Betteti Simone

University of Padua

Education

2016–2019 **B.Sc. Psychological Science**, *University of Padua*, Padova, IT, Graduation mark: 110 Cum Laude/110; GPA: 28.15/30.
Thesis: 'Structure Development in Dynamically Pruned ANNs'

2019–2022 **M.Sc. Mathematical Engineering**, *Univerisity of Padua*, Padova, IT, Graduation mark: 110 Cum Laude/110; GPA: 28.97/30.
Thesis: 'The Relationship Between MSR and Network Properties in Simple Neural Networks of the Cortex'

2022-2025 **Ph.D. Information Engineering**, *University of Padua*, Padova, IT, Project: Mathematical Models for the Virtual Brain.

Publications

1 **Betteti S.,Baggio G., and Zampieri S.**, *On the capacity of continuous-time Hopfield models*, 2024 63rd IEEE Conference on Decision and Control (Accepted), 2024.

2 **Betteti S., Baggio G., Bullo F., and Zampieri S.**, *"Input-Driven Dynamics for Robust Memory Retrieval in Hopfield Networks"*, arXiv, 2024.

3 **Betteti S., Baggio G., Bullo F., and Zampieri S.**, *"Firing Rate Models as Associative Memory: Excitatory-Inhibitory Balance for Robust Retrieval"*, arXiv, 2024.

Internships

**February-
July
2019**

Project/Thesis, *Computational Cognitive Neuroscience Lab*, Padova.
Achievements:
- Development of an evolutionary pruning process for a Deep Belief Network (DBN).
- Development of equally effective DBNs architectures with high sparsity (.15 active synaptic connections at the end of training).
- Assessment of topological similarities between synaptic explosion/pruning in biological neuronal development and DBNs.

Supervisors*: Prof. Testolin A., Prof. Suweis S.S.*

**August-
December
2021**

Thesis, *Kavli Institute for Systems Neuroscience, NTNU*, Trondheim.
Achievements:
- Spike series analysis by means of Multiscale Relevance (MSR).
- Development of spiking neural networks exhibiting sustained chaotic activity.
- Analysis of the dependence of MSR on topological network properties.

Supervisors*: Prof. Suweis S.S., Prof. Roudi Y.*

**September
2024, June
2025**

Research visit, *Center for Control, Dynamical Systems and Computation, UCSB*, Santa Barbara, CA.
Achievements (in progress):
- Study of classical rate models for associative memory and modern Hopfield architectures for the improvement of transformer models.
- Study of stochastic processes and their associated probability measure, with a close focus on its convergence properties.
- Study of the equilibrium tracking problem for systems with noise, where the equilibrium trajectory depends on the first moment of the stochastic process.

Supervisors*: Prof. Zampieri S., Prof. Bullo F., Prof. Baggio G.*

Summer Schools

**September
2019**

Summer School, *Computational and Theoretical Models in Neuroscience*, Venice, IT.
Achievements:
- Study of signaling in Neuronal populations.
- Inference of functional and physiological connectivity from time series of neuronal clusters' signaling.

August 2021

Summer School, *Mathematical Methods in Computational Neuroscience*, Online.
Lectures on:
- Reinforcement Learning.
- Dimensionality Reduction techniques.
- Automata.
- Spiking Neural Networks.

September 2023	**Fall School**, *EITN School In Computational Neuroscience*, Paris, FR.
	Achievements:
	○ Comprehensive study of biophysical, mean field, and whole brain models.
	○ Simulation of synaptic dynamics for single neurons.
July 2024	**Summer School**, *SIDRA*, Bertinoro, IT.
	Achievements:
	○ Study of nonlinear ordinary differential equations (ODEs) by means of Lyapunov theory.
	○ Application of suitable controls to steer the system towards the set of fixed points for the ODE dynamics.

Computer Skills

Python:	Full professional use
Matlab:	Full professional use
Java:	Beginner
SLURM:	Intermediate level user
LaTex:	Full professional use
Office:	Intermediate level user
Linux, Windows:	Intermediate level user

Language

Italian	Mother tongue
English	C2
French	A1