Aryo Pradipta Gema

+44 7476 686838 | aryopg[at]gmail[dot]com | LinkedIn | Twitter | GitHub | Website | Edinburgh, UK

Summary

Aryo is currently a PhD student in Biomedical AI at the University of Edinburgh under the supervision of Dr. Beatrice Alex, Dr. Pasquale Minervini, and Dr. Luke Daines. His research interests are in the intersection between NLP and the clinical domain, with a particular emphasis on mitigating hallucinations in LLMs to enhance their reliability in healthcare applications.

Education

University of Edinburgh — Edinburgh, United Kingdom

PhD in Biomedical AI; ***expected: August 2026*** — *Sep 2023 – Present*

- **Thesis:** Knowledge-Augmented Language Models for Patient Information Modelling.
- **Projects:** Survey of Knowledge-augmented Biomedical and Clinical Language Models; Probing evaluation of Language Model in encoding clinical knowledge; LLM-enhanced synthesis of Discharge Summaries from ICD codes; Unifying embeddings of Molecular Language Models for Protein-Ligand binding affinity prediction.
- **Advisors:** Dr. Beatrice Alex, Dr. Pasquale Minervini, and Dr. Luke Daines.

MSc by Research in Biomedical AI; ***Distinction*** — *Sep 2022 – Aug 2023*

- **Thesis:** Parameter-efficient Fine-tuning of Large Language Models for the Clinical Domain.
- **Projects:** Systematic Review of NLP methods for detecting adverse drug events; Biomedical knowledge graph embedding for polypharmacy tasks; Protein Language Model for SARS-CoV-2 vaccine design.
- **Advisors:** Dr. Beatrice Alex, Dr. Pasquale Minervini, and Dr. Luke Daines.

Bina Nusantara University — Jakarta, Indonesia

BSc in Computer Science; ***GPA: 3.87/4.00*** — *Sep 2014 – Aug 2018*

- **Thesis:** Sequence-To-Sequence Learning For Motion-Aware Claim Generation.
- **Projects:** Energy-based learning for recognising argumentative relations in persuasive essay; Attention mechanism model for recognising insufficiently supported arguments; Attention-based argumentation mining.
- **Advisors:** Dr. Derwin Suhartono.

Professional Experience

AstraZeneca (Pharmaceutical and biotechnology company) — Cambridge, United Kingdom

Research Scientist Intern — *July 2024 – September 2024*

- Conducted research on LLM hallucination mitigation, focusing on innovative post-training strategies.
- Developed and tested a novel decoding framework, DeCoRe, which leverages contrasting retrieval heads to reduce hallucinations in LLM outputs.

Epigene Labs (AI-driven Precision Oncology startup) — Paris, France

Senior Data Scientist — *October 2021 – August 2022*

- Supervised data collection, data labelling, ontology formulations, and model evaluations.
- Maintained the quality of more than 20 Machine Learning models in production.
- Worked with the Head of Data to align Data Science research and product timelines.
- Supervised data science internship projects on NLP-based biomedical concept extraction.
- Initiated a regular inter-departmental research workshop.

Data Scientist — *October 2019 – September 2021*

- Researched and implemented a Language-Agnostic, Format-Agnostic, and Cancer-Agnostic Data Harmonisation Pipeline using hybrid Machine Learning techniques.
- Supervised data science internship projects on Tailored Performance Metrics and Continuous Learning.
- Contribute to an open-sourced batch effect correction library (https://github.com/epigenelabs/pyComBat).
- Directly worked under the C-level to align data science research, DevOps, and product timelines.

Riminder (now HrFlow; Recruitment solution startup) — Paris, France

Staff AI Research Scientist — *February 2019 – October 2019*

- Supervised day-to-day operations of the research team.
- Directly worked with the C-level to align research and product timelines.
- Improved in-house Named Entity Recognition model by 20% F1 score, block tagger, and other ML models by 5%.

AI Research Scientist *October 2018 – January 2019*

- Contributed to the research team to further improve profile-to-job matching/recommendation using deep learning algorithms.
- Introduced novel approaches for profile-to-job matching, and improved the model by a 10% ROC AUC score.
- Held ownership of multiple of Riminder's highest-valued projects.

Julo (AI-driven financial technology startup) Jakarta, Indonesia

Data Scientist *September 2017 – July 2018*

- Developed multiple machine learning solutions, including Automatic individual credit performance grading, deep learning-based supervised and unsupervised text processing, and recognition.
- Worked collaboratively with the Head of Analytics in day-to-day development and recruitment.
- Designed and supervised data collection, data labelling, and evaluations.
- Mentored junior data scientists and interns.

Bina Nusantara University Jakarta, Indonesia

Undergraduate Researcher; placement programme *March 2017 – July 2018*

- Researched cutting-edge Deep Learning and other Machine Learning techniques in Argumentation Mining.
- Published 3 papers in 2 international conferences and 1 journal (ICCSCI 2017, MIWAI-SoDeLIA 2017, IJCVR 2018).
- Best Presenter of ICCSCI 2017.
- Appointed as the lead researcher for the team of undergraduate researchers.

RE/MAX 2000 (real-estate company) California, United States (Remote)

Freelance Full Stack Software Engineer *July 2017 – September 2017*

- Developed 10 core modules for internal Customer Relationship Management (CRM) application.
- Developed 8 core modules for Image and Descriptive Text Verification applications.
- Developed 5 WordPress-based websites.

Volantech (B2B software house) Jakarta, Indonesia

Software Engineer *February 2016 – July 2017*

- Developed Customer Relationship Management (CRM) applications for mining companies.
- Held ownership of multiple of Volantech's high-value projects.
- Worked closely with the C-level in developing product timelines.
- Research on Deep Learning techniques in conjunction with Internet of Things systems.

Publications

Preprint (in submission)

- **Gema, A. P.**, Jin, C., Abdulaal, A., Diethe, T., Teare, P., Alex, B., ..., Saseendran, A. (2024). *DeCoRe: Decoding by Contrasting Retrieval Heads to Mitigate Hallucinations.* arXiv preprint arXiv:2410.18860.
- Zhao, Y., Devoto, A., Hong, G., Du, X., **Gema, A. P.**, Wang, H., ..., Minervini, P. (2024). *Steering Knowledge Selection Behaviours in LLMs via SAE-Based Representation Engineering.* arXiv preprint arXiv:2410.15999.
- Zhao, Y., Du, X., Hong, G., **Gema, A. P.**, Devoto, A., Wang, H., ..., Minervini, P. (2024). *Analysing the Residual Stream of Language Models Under Knowledge Conflicts.* arXiv preprint arXiv:2410.16090. ***To appear in The Foundation Model Intervention Workshop @ NeurIPS 2024***
- Leang, J. O. J., **Gema, A. P.**, Cohen, S. B. (2024). *CoMAT: Chain of Mathematically Annotated Thought Improves Mathematical Reasoning.* arXiv preprint arXiv:2410.10336.
- Lysandrou, G., Owen, R. E., Popovic, V., Brun, G. L., **Gema, A. P.**, Alex, B., Fairley, E. A. (2024). *A Comparative Study on Patient Language across Therapeutic Domains for Effective Patient Voice Classification in Online Health Discussions.* arXiv preprint arXiv:2407.16593.
- **Gema, A. P.**, Leang, J. O. J., Hong, G., Devoto, A., Mancino, A. C. M., Saxena, R., ..., Minervini, P. (2024). *Are We Done with MMLU?.* arXiv preprint arXiv:2406.04127.
- Hong, G., **Gema, A. P.**, Saxena, R., Du, X., Nie, P., Zhao, Y., ..., Minervini, P. (2024). *The Hallucinations Leaderboard–An Open Effort to Measure Hallucinations in Large Language Models.* arXiv preprint arXiv:2404.05904.

- Guellil, I., Wu, J., **Gema, A. P.**, Francis, F., Berrachedi, Y., Chenni, N., Tobin, R., Llewellyn, C., Arakelyan, S., Wu, H., Guthrie, B., Alex, B. (2023). *Natural Language Processing for Detecting Adverse Drug Events: Systematic Review.*
- **Gema, A. P.**, Kobiela, M., Fraisse, A., Rajan, A., Oyarzun, D., Alfaro, J. (2023). *Vaxformer: Antigenicity-controlled Transformer for Vaccine Design Against SARS-CoV-2.* arXiv preprint arXiv:2305.11194.

In proceedings

- Falis, M., **Gema, A. P.**, Dong, H., Daines, L., Basetti, S., Holder, M., ..., Alex, B. (2024). *Can GPT-3.5 generate and code discharge summaries?.* Journal of the American Medical Informatics Association, 31(10), 2284-2293.
- **Gema, A. P.**, Grabarczyk, D., De Wulf, W., Borole, P., Alfaro, J., Minervini, P., Vergari, A., Rajan, A. (2024). *Knowledge Graph Embeddings in the Biomedical Domain: Are They Useful? A Look at Link Prediction, Rule Learning, and Downstream Polypharmacy Tasks.* Bioinformatics Advances, 4(1), vbae097.
- **Gema, A. P.**, Lee, C., Minervini, P., Daines, L., Simpson, T. I., Alex, B. (2024). Edinburgh clinical NLP at MEDIQA-CORR 2024: Guiding large language models with hints. In Proceedings of the 6th Clinical Natural Language Processing Workshop. Association for Computational Linguistics.
- **Gema, A. P.**, Hong, G., Minervini, P., Daines, L., Alex, B. (2024). Edinburgh clinical NLP at SemEval-2024 Task 2: Fine-tune your model unless you have access to GPT-4. In Proceedings of the 18th International Workshop on Semantic Evaluation (SemEval-2024) (pp. 1905-1915). Mexico City, Mexico: Association for Computational Linguistics.
- **Gema, A. P.**, Minervini, P., Daines, L., Hope, T., Alex, B. (2024). Parameter-efficient fine-tuning of llama for the clinical domain. In Proceedings of the 6th Clinical Natural Language Processing Workshop. Association for Computational Linguistics.
- Halimawan, N., Suhartono, D., **Gema, A. P.**, Yunanda, R. (2022). BERT and ULMFiT Ensemble for Personality Prediction from Indonesian Social Media Text. In 2022 International Symposium on Information Technology and Digital Innovation (ISITDI) (pp. 156–161).
- William, D., Achmad, S., Suhartono, D., **Gema, A. P.** (2022). Leveraging BERT with Extractive Summarization for Depression Detection on Social Media. In 2022 International Seminar on Intelligent Technology and Its Applications (ISITIA) (pp. 63–68).
- Saputra, F., Namyu, U., Suhartono, D., **Gema, A. P.** (2021). Automatic Piano Sheet Music Transcription with Machine Learning. Journal of Computer Science, 17(3), 178–187.
- Suhartono, D., **Gema, A. P.**, Winton, S., David, T., Fanany, M., Arymurthy, A. (2020). Sequence-To-Sequence Learning For Motion-Aware Claim Generation. International Journal of Computing, 19(4), 620–628.
- Suhartono, D., **Gema, A. P.**, Winton, S., David, T., Fanany, M., Arymurthy, A. (2020). Argument annotation and analysis using deep learning with attention mechanism in Bahasa Indonesia. Journal of Big Data, 7, 1–18.
- Suhartono, D., **Gema, A. P.**, Winton, S., David, T., Fanany, M., Arymurthy, A. (2019). Attention-based argumentation mining. International Journal of Computational Vision and Robotics, 9(5), 414–437.
- Anderson, R., **Gema, A. P.**, Isa, S., others (2018). Facial attractiveness classification using deep learning. In 2018 Indonesian Association for Pattern Recognition International Conference (INAPR) (pp. 34–38).
- Suhartono, D., **Gema, A. P.**, Winton, S., David, T., Fanany, M., Arymurthy, A. (2017). Hierarchical attention network with XGBoost for recognizing insufficiently supported argument. In Multi-disciplinary Trends in Artificial Intelligence: 11th International Workshop, MIWAI 2017, Gadong, Brunei, November 20-22, 2017, Proceedings 11 (pp. 174–188).
- **Gema, A. P.**, Winton, S., David, T., Suhartono, D., Shodiq, M., Gazali, W. (2017). It takes two to tango: modification of siamese long short term memory network with attention mechanism in recognizing argumentative relations in persuasive essays. Procedia computer science, 116, 449–459.

Invited Talks

- **DeCoRe: Decoding by Contrasting Retrieval Heads to Mitigate Hallucination**, Dec 2024, Centre for AI @AstraZeneca
- **PhD in Clinical NLP**, Nov 2024, Epigene Labs
- **Clinical NLP in the LLM era**, Jul 2024, Discovery Sciences @AstraZeneca
- **Clinical NLP in the LLM era**, Apr 2024, Clinical NLP Group @University of Edinburgh
- **Clinical NLP in the LLM era**, Apr 2024, CDT Biomedical AI @University of Edinburgh
- **Parameter-efficient Fine-tuning of LLMs for the Clinical Domain**, Dec 2023, Bina Nusantara University
- **Parameter-efficient Fine-tuning of LLMs for the Clinical Domain**, Nov 2023, Bina Nusantara University
- **Knowledge Graph Embeddings in the Biomedical Domain**, Nov 2023, University of Edinburgh
- **Parameter-efficient Fine-tuning of LLMs for the Clinical Domain**, Oct 2023, University of Edinburgh

- **Introduction to the Large Language Model**, Jul 2023, Sutton Trust Summer School
- **Knowledge Graph Embeddings in the Biomedical Domain**, May 2023, Bina Nusantara University
- **Knowledge-Augmented Clinical Language Models**, May 2023, Bina Nusantara University
- **ChatGPT: A Biomedical AI Perspective**, May 2023, University of Edinburgh
- **Knowledge-Augmented Clinical Language Models**, Mar 2023, Bina Nusantara University
- **Clinical Language Models**, Feb 2023, Bina Nusantara University
- **Building a Knowledge Base from Biomedical Literature**, Jul, 2022, Bina Nusantara University
- **Augmenting Intelligence to Drug Discovery**, Dec, 2021, Bina Nusantara University
- **Augmenting Intelligence to Drug Discovery**, Apr, 2021, Bina Nusantara University
- **Introduction to Artificial Intelligence**, Oct, 2020, Bina Nusantara University

Peer Review

- ACL Rolling Review - October 2023, December 2023 **(Outstanding reviewer EACL 2024)**, February 2024, April 2024, June 2024, August 2024, October 2024
- Clinical NLP at NAACL 2024 - February 2024
- ICLR 2025
- 7th Healthcare Text Analytics Conference - March 2024
- Conference in AI for Health 2024 - March 2024

Awards & Achievements

Academic

- **Binusian Award (2018):** awarded to the most achieving graduate.
- **Applied Research Grant Binus (2017):** awarded to research initiatives by Binus University.
- **Scholarship Mentor Program (2015):** awarded to students that successfully mentor their peers.
- **Student of Excellence Honour (2015):** awarded to students with international and national achievements.
- **Student of Excellence Honour (2014):** awarded to students with international and national achievements.

Non-academic

- **United Asian Debating Championship (2015)**: Quarterfinalist in English as Foreign Language Category.
- **Asian Law Students' Association University of Indonesia (2015)**: Octofinalist.
- **Asian Law Students' Association Universitas Padjadjaran (2015)**: Semifinalist and 8th Best Speaker.
- **Indonesian Varsity English Debate University of Indonesia (2015)**: Champion in Novice Category.
- **Founder's Trophy Debating Championship University of Indonesia (2014)**: Best Novice Team.
- **Newbies Debating Championship University of Indonesia (2014)**: 1st Runner Up and 3rd Best Speaker.

Skills

Languages: Indonesian – Native, Banjarese - Native, English – Bilingual, French – Elementary

Programming Languages: Python, C/C++, Go, JavaScript, SQL

Libraries: PyTorch, TensorFlow, Transformers, Accelerate, Scikit-Learn, NumPy, Pandas, Matplotlib, Seaborn

Technologies: Git, Slurm, Docker, Kubernetes, Flask, Streamlit, MySQL, PostgreSQL, MongoDB, Azure Cosmos DB

Other interests: Chess, Parliamentary Debate, Sports, Cooking