Riccardo Campanella

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WORK EXPERIENCE

Software Engineer - Backend Engineering Dubai, United Arab Emirates
HOTDESK *January 2023 – June 2023*

- Worked with Python using **Django** framework, **REST APIs** and **Swagger** to **enhance existing systems.**
- Worked with **Docker** and **Pipelines.**
- Tested and debugged features by providing **automated test cases.**
- Provided **Design Documents** for features.

Software Engineer - Innovation Advanced Technology Cosenza, Italy
NTT DATA *September 2022 – March 2023*

- Worked with **Python** using **OpenCV** library to find the best algorithm to perform an **Image Recognition** task.
- Worked with **Blockchain DLT** for Enterprise to update a **CorDapp** using **Java** for the European Banking System.
- Updated **a Spring MVC App** working as **Java backend developer.**
- Fundamentals of **Agile** & **DevOps**, **Microservices**: Architectures & Frameworks and **JavaEE** programming.

Software Engineering Intern Cosenza, Italy
Info Edge Technology *July 2022 - August 2022*

- Worked with **Scala** to convert a **C++** application used in Distributed Systems.
- Fundamentals of **Scala.**

EDUCATION

Master's degree in Artificial Intelligence Utrecht, Netherlands
Utrecht University *September 2023 – September 2025*

Fairness and Explainability

- Trained a Logistic Regression classifier on the COMPAS dataset to measure **(Intersectional) Fairness** using pre-processing methods as **Reweighing** and post-processing as **Equalized odds**.
- Trained **Logistic Regression** on the ChaLearn LAP-FI dataset to measure **Feature Importance** and **Feature effect**. Trained a **Multi-layer Perceptron** to interpret and explain its decision with Model-agnostic methods as **PDP, ICE and PFI**.
- Trained **Bayesian Networks, RuleFit, EBM and Neural Network** on the US-130 Diabetes dataset to identify the **factors** that contribute the most **over time** to a diabetes patient being re-admitted and the **features** that influence **readmission** risk in diabetic patients.

Natural Language Processing

- Estimate **N-gram models** of different order from Treebank corpus to get **Sentence probability** and evaluate the **Perplexity**. Implemented the **Viterbi algorithm** for sequence modeling to recover the most likely sequence underlying the input sequence and the **CKY** algorithm to find all the possible ways to parse the input with a predefined grammar.
- Trained on several data from nltk two **LSTM-based UPOS taggers**, one with randomly initialized embeddings while another reusing the **GloVe** embeddings. Used **BERT transformer** model's contextualized word embeddings to tackle the **word sense disambiguation**.
- Designed and implemented **Probes** for **masked language modeling** in **BERT** to interpret the outputs of language models and probe **features** to understand how closely LLMs resembles **human language** use/knowledge.

Computer Vision

- **Computer Vision tasks**: Geometric camera calibration, Voxel-based 3D reconstruction, Color-based voxel labeling, Trained-validated-tested **LeNet5** and variants (CNN), Created **Two-stream CNN** for Action recognition with focus on **Transfer learning** and additional use of **Optical flow** and combination of CNN outputs.

Philisophy of AI

- Composed a paper about **LLM's Internal testing** involving **Mechanistic Reasoning** to assess the real model capabilities of intelligence based on Commonsense Reasoning. Using interpretability methods, the core features of **Commonsense Reasoning** are uncovered through two **Cognitive Theories of Mind**.

Reinforcement Learning

- Implemented two **Reinforcement Learning** agents using **Semi-gradient SARSA** and **Q-learning** algorithms with a **Linear Approximation** function to complete an **Episodic MDP** task.

- Implemented Reinforcement learning **Epsilon-greedy algorithm** to solve a k-armed bandit problem in custom environment based on **Open-AI gymnasium framework**. Evaluated on a 10-armed Testbed.

Causal Inference

- Estimated the **causal-effect** of patient's drug dosage taken on the recovery based on observational and experimental data of a **Structural Causal Model**.
- Implemented the PC algorithm to discover causal relations on sachs2005_combined dataset, following the paper *Causal Protein-Signaling Networks Derived from Multiparameter Single-Cell Data.*

Machine Learning, Deep Learning

- Magnetoencefalography **(MEG)** data classification to infer brain states with **CNNs, RNNs** and **Transformers**. Based on the paper *Deep brain state classification of MEG data (2020).*
- Handwritten digit classification, MNIST dataset, using **Logistic regression** and **Support Vector Machines** with **handcrafted features.**

Machine Learning for CV and NLP, Methods of AI for research

- Learned **Word vectors** based on **GloVe** for Word Representation and developed **Recurrent Neural Network**-based **Sequence model.**
- Identified handwritten numbers and objects from images using the **Keras** library for Python to implement **Deep Convolutional Neural Networks.**
- Designed, implemented, evaluated a **Recommendation Dialog System** by employing Domain modeling and Text classification leveraging **Supervised Machine Learning** algorithms.

Bachelor's degree in Computer Engineering Cosenza, Italy
University of Calabria *Graduation date - June 2022*

- Created Custom circuit working with **Xilinx Vivado** using **VHDL**
- Developed Web-app based on **Java** using **IntelliJ**, **PostgreSQL** for the backend and **Flutter** for frontend.
- Graduate Thesis "Deep Neural" about **Deep Neural Networks training and evaluation strategies**

EXTRACURRICULAR COURSES

Masterclass: Methods for Spatially-Extended Neurobiological Networks Utrecht University**,** May 2024

- Implemented tutorials of Numerical and Analytical Methods for Spatially-Extended Neurobiological Networks by Dr. Daniele Avitabile **at** Centre for Complex Systems Studies

AI Safety Fundamentals Course Utrecht, Drift 23
Effective Altruism Utrecht *September 2023 - December 2023*

- Final-project: demonstrated **Goal Misgeneralization** with a **DeepQlearningNetwork (DQN)** on a **Reinforcement learning** task.

Mathematics for Machine Learning Specialization, Imperial College London Coursera, 2023

CHALLENGES

AI for Life Sciences Hackathon (AI and Hydrology) TAIKAI online platform, July 2024 – September 2024

- Identify and rank the **exogenous variables** for **forecasting the GRACE time series (**groundwater data) by evaluating the variable's predictive power. Challenge proposed by the University of Vienna.

InnovAId Hackaton (AI and Healthcare) Utrecht Medical Center, November 2023

- Proposed **NLP-based approaches** to solve a predictive troubleshooting problem: used **BoW**, **Google Word2Vec** model using SONAR-combined dataset, and **Google Transformer BERT** to recommend preemptive actions on infusion pumps.

TECHNICAL SKILLS

Programming Languages

- **AI**: Python, R
- Backend development: **Java, Python**
- **Blockchain**: Java, Kotlin, Scala

Frameworks

- **AI**: TensorFlow, Scikit-learn, OpenCV, Pytorch, OpenAI Gymnasium
- Backend: Spring, Django
- Frontend: Angular, Flutter
- Blockchain: R3 Corda

Languages: English (C1), Italian (Native)