Joshua Ong

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Summary

Joshua is currently a research assistant under the supervision of Shay B. Cohen and an incoming PhD student at Imperial College London, supervised by Eleonora Giunchiglia. His research interests lie in Large Language Model (LLM) reasoning, with a particular focus on LLM interpretability and neurosymbolic approaches to enhance the faithfulness and reasoning capabilities of LLMs.

Education

Imperial College London (Imperial-X) — London, United Kingdom
PhD in Electrical and Electronic Engineering — *September 2025 (Incoming)*

- **Research Topic**: Integrating Logical Constraints into LLMs for Enhanced Reasoning and Trustworthiness.
- **Supervisor**: Dr. Eleonora Giunchiglia

University of Edinburgh — Edinburgh, Scotland
Bachelors of Science (Honours) Mathematics and Statistics (Second-Year Entry) — *September 2021 - May 2024*

- **Grade**: First Class Honours.
- **Dissertation Topic**: Detecting Redundancy in the Architecture of Boltzmann Machine (**77%**).
- **Courses**: Applied Statistics; Applied Stochastic Differential Equations; Bayesian Theory; Machine Learning in Python; Natural Language Understanding, Generation, and Machine Translation (NLU+)
- **Projects:** Spatial and Seasonal Analysis of Scottish Weather Data using Monte Carlo Permutation Test and Spatial Prediction Models (**100%)**

Research Experience

University of Edinburgh School of Informatics (ILCC) — June 2024 – Present
Research Assistant (Supervisor: Shay B. Cohen) — *Edinburgh, Scotland*

- *Theorem Prover as a Judge:* Leveraging autoformalisation to generate synthetic data and introducing Reinforcement Learning from Theorem Prover Feedback to improve model training and reasoning. [1]
- *CoMAT:* Leveraging symbolic representations to enhance the accuracy and reliability of LLMs in mathematical reasoning, eliminating the need for external symbolic solvers. [2].
- Developed questions and solutions, and hosted office hours for the final assignment in *Natural Language Understanding, Generation, and Machine Translation* course, with CoMAT selected as the core component.

Experience

University of Edinburgh Information Service Group (EDINA) — October 2023 – August 2024
Machine Learning Specialist — *Edinburgh, Scotland*

- Researched and engineered a Retrieval-Augmented Generation (RAG) system utilising Dense Passage Retrieval for retrieval and Llama-3.1 as the generator, improving information retrieval accuracy and output precision from large-scale financial documents.
- Implemented and transitioned language models from GPT to open-source models, including Llama-3, Mistral, phi-3, among others, achieving cost reductions while elevating model performance and sustainability.
- Successfully deployed a Financial Query Answering (FinQA) model via HuggingSpace, serving both the Edinburgh University Trading and Investment Club and the University of Edinburgh Business School, and ensured going maintenance and optimisation of the model.

University of Edinburgh Information Service Group (EDINA) — June 2023 – August 2023
GPT Analyst Intern — *Edinburgh, Scotland*

- Engineered a Financial Query Answering (FinQA) system independently, enhanced its efficiency in resolving financial queries by integrating RoBERTa-based retriever and GPT-based generator components, and further enriched the system with a translation function and definition function using prompt engineering.
- Designed and presented a demonstration interface for the FinQA model utilising Streamlit to the Smart Data Foundry, effectively showcasing the advanced functionalities and potential applications of the model.
- Leveraged LangChain to implement a robust question-answering system capable of extracting and analysing content from uploaded PDF documents, thereby producing contextually accurate and reliable responses.

Research Papers

Leang, J.O.J., Hong G., Li W., Cohen, S.B.: *Theorem Prover as a Judge for Synthetic Data Generation*, 2025.[*arXiv:2502.13137v1*]

Leang, J.O.J., Gema, A.P., Cohen, S.B.: *CoMAT: Chain of Mathematically Annotated Thought Improves Mathematical Reasoning*, 2024. [*arXiv:2410.10336*]

Gema, A.P., **Leang, J.O.J.**, Hong, G., Devoto, A., Mancino, A.C.M., Saxena, R., He, X., Zhao, Y., Du, X., Ghasemi Madani, M.R., Barale, C., McHardy, R., Harris, J., Kaddour, J., van Krieken, E. and Minervini, P.: *Are We Done with MMLU?. In Proceedings of the Nations of the Americas Chapter of the Association for Computational Linguistics (NAACL), 2025.* [*arXiv:2406.04127*]

Peer Review

ACL Rolling Review - October 2024, December 2024, February 2025

TMLR - December 2024

ICLR 2025 - October 2024

Invited Talk

LLM Reasoning in the Mathematical Domain, November 2024, Natwest Data Science Seminar

Skills

Languages: English (Proficient), Chinese (Native), Hokkien (Native), Malay (Proficient)
Programming Languages: Python, Java, Javascript, R, Swift, SQL.
Developer Tools: Git, Ubuntu, Kubernates, Flask, Streamlit, Gradio, VSCode.
Libraries: TensorFlow, PyTorch, Transformers, Scikit-Learn, Numpy, Pandas, Matplotlib, Seaborn.
Other Interests: Taylor Swift, Football (Real Madrid), Disney, Travelling, Swimming.