Matteo Nulli

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Education

- **University of Amsterdam** — Amsterdam, The Netherlands
  MSc in Artificial Intelligence; GPA: 4.0/4.0 (8.2/10) — *Sep 2023 - Sep 2025*
  - **Relevant Courses**: Foundation Models, Deep Learning 1 & 2, Computer Vision, Natural Language Processing, Information Retrieval, Machine Learning 1.
- **Università Commerciale Luigi Bocconi** — Milan, Italy
  BSc in Mathematics and Computing Sciences for Artificial Intelligence; GPA: 3.6/4.0 (99/110) — *Sep 2020 - July 2023*
  - **Thesis**: Analysed **Generative** Adversarial Networks and Recurrent Neural Networks with time-series financial data to determine future prices of stocks.
  - **Relevant Courses**: Machine Learning, Mathematical Modelling for Finance, Mathematical Analysis 1,2 & 3, Physics 1 & 2, Statistical and Quantum Physics, Optimization Algorithms, Programming.
- **University of Sydney** — Sydney, Australia
  Exchange Semester in Applied Mathematics and Computing Sciences; GPA: 3.6/4.0 — *Feb 2023 - July 2023*
  - **Scholarship**: Selected by Merit with paid tuition for a full semester.
  - **Relevant Courses**: Stochastic Processes (Adv), Big Data and Data Diversity (Adv), Deep Learning, Spanish.

Experience

- **eBay** — Amsterdam, The Netherlands
  Applied Scientist — *July 2024 - Current*
  - **MLLMs**: Incoming Intern on Multimodal LLMs research and development for architecture and pre-training.
- **Aindo** — Milan, Italy
  Machine Learning Engineer — *June 2022 - Sep 2022*
  - **VAEs**: Learned PyTorch library and developed Variational Auto-encoders from scratch.
- **BAINSA** — Milan, Italy
  Co-Founder — *Jan 2022 - July 2023*
  - **AI association**: Founded first Artificial Intelligence association at Bocconi.
  - **Events**: Spread awareness & perception on AI's applications through events held inside and outside the university.
  - **Partners**: Main Partners include Bending Spoons, Vedrai and Insitute Europia.
- **BSI - Build Sustainable Innovation** — Milan, Italy
  Tech Consultant — *Jan 2021 - July 2023*
  - **ML Engeneering**: Implemented ML & Statistical based solutions for Companies.
  - **Data Analysis**: Applied Data analysis techniques to costumer provided datasets.

Publications & Pre-prints

- **'Explaining RL decisions with trajectories': A Reproducibility Study**: *Research published in TMLR.* Reproduced and extended 'Explaining RL decisions with trajectories' from Adobe Research. Investigated new methodologies by changing the clustering algorithm and by encoding trajectories through Hugging Face based Transformers. Obtained better visual cluster representation.
- **CoT Prompting Improves Compositional Understanding of VLMs**: *Research submitted to ICML workshop.* Analysed and evaluated generative and contrastive-based VLMs such as CLIP, LLaVa and cogVLM on compositionality-based benchmarks (ARO, winoground, sugarcrape). Employed synthetic chain-of-thought prompting in a few-shot fashion to enhance model performance, attaining a 5% enhancement.
- **Vocabulary Reduction and Contrastive Decoding in LLMs**: *Research to be submitted.* Modified existing early-exiting techniques and applied contrastive decoding to encoder-decoder Large Language models such t5. By employing vocabulary pruning technique we achieved 100x improvement in FLOPs, while retaining almost all performance.

Projects

- **Machine Learning for Breast Cancer Cells analysis**: *Project winner of AI-Lab competition, prof. Francesca Buffa.* Utilized Unsupervised and Supervised ML methods (Tree based methods and Deep Neural Network) to analyse breast cancer cells and capture interactions between them. Detected with a success rate of 95% Hypoxic vs Normoxic cells. Presented the project at the University of Oxford Oncology Department.
- **CLIP based visual prompting, Transfer Learning CNNs**: *University project.* Learned different Visual prompts through CLIP and adapted network to different datasets.
- **Deep Generative models and Transformer based models**: *University project.* Implementing causal self-attention in gpt-2 and developed Variational Auto-encoders and Adversarial Auto-encoders from scratch in PyTorch.
- **Content-Based Retrieval Ranking and Re-Ranking Systems**: *University project.* Applied Neural-IR ranking and re-ranking methods through Cross-Encoder, Sparse and Dense Encoders with BERT Transformer. Achieved a 4% enhancement in performance when combining Dense and Cross-Encoders together.

Scholarships & Awards

- **Scholarship**: University of Sydney, full ride scholarship of 26,500 A$.

- **Award**: University of Oxford, Università Commerciale Luigi Bocconi.
  AI-Lab Competition Winner, presented the project at Oncology Department at University of Oxford, received travel reimbursement. Supervised by professor Francesca Buffa.

- **Scholarship**: Mario Negri Foundation, scholarship of 1,000$.

Programming Skills

- **Languages**: Python, R, SQL, LaTeX, C (Beginner)

- **Libraries**: Pytorch, OpenCV, SciPy, Pandas, NumPy, Matplotlib, Scikit Learn, CLIP, Transformers