Marco Valentino, Ph.D.

POSTDOCTORAL RESEARCHER

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About

Marco is a Postdoctoral Researcher at the Neuro-Symbolic AI Group at the Idiap Research Institute.

His main research activity lies at the intersection of Natural Language Inference (NLI) and Explanation, contributing to the field of Explanation-Based NLI – i.e., the development of Artificial Intelligence (AI) models that can reason in complex domains (e.g., Science, Mathematics, Clinical Trials) and generate natural language explanations in support of their decisions.

More specifically, his research attempts to inject explanatory knowledge into hybrid neuro-symbolic architectures to improve the generalization, robustness, efficiency and controllability of neural models (including Large Language Models) and to better understand the explanatory reasoning process in both humans and machines. Moreover, Marco is interested in developing systematic methodologies to interpret and uncover inference strategies and limitations of large black-box neural networks.

Research Experience

May 2022 - Current **Postdoctoral Researcher,** Idiap Research Institute, Martigny, Switzerland. Funded by the Swiss National Science Foundation (SNSF) project "Neumath: Neural Discourse Inference over Mathematical Texts".

Sep 2021 - May 2022 **Research Intern,** Idiap Research Institute, Martigny, Switzerland.

Sep 2018 - Dec 2022 **Postgraduate Researcher,** University of Manchester, Manchester, United Kingdom. Funded by an Engineering and Physical Sciences Research Council (EPSRC) scholarship and a President Doctoral Scholar (PDS) Award.

Sep 2017- Sep 2018 **Research Assistant,** ICAR - Consiglio Nazionale delle Ricerche (CNR), Naples, Italy. Funded by the project "UPA4SAR: User-centred Profiling and Adaptation for Socially Assistive Robotics"

Teaching Experience

2021-Present **Learning Manager,** Boosting, Fundamentals in Machine Learning 1. Master in Artificial Intelligence. Martigny, Switzerland. *UniDistance Suisse*

2021-Present **Learning Manager,** Exact and Approximate Inference in Bayesian Networks, Fundamentals in Machine Learning 2. Master in Artificial Intelligence. Martigny, Switzerland. *UniDistance Suisse*

2019-2020 **Teaching Assistant,** Introduction to Artificial Intelligence. Manchester, United Kingdom. *University of Manchester*

Education

University of Manchester *Manchester, United Kingdom*
PH.D. COMPUTER SCIENCE *Sep 2018 - Dec 2022*

- Thesis: "Explanation-Based Scientific Natural Language Inference"
- Supervisor: Dr. André Freitas

University of Naples "Federico II" *Naples, Italy*

M.Sc. Computer Science *Sep 2015 - Jul 2017*

- Grade: 110/110 cum laude
- Specialization: Intelligent Robotics and Advanced Cognitive Systems
- Thesis: "A Natural User Interface for Small Groups in an Immersive 3D Environment"
- Supervisor: Prof. Francesco Cutugno

University of Naples "Federico II" *Naples, Italy*

B.Sc. Computer Science *Sep 2010 - Feb 2014*

- Grade: 107/110
- Thesis: "A Web Portal for Smart Cities in Naples: System Design and Development of Aspects Related to HCI"
- Supervisor: Prof. Francesco Cutugno

Awards

2023   **Best Task Paper Award Honorable Mention,** awarded by the 17th International Workshop on Semantic Evaluation (SemEval-2023) co-located with the 61st Annual Meeting of the Association for Computational Linguistics (ACL 2023).

2018-2021   **President's Doctoral Scholar Award,** awarded by the University of Manchester.

Publications

The complete list of Marco's publications can be found on Google Scholar. Here is a selection of representative works:

1. **Marco Valentino**, Jordan Meadows, Lan Zhang, André Freitas. *Multi-Operational Mathematical Derivations in Latent Space*. To appear in Proceedings of the 2024 Annual Conference of the North American Chapter of the Association for Computational Linguistics (NAACL 2024).

2. Jordan Meadows, **Marco Valentino**, Damien Teney, André Freitas. *A Symbolic Framework for Evaluating Mathematical Reasoning and Generalisation with Transformers*. To appear in Proceedings of the 2024 Annual Conference of the North American Chapter of the Association for Computational Linguistics (NAACL 2024).

3. Yingji Zhang, **Marco Valentino**, Danilo S. Carvalho, Ian Pratt-Hartmann, André Freitas, *Graph-Induced Syntactic-Semantic Spaces in Transformer-Based Variational AutoEncoders*. To appear in Findings of the 2024 Annual Conference of the North American Chapter of the Association for Computational Linguistics (NAACL 2024).

4. Xin Quan, **Marco Valentino**, Louise A. Dennis, André Freitas. *Enhancing Ethical Explanations of Large Language Models through Iterative Symbolic Refinement*. To appear in Proceedings of the 18th Conference of the European Chapter of the Association for Computational Linguistics (EACL 2024).

5. **Marco Valentino**, Danilo S. Carvalho, André Freitas. *Multi-Relational Hyperbolic Word Embeddings from Natural Language Definitions*. To appear in Proceedings of the 18th Conference of the European Chapter of the Association for Computational Linguistics (EACL 2024).

6. Yingji Zhang, Danilo S. Carvalho, **Marco Valentino**, Ian Pratt-Hartmann, André Freitas. *Improving Semantic Control in Discrete Latent Spaces with Transformer Quantized Variational Autoencoders*. To appear in Findings of the 18th Conference of the European Chapter of the Association for Computational Linguistics (EACL 2024).

7. Mael Jullien, **Marco Valentino**, Hannah Frost, Paul O'Regan, Donal Landers, André Freitas. 2023. ***NLI4CT: Multi-Evidence Natural Language Inference for Clinical Trial Reports***. In Proceedings of The 2023 Conference on Empirical Methods in Natural Language Processing (EMNLP 2023). DOI: https://doi.org/10.18653/v1/2023.emnlp-main.1041

8. Julia Rozanova, **Marco Valentino**, André Freitas. 2023. ***Interventional Probing in High Dimensions: An NLI Case Study***. In Findings of the 1the 17th Conference of the European Chapter of the Association for Computational Linguistics (EACL 2023). DOI: https://doi.org/10.18653/v1/2023.findings-eacl.188

9. **Marco Valentino**, Mokanarangan Thayaparan, André Freitas. 2022. ***Case-Based Abductive Natural Language Inference***. In Proceedings of the 1the 29th International Conference on Computational Linguistics (COLING 2022). URL: https://aclanthology.org/2022.coling-1.134/

10. **Marco Valentino**, Mokanarangan Thayaparan, Deborah Ferreira, André Freitas. 2022. ***Hybrid Autoregressive Inference for Scalable Multi-hop Explanation Regeneration***. In Proceedings of the 36th AAAI Conference on Artificial Intelligence (AAAI 2022, Main track, Oral). DOI: https://doi.org/10.1609/aaai.v36i10.21392

11. Mokanarangan Thayaparan, **Marco Valentino**, Deborah Ferreira, Julia Rozanova, André Freitas. 2022. ***Diff-Explainer: Differentiable Convex Optimization for Explainable Multi-hop Inference***. Transactions of the Association for Computational Linguistics (TACL, presented at EMNLP 2022). DOI https://doi.org/10.1162/tacl_a_00508

12. Deborah Ferreira, Mokanarangan Thayaparan, **Marco Valentino**, Julia Rozanva, André Freitas. 2022. ***To be or not to be an Integer? Encoding Variables for Mathematical Text***. In Findings of the 60th Annual Meeting of the Association for Computational Linguistics (ACL 2022). DOI: https://doi.org/10.18653/v1/2022.findings-acl.76

13. **Marco Valentino**, Ian Pratt-Hartmann, André Freitas. ***Do Natural Language Explanations Represent Valid Logical Arguments? Verifying Entailment in Explainable NLI Gold Standards***. In Proceedings of the 14th International Conference on Computational Semantics (IWCS 2021). URL: https://aclanthology.org/2021.iwcs-1.8

14. **Marco Valentino***, Mokanarangan Thayaparan*, André Freitas. 2021. ***Unification-based Reconstruction of Multi-hop Explanations for Science Questions***. In Proceedings of the 16th Conference of the European Chapter of the Association for Computational Linguistics (EACL 2021). DOI: https://doi.org/10.18653/v1/2021.eacl-main.15

15. Deborah Ferreira*, Julia Rozanova*, Mokanarangan Thayaparan*, **Marco Valentino***, André Freitas. 2021. ***Does My Representation Capture X? probe-ably***. In Proceedings of the 59th Annual Meeting of the Association for Computational Linguistics (ACL 2021): System demonstrations. DOI: https://doi.org/10.18653/v1/2021.acl-demo.23

16. Mokanarangan Thayaparan, **Marco Valentino**, André Freitas. 2021. ***Explainable Inference Over Grounding-Abstract Chains for Science Questions***. In Findings of the 59th Annual Meeting of the Association for Computational Linguistics (ACL 2021). DOI: https://doi.org/10.18653/v1/2021.findings-acl.1

17. Viktor Schlegel, **Marco Valentino**, André Freitas, Goran Nenadic, Riza Batista-Navarro. 2020. ***A Framework for Evaluation of Machine Reading Comprehension Gold Standards***. In Proceedings of the 12th Language Resources and Evaluation Conference (LREC 2020). Link: https://aclanthology.org/2020.lrec-1.660/

Workshops

Marco contributed to the organization of the following international workshops:

1. **MathNLP: The 2nd Workshop on Mathematical Natural Language Processing.** Co-located with The 2024 Joint International Conference on Computational Linguistics, Language Resources and Evaluation (LREC-COLING 2024). May 21, 2024. Turin, Italy.

2. **TextGraphs-17: Graph-based Methods for Natural Language Processing.** Co-located with The 62nd Annual Meeting of the Association for Computational Linguistics (ACL 2024). August 11–16, 2024. Bangkok, Thailand.

3. **MathNLP: The 1st Workshop on Mathematical Natural Language Processing.** Co-located with The 2022 Conference on Empirical Methods in Natural Language Processing (EMNLP 2022). December 8, 2022. Abu Dhabi.

4. **TextGraphs-16: Graph-based Methods for Natural Language Processing.** Co-located with The 29th International Conference on Computational Linguistics (COLING 2022). October 16, 2022. Gyeongju, Republic of Korea.

Competitions

Marco contributed to the organization of the following international competitions:

1. **Semeval-2024 Task 2: Safe Biomedical Natural Language Inference for Clinical Trials.** To be part of The 17th International Workshop on Semantic Evaluation (Semeval-2024) co-located with the 2024 Annual Conference of the North American Chapter of the Association for Computational Linguistics (NAACL 2024). Mexico City, Mexico.

2. **Semeval-2023 Task 7: Multi-evidence Natural Language Inference for Clinical Trial Data (NLI4CT).** The 17th International Workshop on Semantic Evaluation (Semeval-2023) co-located with The 61st Annual Meeting of the Association for Computational Linguistics (ACL 2023). Toronto, Canada.

3. **TextGraphs 2022 Shared Task on Natural Language Premise Selection.** TextGraphs-16: Graph-based Methods for Natural Language Processing, co-located with The 29th International Conference on Computational Linguistics (COLING 2022). Gyeongju, Republic of Korea.

4. **TextGraphs 2021 Shared Task on Multi-Hop Inference for Explanation Regeneration.** The Fifteenth Workshop on Graph-Based Methods for Natural Language Processing (TextGraphs-15), co-located with The 2021 Annual Conference of the North American Chapter of the Association for Computational Linguistics (NAACL 2021). Virtual Conference.

Talks, Tutorials and Seminars

1. November 2024. *Reasoning with Natural Language Explanations*. Tutorial accepted at the 2024 Conference on Empirical Methods in Natural Language Processing (EMNLP 2024). Miami, Florida, United States.

2. March 2023. *Abstract Reasoning*. Making Sense of ChatGPT. Idiap Research Institute. Martigny, Switzerland.

3. May 2023. *Transformers: Evoluzione e Limiti della Tecnologia Sottostante ChatGPT*. Fra Antico e Futuro: La Filologia nell'Era dell'Intelligenza Artificiale. Sapienza University of Rome. Rome,

Italy.

4. April 2022. *Explainable Natural Language Inference*. ITEE Seminars. University of Naples Federico II. Naples, Italy.

5. April 2022. *An Introduction to Deep Learning for Natural Language Processing*. ITEE Seminars, University of Naples Federico II. Naples, Italy.

6. February 2022. *Hybrid Autoregressive Inference for Scalable Multi-hop Explanation Regeneration*. The 36th AAAI Conference on Artificial Intelligence (AAAI 2022). Virtual Conference.

7. November 2019. *Identifying Supporting Facts for Multi-hop Question Answering with Document Graph Networks*. TextGraphs-13 at the 2019 Conference on Empirical Methods in Natural Language Processing (EMNLP 2019). Hong Kong, China.

8. June 2018. *Adaptive Workflows of Home-care Services*. 27th IEEE International Conference on Enabling Technologies: Infrastructure for Collaborative Enterprises (WETICE-2018). Paris, France.

Community Services

Marco served as an area chair (action editor) at the following conferences:

ACL Rolling Review (2024-current), The Annual Meeting of the Association for Computational Linguistics (ACL 2024).

Moreover, Marco served as a reviewer at the following conferences and workshops:

ACL Rolling Review (2023 and 2024), The Annual AAAI Conference on Artificial Intelligence (AAAI 2023), The Annual Meeting of the Association for Computational Linguistics (ACL 2023), The Conference on Empirical Methods in Natural Language Processing (EMNLP 2022 and 2023), The International Joint Conferences on Artificial Intelligence (IJCAI 2023 and 2024), The North American Chapter of the Association for Computational Linguistics (NAACL 2024), The European Chapter of the Association for Computational Linguistics (EACL 2023 and 2024), eXplainable AI approaches for deep reinforcement learning (XAI4DRL at AAAI 2024), eXplainable AI approaches for debugging and diagnosis (XAI4Debugging at NeurIPS 2021).