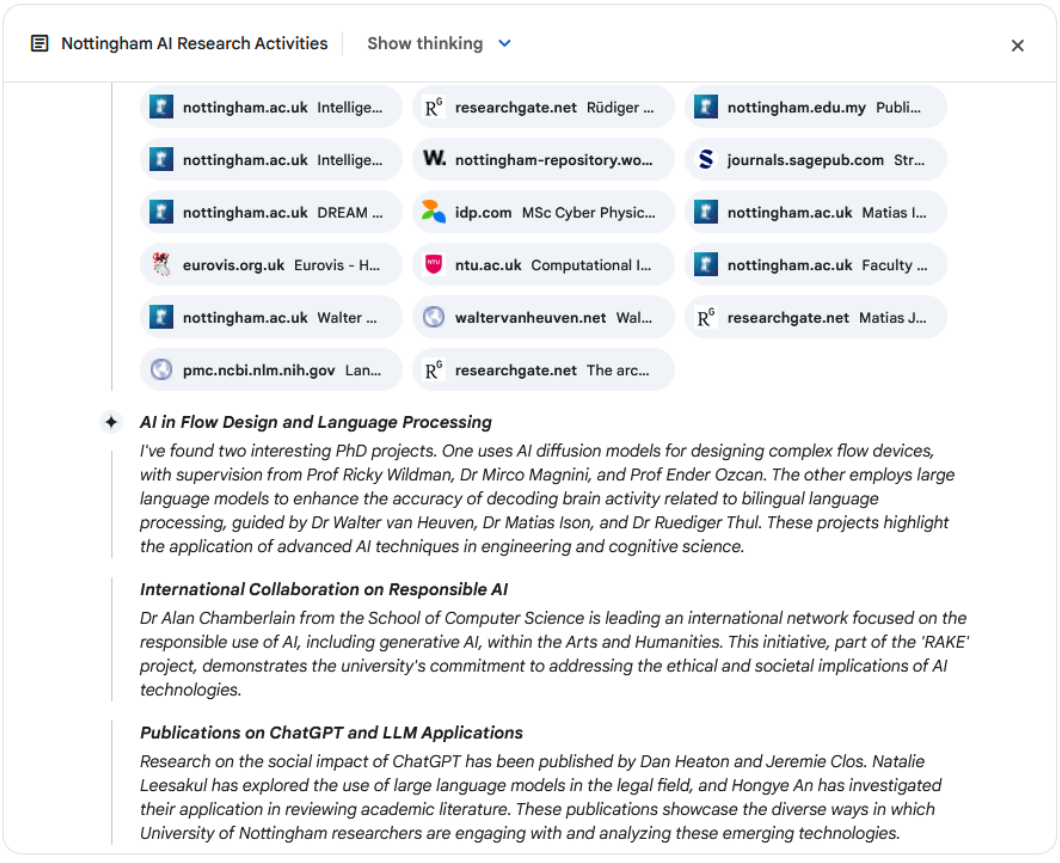
youtube.com Dr. Mirco Ma...
jobs.nottingham.ac.uk EN...
blogs.nottingham.ac.uk T...
people.cs.nott.ac.uk Sieb...
orcid.org Ricky Wildman (...
gtr.ukri.org Ricky Wildman...
nottingham.ac.uk The Vis...
nottingham.ac.uk About u...
nottingham.ac.uk Tissa C...
youtube.com A.I. and Soci...
pure.au.dk Generative Art...
rthul.github.io Rüdiger Thul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waltervanheuven.net Wal...
researchgate.net Matias J...
pmc.ncbi.nlm.nih.gov Lan...
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AI in Flow Design and Language Processing
I've found two interesting PhD projects. One uses AI diffusion models for designing complex flow devices, with supervision from Prof Ricky Wildman, Dr Mirco Magnini, and Prof Ender Ozcan. The other employs large language models to enhance the accuracy of decoding brain activity related to bilingual language processing, guided by Dr Walter van Heuven, Dr Matias Ison, and Dr Ruediger Thul. These projects highlight the application of advanced AI techniques in engineering and cognitive science.
International Collaboration on Responsible AI
Dr Alan Chamberlain from the School of Computer Science is leading an international network focused on the responsible use of AI, including generative AI, within the Arts and Humanities. This initiative, part of the 'RAKE' project, demonstrates the university's commitment to addressing the ethical and societal implications of AI technologies.
Publications on ChatGPT and LLM Applications
Research on the social impact of ChatGPT has been published by Dan Heaton and Jeremie Clos. Natalie Leesakul has explored the use of large language models in the legal field, and Hongye An has investigated their application in reviewing academic literature. These publications showcase the diverse ways in which University of Nottingham researchers are engaging with and analyzing these emerging technologies.