Federico Corradi, Ph.D.

Research & Development Scientist · Neuromorphic Engineering Expert

Ackersteinstrasse 62, 8049 Zürich

(+41) 78 776 45 81 | federico.corradi@gmail.com | www.federicocorradi.com | federicohyo | federico-corradi-19a69a17

Academic Experience

PostDoc Researcher, Neuromorphic Cognitive Systems Group

Zürich, Switzerland

University of Zürich

Jun. 2016 - Jan. 2017

- Working towards a new generation of brain-inspired computing platforms, i.e. neuromorphic processors. Development and implementation of deep neural networks algorithms in neuromorphic hardware. Exploring deep neural networks algorithms for visual pattern identification and classification. Development of neural network architectures tailored to neuromorphic hardware (processors, silicon retinas, and silicon cochleas).

Undergraduate Researcher, Neuromorphic Cognitive Systems Group

Zürich, Switzerland

University of Zürich

Mar. 2011 - Jul. 2015

- Worked for the EU FP7 ERC project Neurop 257219 project. One of the main goal was to build event-based VLSI models of cortical circuits for brain-inspired computation.
- Developed a variety of mixed-signal analog/digital VLSI neuromorphic devices (Spikebetter, ROLLS, Ziggi) for emulating basic processes and functions of neural spiking systems.
- Realized a neuromorphic system capable of recording from neural tissue. This system is conceived as event-based Brain-Machine Interface that exploits asynchronous logic to sense and transmit information collected from neural tissue

Employments

Inilabs GmbH

Zürich, Switzerland

Research & Development Scientist

2015 - now

- Inilabs develops and sells neuromorphic technologies.
- Characterization of a variety of Dynamic Vision Sensors, DAVIS and DVS. Development of a new generation of DVS.
- Characterization and development of the Dynamic Neuromorphic Asynchronous Processor, Dynap-se product.
- Involved in the Neuromorphic Processor Project (NPP) that is sponsored by Samsung. One of the main goals is to develop a digital deep neural network accelerator. Specifically, I have been working on developing Convolutional Neural Networks tailored toward easy implementation in the neural accelerator. These CNN exploit the sparse output data from the silicon retina (DVS).
- I am currently involved in a project that aims to achieve 3D scene reconstruction using an active vision system composed of an event-based dynamic vision sensor (DVS) and a laser.
- I am currently involved in a project that aims to achieve real-time tracking of moving objects in the environment. This project targets robotic industrial applications.

University of Zürich and ETH Zürich

Zürich, Switzerland

PostDoc Researcher

2016 - 2017

50% position in Neuromorphic Engineering, Neuroscience. Development of Neural Network algorithms for embedded systems.

Development of neuromorphic hardware.

Flyer Communication

Rome, Italy

System Administrator

2009 - now

Unix System administrator for a web-based company.

University of Zürich and ETH Zürich

Zürich, Switzerland

Ph.D. student

2011 - 2015

Ph.D. in Neuromorphic Engineering, Neuroscience.

Xoolab

Rome, Italy

Website Developer

2008/2009

Web developer in Php, Mysql, Ajax.

Immobiliare.it

Rome, Italy

Website Developer

2008

Web developer in Php, Mysql, Ajax.

Education

University of Zürich and ETH Zürich
Zürich, Switzerland

Ph.D. in Neuroscience and Natural Sciences — *2011 - 2015*

My Ph.D. has focused at the interface between neuroscience and neuromorphic engineering. I've been investigating basic research questions that are related to the way neural circuits carry out computation and at the same time in developing a new generation of computing technologies based on neuromorphic circuits on CMOS VLSI technology. The title of my Ph.D. dissertation is "Distributed Information Processing in Neural-Inspired Microelectronic Circuits". In addition, I have successfully completed the international Ph.D. program in Neuroscience offered by the UZH and ETH.

Università La Sapienza
Rome, Italy

M.Sc. in Physics — *2007 - 2010*

MSc Thesis at the Italian Institute of Health (ISS) under the supervision of Prof. P. del Giudice and Prof. L. Zanello. I've been working in the computational neuroscience field researching on neuromorphic hardware. The title of my MSc thesis is "Attractor Dynamics in a Network of Spiking Neurons on VLSI Neuromorphic Chips"

Universiteit Leiden
Leiden, The Netherlands

Intern in Physics Laboratory — *2005 - 2006*

Worked in the MiniGRAIL team that is part of the Quantum Physics and Applications at Ultra Low Temperatures in the Lion Laboratory under the supervision of Prof. Giorgio Frossati. I participated, as exchange student during the one year Erasmus program, in testing and developing electronic instruments at low temperature for the gravitational radiational antenna. Provided research for the BSc Thesis that has been presented in Parma University.

Università degli studi di Parma
Parma, Italy

B.Sc. in Physics — *2003 - 2007*

Title of my BSc thesis "Study of High Quality Factor Capacitive Transducers, for Gravitational Antennas".

Teaching Experience

UZH Teaching Assistant
Zürich, Switzerland

Universität Zürich — *Fall 2012*

- Neuromorphic Engineering I

UZH Teaching Assistant
Zürich, Switzerland

Universität Zürich — *Spring 2012*

- Neuromorphic Engineering II

ETH Teaching Assistant
Zürich, Switzerland

Eidgenössische Technische Hochschule Zürich — *Fall 2011*

- Laboratory Electronics: Analog Circuit Design

ETH Teaching Assistant
Zürich, Switzerland

Eidgenössische Technische Hochschule Zürich — *Spring 2011*

- Physics Laboratory

Unix Instructor
Rome, Italy

Performa s.r.l — *2009/2010*

- Unix System Administrator

Extracurricular Activity

Peer Reviewer IEEE Transactions on Circuits and Systems
Online

Institute of Electrical and Electronics Engineers, IEEE — *Sep. 2015 - PRESENT*

- Reviewed multiple papers on circuits and systems.

Peer Reviewer IEEE Transaction Neural Networks and Learning Systems
Online

Institute of Electrical and Electronics Engineers, IEEE — *Sep. 2012 - PRESENT*

- Reviewed multiple papers on neuromorphic engineering and learning systems.

Peer Reviewer Frontiers in Neuromorphic Engineering *Online*

Fronters in Neuroscience *Sep. 2015 - PRESENT*

- Reviewed multiple papers on neuromorphic engineering and learning systems.

IEEE Computational Intelligence Society *Online*

Member *Sep. 2014 - PRESENT*

- Gained expertise computational intelligence and learning systems.
- Participated on several IEEE conferences and won an award.

Honors & Awards

International

2014 **Honorary Mention**, For the manuscript entitled "Mapping Arbitrary Mathematical Functions and Dynamical Systems to Neuromorphic VLSI Circuits for Spike-based Neural Computation", by the Neural Systems and Applications Circuits and Systems Technical Committee — *ISCAS, Melbourne NSA Track*

Certification

Laser Safety Officer for technical applications *Zürich*

UVEX Academy *Feb. 2016*

- The title fulfills the requirements of the German D6UV rule 11 (hitherto BGV B2) 'Accident prevention regulation for laser beam'.

Peer-reviewed journal papers

A Sensitive Dynamic and Active Pixel Vision Sensor for Color or Neural Imaging Applications — *Biomedical Circuits and Systems, IEEE Transactions on - in press*, *2017*

D.P. Moeys, F. Corradi, Chenghan Li, S. Bamford, L. Longinotti, F. F. Voigt, S. Berry, G. Taverni, F. Helmchen, T. Delbruck

doi:10.1109/TBCAS.2017.2759783

NullHop: A Flexible Convolutional Neural Network Accelerator Based on Sparse Representations of Feature Maps — *IEEE Transactions on VLSI Systems - in press*, *2017*

A. Aimar, H. Mostafa, E. Calabrese, A. Rios-Navarro, R. Tapiador-Morales, I. Lungu, M. B Milde, F. Corradi, A. Linares-Barranco, SC Liu, T. Delbruck

A Neuromorphic Event-Based Neural Recording System for Smart Brain-Machine-Interfaces — *Biomedical Circuits and Systems, IEEE Transactions on, Vol. 99*, *2015*

F. Corradi, and G. Indiveri

doi:10.1109/TBCAS.2015.2479256

Real time unsupervised learning of visual stimuli in neuromorphic VLSI systems — *Nature Scientific Reports, Vol. 5*, *2015*

M. Giulioni, F. Corradi, V. Dante, and P. del Giudice

doi:10.1038/srep14730

A Re-configurable On-line Learning Spiking Neuromorphic Processor comprising 256 neurons and 128K synapses — *Frontiers in Neuroscience, Vol. 9*, *2015*

N. Qiao, H. Mostafa, F. Corradi, M. Osswald, F. Stefanini, D. Sumislawska, and G. Indiveri

doi:10.3389/fnins.2015.00141

Towards a Neuromorphic Vestibular System — *Biomedical Circuits and Systems, IEEE Transactions on, Vol. 8*, *2014*

F. Corradi, D. Zambrano, M. Raglianti, G. Passetti, C. Laschi, and G. Indiveri

doi:10.1109/TBCAS.2014.2358493

Peer-reviewed conference papers

Steering a Predator Robot using a Mixed Frame/Event-Driven Convolutional Neural Network

P.M. Diederik, F. Corradi, E. Kerr, P. Vance, G. Das, D. Neil, D. Kerr, Tobi Delbrück

IEEE Event-Based Control, Communication and Signal Processing
2016, Krakow, POL

Decision Making and Perceptual Bistability in Spike-Based Neuromorphic VLSI Systems

F. Corradi, H. You, M. Giulioni, G. Indiveri

doi:10.1109/ISCAS.2015.7169245

IEEE International Symposium on Circuits and Systems
2015, Lisbon, PT

Neuromorphic Architectures for Spiking Deep Neural Networks

G. Indiveri, F. Corradi, and N. Qiao

doi:10.1109/IEDM.2015.7409623

IEEE International Electron Devices Meeting
2015, Washington, DC, USA

Toward Neuromorphic Intelligent Brain-machine Interfaces: an Event-based Neural Recording and Processing System

F. Corradi, D. Bontrager, and G. Indiveri

doi:10.1109/BioCAS.2014.6981793

IEEE Biomedical Circuits and Systems Conference
2014, Lausanne, CH

Mapping Arbitrary Mathematical Functions and Dynamical Systems to Neuromorphic VLSI Circuits for Spike-Based Neural Computation

F. Corradi, C. Eliasmith, and G. Indiveri

doi:10.1109/ISCAS.2014.6865117

IEEE International Symposium on Circuits and Systems
2014, Melbourne, VIC, AU

A spiking implementation of the lamprey's Central Pattern Generator in neuromorphic VLSI

E. Donati, F. Corradi, C. Stefanini, G. Indiveri

doi:10.1109/BioCAS.2014.6981775

IEEE Biomedical Circuits and Systems Conference
2014, Lausanne, CH

A Hybrid Analog/Digital Spike-Timing Dependent Plasticity Learning Circuit for Neuromorphic VLSI Multi-Neuron Architectures

H. Mostafa, F. Corradi, F. Stefanini, and G. Indiveri

doi:10.1109/ISCAS.2014.6865270

IEEE International Symposium on Circuits and Systems
2014, Melbourne, VIC, AU

Automated synthesis of asynchronous event-based interfaces for neuromorphic systems

H. Mostafa, F. Corradi, M. Osswald, and G. Indiveri

doi:10.1109/ECCTD.2013.6662213

IEEE European Conference on Circuit Theory and Design
2013, Dresden, DE

Implementation of a Neuromorphic Vestibular Sensor with Analog VLSI Neurons

G. Passetti, F. Corradi, M. Raglianti, D. Zambrano, C. Laschi, and G. Indiveri

doi:10.1109/BioCAS.2013.6679667

IEEE Biomedical Circuits and Systems Conference
2013, Rotterdam, NL

Demonstrations at international conferences

Convolutional Neural Network Driven by Dynamic Vision Sensor Playing RoShamBo

I.-A. Lungu, F. Corradi, T. Delbruck

IEEE Symposium on Circuits and Systems
2017, Baltimore, MD, USA

Learning to recognize visual stimuli in neuromorphic VLSI

F. Corradi, M. Giulioni

doi:10.1109/BioCAS.2012.6418494

IEEE Biomedical Circuits and Systems Conference
2012, Hsinchu, TW

Skills

VLSI design of mixed signal analog/digital circuits	Cadence, Spice
Printed circuit board design	Altium, Eagle
Software design	C/C++, Python, OpenFrameworks
Neural network simulation of deep and/or spiking networks	Caffe Deep Learning Framework, Brian, Matlab
Dynamical System Analysis	Xppaut, Mathematica
Linux system administration of web-servers and always-on systems	Linux, Unix, Mysql, Apache2, Bash
Web design	Php, Nodejs, Mongodb, Ajax, Javascript, Css
Lanugages	Italian (mother tongue), English (fluent)