Samuele Bortolotti

PH.D. STUDENT IN COMPUTER SCIENCE

samuele.bortolotti@unitn.it | samuelebortolotti.github.io | samuelebortolotti | samuele-bortolotti

Education

University of Trento

Trento, IT

PH.D. IN COMPUTER SCIENCE

Nov. 2023 - Current

- **Supervisors**: Professor Stefano Teso and professor Andrea Passerini
- **PhD Scholarship:** Trustworthy Neuro-Symbolic Machine Learning

University of Trento

Trento, IT

MASTER'S DEGREE IN COMPUTER SCIENCE

Sept. 2021 - Oct. 2023

- **GPA**: 4.0/4.0
- **Grade**: 110/110 cum laude
- **Final dissertation**: *"From Models to Arguments and Back", supervised by professors Andrea Passerini and Stefano Teso*

University of Trento

Trento, IT

BACHELOR'S DEGREE IN COMPUTER SCIENCE

Sept. 2018 - Jul. 2021

- **GPA**: 4.0/4.0
- **Grade**: 110/110 cum laude
- **Final dissertation**: *"Analysis of user warnings in Wikipedia", supervised by professor Alberto Montresor*

Work Experience

Structured Machine Learning Group

Trento, IT

RESEARCH INTERN

Nov. 2022 - Jun. 2023

- Work on a novel interactive multi-shot debugging protocol that allows the exchange of arguments between a machine and a user in order to correct the model's beliefs.
- Integrate state-of-the-art eXplainable Artificial Intelligence techniques, such as the 'Right for the Right Reasons' loss, into structured prediction output Neuro-Symbolic models like Coherent Hierarchical Multi-label Classification Networks and Semantic Probabilistic Layers.
- Successfully recover the performance of confounded models in the field of hierarchical classification.

Eurecat - Centre Tecnològic de Catalunya

Barcelona, ES

JUNIOR DATA SCIENTIST

May. 2021 - Jun. 2021

- Extract Wikipedia data from the Wikipedia dumps - *937GB bz2 and 157GB 7z compressed*.
- Design an effective way to extract and analyze the languages spoken by the Wikipedia users - *109'452 database entries*.
- Develop a strategy to retrieve Wikipedia users' *User Warnings* and *Wikibreaks*, studying how they affect the users' activity level - respectively *25'843 and 2'777'181 database entries*.
- Build an automated pipeline to download the dumps, extract the data, and compute the statistics using Docker.

Alysso Srl

Trento, IT

JUNIOR SOFTWARE DEVELOPER

Jul. 2017 - Aug. 2017

- Create corporate libraries with the aim of handling database connections regardless of the database management system (SQLite, PostgreSQL, MySQL, and Oracle) in Java.
- Develop a Java-based internal software function that can calculate the distance between two buildings using GIS data.
- Develop a web application in HTML5, CSS3, and JavaScript to show the obtained results.

Social IT

Trento, IT

JUNIOR SOFTWARE DEVELOPER

Jun. 2016 - Jul. 2016

- Contribute to the development of an internal Customer Relationship Management System using Java, JavaScript, HTML5, CSS3, and MySQL.

Publications

A Benchmark Suite for Systematically Evaluating Reasoning Shortcuts

Preprint. Under review

S. BORTOLOTTI*, E. MARCONATO*, T. CARRARO, P. MORETTIN, E. VAN KRIEKEN, A. VERGARI, S. TESO AND A. PASSERINI

14 Jun 2024

- Powerful neural classifiers have raised interest in learning and reasoning problems, but these often suffer from reasoning shortcuts (RSs), where models solve tasks without correctly linking learned concepts to the intended semantics. `rsbench` is a new benchmark suite for evaluating the impact of RSs in tasks requiring both learning and reasoning. It provides customizable tasks and metrics to assess concept quality and detect RSs, highlighting the ongoing challenge of achieving high-quality concept learning in neural and neuro-symbolic models.
- * = Equal contribution.

BEARS Make Neuro-Symbolic Models Aware of their Reasoning Shortcuts *UAI 2024*

E. Marconato*, **S. Bortolotti***, E. van Krieken*, A. Vergari, A. Passerini and S. Teso *20 Feb 2024*

- Neuro-Symbolic (NeSy) models can be affected by Reasoning Shortcuts (RSs), requiring costly dense supervision for effective mitigation. `bears` (BE Aware of Reasoning Shortcuts) presents a way to calibrate concept-level confidence without compromising prediction accuracy. This encourages NeSy architectures to present uncertainty about RS-affected concepts. Empirical results show that bears enhances RS-awareness in state-of-the-art NeSy models, facilitating the acquisition of informative dense annotations for mitigation.
- * = Equal contribution.

Projects

University

DarkrAI: a Pareto epsilon-greedy policy [code][report] *Python*

Member *Apr. 2022 - Jul. 2022*

- Train two ε-greedy reinforcement learning agents in the field of Pokémon battles.
- Compare the performances between classic deep Q-learning and an ε-greedy strategy which chooses Pareto optimal moves employing NSGA-II for the first part of the training.
- Conduct a quantitative analysis using the Wilcoxon Rank Sum Test on the obtained results, showing a significant improvement in the episode reward distribution for the proposed agent (p-value = 2.886e-12).

UDA (Unsupervised Domain Adaptation) [code] *Python*

Team Leader *Apr. 2022 - Jul. 2022*

- Replicate and adapt a collection of methods concerning unsupervised domain adaptation techniques such as Deep Domain Confusion, Domain Adversarial Neural Networks, and Domain Separation Networks.
- Enhanced the Entropy Minimization vs. Diversity Maximization architecture, a state-of-the-art network for unsupervised domain adaptation, by integrating other approaches from the literature.
- Achieved a significant gain of 15.76 from product images to real-life and 2.86 from real-life to product images, thereby improving the ResNet18 baseline.

Neural PRNU Extractor [code] *Python*

Team Leader *Nov. 2021 - Feb. 2022*

- Develop a pipeline to perform noise extraction from a set of camera images and achieve camera identification using the estimated PRNU.
- Adapt a PRNU estimation algorithm [DOI] in order to deal with noise extracted by a neural network [CODE].
- The neural network is based on FFDNet which works with different noise levels and uses state-of-the-art convolutional neural network structures.

Extracurricular Training

Nordic Probabilistic AI School *Copenhagen, DK*

Attendee *Jun. 2024*

- **Acceptance rate**: 18%.
- **Topics**: Probabilistic models, bayesian workflow, variational inference and optimization, deep generative models, diffusion models, monte carlo methods, probabilistic circuits, gaussian processes and causal inference.

Skills

Programming	Python (proficient), Java (proficient), Ruby (intermediate), JavaScript (intermediate), TypeScript (intermediate), R (intermediate), C++ (intermediate), C (intermediate), C# (academic), Matlab (academic)
Miscellaneous	Linux, Git, GitHub, LaTex, SQL, PyTorch, TensorFlow, Keras
Languages	English (C1), Italian (native), German (A2)

Honors & Awards

2022 **Merit Grant,** Premio allo studio Marco Modena (Cassa Rurale Alto Garda - Rovereto, Trento, IT) *Trento, IT*

2023 **Ph.D. scholarship,** Three year sponsorship: rank 6th out of 120 participants *Trento, IT*