Joris Gentinetta

https://joris-gentinetta.github.io

jorisg@mit.edu
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Swiss Citizen

Languages:

German (proficient), English (proficient),
French (fluent), Spanish (basic fluent),

Programming Languages:

Proficient in Python,
Familiar with SQL, C++/C

Tools:

Linux CLI, Git, Raspberry Pi, PyTorch, Tensorboard, W&B, Pandas, Numpy, Tensorflow, Scikit-learn, Matplotlib, Ray

Core Skills:

Neural Data Analysis:

Developed a pipeline for spike sorting and connectivity / causality analysis. Built an optogenetic stimulation system. Working with the MIT Media Lab to develop algorithms to infer movement from EMG data.

Neural Network Theory:

Worked with IBM Research to develop an alternative to backpropagation through time (BPTT), enabling online learning in recurrent neural networks.

3D Computer Vision:

Worked on a project using image segmentation and graph neural networks for indoor localization. Created a system to train a prosthesis control system based on pose estimation. Built a device to track and shoot down mosquitos. Worked on a project to segment and track living cells.

Person

Passionate about cognition and technology since high school. Always working on some project. Active in swimming and rowing clubs, finished military service in a scout sniper unit, one year of backpacking and volunteer work in Africa and Central America.

Education

MSc Data Science ETH / MIT / SNU — 09/22-09/24

Neural Information Processing track: Focus on artificial intelligence and brain-like computation.
Exchange to SNU, South Korea in spring 2023.
Master's thesis at MIT in spring 2024

BSc Electrical Engineering and Information Technology ETH — 09/18-09/22

Projects in data analysis/machine learning as well as neuroinformatics.

Work Experience

Research Assistant at the ETH/UZH Institute of Neuroinformatics — 09/22-02/24

Goal: Studying the brain mechanisms for imitation learning.
Task: Building a monkey robot to interact with real Marmoset monkeys.
Role: Developing the specifications and framework, creating, coordinating, and supervising the student projects that lead to the completion of the robot.
Result: Lead the project from conception to deployment. Supervised both a bachelor's thesis and a master's student.

Internship at IBM Research Zurich — 11/22-10/23

Title: 'Biologically Inspired Online Training Algorithms with Neuromorphic Hardware'
Goal: Combining insights from neuroscience with advances from hardware accelerators to improve current learning algorithms.
Result: Reduced the memory complexity of the Online Spatio-Temporal Learning (OSTL) algorithm for RNNs from $O(n^2)$ to $O(n)$. Created a PyTorch framework for BPTT and OSTL training on simulated and real in-memory computing hardware as well as a tool to create and maintain a ray cluster within LSF batch systems.

Internship at ABB Semiconductors / Hitachi Energy 09/21-02/22

Goal: Defect classification and fault-pattern detection on semiconductor chips.
Result: Developed a Pytorch framework for efficient and automated model training, evaluation and comparison on a remote server, combined the pattern and classification projects developing a clustering algorithm considering both positional data as well as the output of the classification network and wrote a GUI to quickly analyze the output. The pipeline is now used productively.

Teaching Assistant at the ETH Institute for Mechanical Systems 09/19-12/20

Role: Independently teaching Engineering Mechanics to a group of 20 university students using self-developed material. Helping with exam correction.

Academic Projects

Master's Thesis (MIT Biomechatronics Group) 2024

Title: 'Machine Learning Driven Augmentation of Neuromuscular Modeling-Based Prosthesis Control'
Goal: Improving an existing modeling-based approach with neural network based EMG disentanglement, residual error correction and a novel data acquisition scheme based on pose estimation.

Semester Project (ETH Institute of Molecular Health Sciences) 2023

Title: 'Large Scale Cell Nuclei Tracking'
Goal: Tracking dividing cells in a Petri dish to study fluorescence intensity over time.
Result: Implemented an algorithm based on hierarchical segmentation and temporal overlap maximization.

Group Project (ETH Computer Vision and Geometry Group) 2022

Title: 'Indoor Image Retrieval Using Monocular Scene Graphs'
Goal: Solving the changing viewpoint issue in indoor localization through monocular images, by matching images through their learned scene graph representations.
Result: Scene Graph approach proven to be suboptimal, issues clearly outlined and reported.

Bachelor's Thesis (ETH Neurotechnology Group) 2021

Title: 'Functional Connectivity Analysis Pipeline for Anxiety Related Tasks – Extracting and Evaluating Single Unit Activity, Spike-Phase Locking and Movement Information'
Goal: Development of a data analysis pipeline using raw electrophysiological data to evaluate drug-based change of functional connectivity between the ventral hippocampus and the prefrontal cortex during anxiety related tasks.
Result: The pipeline used by the Neurotechnology Group in their experiments.

Group project (ETH Laboratory of Biosensors and Bioelectronics) 2020

Title: 'Optogenetic Stimulation of Biological Neuronal Networks in Vitro'
Goal: Development of an LCD and a DLP based stimulation setup for longtime use in an incubator.
Result: Based on our success, the supervising PhD student is now primarily using optogenetics to stimulate neurons instead of electric potentials.
Role: Initiator of the project and coordinator of the group of 5 people.

Personal Projects: https://joris-gentinetta.github.io

MIT Media Lab Foodcam Bot (2024) | Mosquito FLAK (2023) | Computation Cluster Build and Management (2022) | Numerai Tournament (2021) | Construction of a Bionic Hand (2016)

Publications

Online Spatio-Temporal Learning with Target Projection 2023

Conference: IEEE Conference for Artificial Intelligence Circuits and Systems (AICAS 2023)
Summary: An alternative algorithm to backpropagation through time (BPTT), solving the weight-symmetry and update locking challenges, enabling online learning in recurrent neural networks.
Available from: https://ieeexplore.ieee.org/document/10168623, https://arxiv.org/abs/2304.05124