# Aidin Attar

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## Profile

Physicist with a strong background in Physics of Data and expertise in machine learning, data science, and computational modeling. Proficient in Python and machine learning frameworks, with hands-on experience in developing predictive models, analyzing complex datasets, and applying advanced computational techniques to solve real-world problems. Achieved state-of-the-art results in Spiking Neural Networks for object detection and contributed to cutting-edge research in neuromorphic computing. Skilled in time-series forecasting, big data integration, and algorithmic trading strategies, with a passion for leveraging physics-inspired approaches to drive innovation in data-driven fields. Graduated with 110/110 cum laude from the University of Padova. Seeking to apply my interdisciplinary expertise in physics and machine learning to tackle challenging problems in research and industry.

## Education

**Università degli Studi di Padova**, MS in Physics of Data — Sept 2021 – Dec 2024

- GPA: 110/110 cum laude
- **Coursework:** Machine Learning, Deep Learning, Statistical Mechanics, Theoretical Physics Models, Computational Physics, Human Data Analytics, Big Data, Financial Mathematics
- **Thesis:** Exploration of Deep Spiking Neural Network Architectures for Reward-Modulated STDP Learning (link)

**Università degli Studi di Padova**, BS in Physics — Sept 2017 – Apr 2021

- GPA: 106/110
- **Coursework:** Classical Mechanics, Quantum Mechanics, Electromagnetism, Thermodynamics, Computational Physics, Mathematical Methods in Physics, Experimental Physics, Solid State Physics, Programming in Python, Data Structures and Algorithms, Numerical Methods, Scientific Computing, Data Analysis and Visualization
- **Thesis:** Search of gravitational waves signal due to post merger phase of neutron star binary merger (link)

**Liceo Scientifico A. Roiti – Ferrara, Italy**, High School Diploma — Sept 2012 – July 2017

- GPA: 100/100
- Focused on mathematics, physics, and computer science, laying the foundation for my technical and analytical skills.

## Experience

**Research Intern**, SIGNET LAB – Padova, Italy — Mar 2024 – Dec 2024

- Conducted research on Spiking Neural Networks under the supervision of Prof. Michele Rossi, focusing on object detection and achieving state-of-the-art results.
- Designed and implemented SNN models using Python, PyTorch, snntorch, and SpykeTorch, optimizing performance for real-world applications.
- Developed novel algorithms for object detection, significantly improving accuracy and efficiency compared to existing methods.
- Currently preparing the work for publication, contributing to advancements in neuromorphic computing and energy-efficient AI.

**Quant Analyst**, XSOR Capital – London, UK — June 2022 – Dec 2023

- Designed and implemented machine learning models to analyze and predict complex systems, with applications in algorithmic decision-making.
- Developed a Python-based framework for backtesting and deploying predictive models in real-time environments.
- Applied advanced machine learning techniques, including time-series forecasting and deep learning, to improve

model accuracy and performance.

- Integrated data pipelines from multiple providers and platforms, ensuring efficient data processing and analysis.

## Projects

**Object Recognition using SNNs** github.com/aidinattar/snn

- Developed several SNNs architectures and trained them using biologically inspired STDP and R-STDP learning rules that more closely mimic the neural mechanisms of the brain, offering potential advantages in computational efficiency and power consumption
- Tools Used: Python, PyTorch, snnTorch, SpykeTorch

**Patient Activity Recognition with Radio Waves** github.com/aidinattar/radio-wave-activity-detection

- Developed a contactless human activity recognition system using mmWave radar devices for healthcare and security applications, ensuring privacy preservation. Conducted experiments in two environments (homelab and hospital) with 23 subjects, processing range and Doppler data (including micro Doppler). Explored micro Doppler generation using GANs to create realistic synthetic data, reducing the need for extensive real-world data collection. Built end-to-end pipelines for data preprocessing, model training, and evaluation, achieving high accuracy in activity recognition.
- Tools Used: Python, PyTorch, OpenCV, scikit-learn

**Small-footprint Keyword Spotting with Convolutional Neural Networks** github.com/aidinattar/AudioKWS

- Designed and implemented a CNN-based keyword spotting system to detect specific words in speech, optimized for low-resource, edge-computing applications. Utilized the Google Speech Commands Dataset and extracted log Mel filterbank coefficients for feature extraction.
- Tools Used: Python, TensorFlow/Keras, scikit-learn

**Real-Time Cosmic Ray Detection** github.com/aidinattar/CosmicRays-LiveDashboard–Spark-Kafka

- Developed a real-time data processing pipeline for cosmic ray detection using Drift Tubes detectors, enabling live monitoring of detector quality. Processed and analyzed muon hits using distributed frameworks (PySpark) and streamed results via Kafka for real-time visualization. Built a live dashboard using Bokeh/Matplotlib to display histograms, active channel counts, and drift time analysis.
- Tools Used: Python, Kafka, PySpark, S3.

**Volatility Modeling and Trading Signals** github.com/aidinattar/Volatility-carry-trading-strategy

- Developed multi-factor statistical models to estimate and predict the UX1 and UX2 indices (futures on the VIX) for volatility forecasting. Created trading signals to determine optimal entry (short position) and exit points based on volatility conditions.
- Tools Used: Python, statistical modeling libraries (e.g., SciPy, Statsmodels), financial data APIs.

**Delay Time Distribution of Binary Compact Objects** github.com/aidinattar/BBH-Delay-Time

- Conducted research on gravitational waves and binary compact objects, calculating delay time distributions (time between binary star formation and merger) using Euler and Runge-Kutta methods. Implemented adaptive time-step algorithms to optimize computational efficiency and trained random forest models to predict delay times with high accuracy.
- Tools Used: Python, NumPy, SciPy, PyROOT, Scikit-learn, XGBoost, TensorFlow.

**Particle Decay Reconstruction** github.com/aidinattar/cxx-particle-reco

- Developed a C++-based simulation and analysis framework to reconstruct the decay of strange particles ($K_S^0$ and $\Lambda^0$) and compute their invariant mass and decay time, reproducing the pipeline used at CERN. Implemented object-oriented programming principles, including classes, inheritance, and STL containers, to handle particle data and perform statistical analysis.
- Tools Used: C++, ROOT, STL, object-oriented design patterns.

**FIR Filter Implementation for PMOD Audio Processing** github.com/aidinattar/PMOD-FIR-filter-VHDL

- Designed and implemented a 15th-order FIR filter in VHDL to process audio signals from a PMOD I2S2 module on an FPGA, applying both low-pass and high-pass filtering. Developed a UART communication protocol to

transmit filtered audio data to a PC for analysis and visualization. Simulated and validated the design using Vivado, achieving expected frequency response and filtering behavior.

- Tools Used: VHDL, Vivado, Python (for data analysis), PMOD I2S2, FPGA.

## Technologies

**Languages:** C++, C, Objective-C, SQL, Python, Julia, R, VHDL, LaTeX

**Machine Learning Frameworks:** TensorFlow, PyTorch, Scikit-learn, XGBoost

**Data Analysis Tools:** NumPy, Pandas, Matplotlib, SciPy, ROOT

**Big Data Tools:** Kafka, Dask, PySpark

**Hardware Programming:** VHDL, Vivado, FPGA

**Version Control:** Git, GitHub, GitLab

**Cloud Platforms:** AWS S3, Google Cloud

**Development Tools:** VS Code, LaTeX, SSH

**Productivity Tools:** Microsoft Word, Excel, PowerPoint

**Operating Systems:** Windows, Linux

## Hobbies

**Cinema:** Enthusiastic about exploring diverse genres of cinema, fostering creativity and cultural awareness.

**Chess:** Passionate about chess, which enhances strategic thinking and problem-solving skills.

**Books:** Avid reader of fiction and philosophy, with a particular interest in exploring human nature and existential themes.