Matteo Nulli

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Research Interests Multimodal LLMs, Visual-representation Learning, Compositional Understanding, Visual-grounded Reasoning.

Education

- **University of Amsterdam** — Amsterdam, The Netherlands
  MSc in Artificial Intelligence; GPA: 4.0/4.0 (8.3/10) — *Sep 2023 - Sep 2025*
  - **Thesis**: Investigating Compositional Understanding and Visual Grounding in Vision Foundation Models. Supervised by prof. Yuki Asano, Ivona Najdenkoska and Michael Dorkenwald.
  - **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 and received a full ride scholarship of 26,500 A$.
  - **Relevant Courses**: Stochastic Processes (Adv), Big Data and Data Diversity (Adv), Deep Learning

Experience

- **eBay** — Amsterdam, The Netherlands
  Applied Scientist — *July 2024 - Current*
  - **MLLMs**: Research intern on **Multimodal LLMs**.
  - **Focus**: Focusing on pre-training and fine-tuning VLMs for eCommerce-oriented tasks while conducting theoretical research on architecture. Supervised by Hadi Hashemi, Vladimir Orshulevich.
- **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.

Publications & Preprints

- Vincenti, J., Sadek, K. A. A., Velja, J., **Nulli, M.** & Jazbec M. Dynamic Vocabulary Pruning in Early-Exit LLMs, **NeurIPS** ENLSP 2024, Vancuver, Canada.
- **Nulli, M.**, Ibrahimi, A., Pal, A., Lee, H., & Najdenkoska, I. In-Context Learning Improves Compositional Understanding of Vision-Language Models. **ICML** 2024 Workshop on Foundation Models in the Wild, Vienna, Austria.
- Sadek, K. A. A., **Nulli, M.**, Velja, J., & Vincenti, J. 'Explaining RL Decisions with Trajectories': A Reproducibility Study. Transactions on Machine Learning Research @**NeurIPS**, 2024, Vancuver, Canada.

Projects

- **Machine Learning for Breast Cancer Cells analysis**: *Competition winner AI-Lab, 2022.*
  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. Won the competition among peers and presented our findings at the University of Oxford Oncology Department. Supervised by professor Francesca Buffa.
- **Model compression for Machine Translation on ALMA Models**: *University project, 2024.*
  Applied several quantization (GPTQ, Q-LoRA, SmoothQuant) and pruning (Wanda, DSnot) techniques to ALMA-7B. Combined Wanda + GPTQ to obtain memory gains up to 3.5x.
- **Content-Based Retrieval Ranking and Re-Ranking Systems**: *University project, 2024.*
  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.
- **CLIP based visual prompting, Transfer Learning CNNs**: *University project, 2023.*
  Learned different Visual prompts through CLIP and adapted network to different datasets.
- **Deep Generative models and Transformer based models**: *University project, 2023.*
  Implementing causal self-attention in gpt-2 and developed Variational Auto-encoders and Adversarial Auto-encoders from scratch in PyTorch.

Scholarships & Awards

- **Scholarship**: University of Sydney, full ride scholarship of 26,500A$.
- **Award**: University of Oxford, Università Commerciale Luigi Bocconi.
  AI-Lab Competition Winner, presented the project at Oncology Department at University of Oxford, received travel reimbursement. Supervised by professor Francesca Buffa.
- **Scholarship**: Mario Negri Foundation, scholarship of 800$.

Skills

Programming Languages: Python, R, SQL, LaTeX, C (Beginner)
Libraries: Pytorch, OpenCV, Transformers, SciPy, Pandas, NumPy, Matplotlib, Scikit Learn, CLIP, ...
Languages: Italian (Native), English (Fluent), Spanish (Fluent)

Volunteering

- **Class Representative**: *University of Sydney, 2023.*
  Representing my fellow students within the faculty whilst talking with professors to solve problems of the class.
- **Technical Consultant - ML Engeneering**: *BSI Bocconi - Build Sustainable Innovation, 2021-2023.*
  Implemented ML & Statistical based solutions for Companies. Applied Data analysis techniques to costumer provided datasets.
- **Institute Representative - Head Student**: *Liceo Scientifico G.B. Grassi Latina, 2019-2020.*
  In my senior year I was appointed to be the Head Student for my High School representing more than 1500 students. During this period I worked together with the Head Master to manage the school's problems and improved my public speech abilities.