Giovanni Sirio Carmantini

Experience

2019–ongoing **Co-founder**, foldAI, Ecosystem Intelligence.
We bring IoT, AI and Data Science to natural ecosystems for forestry, biodiversity and climate change remediation; Machine Learning infrastructure development and deployment; Machine Learning on the Edge (on-device computing).

2016–2019 **Data Scientist & SW Engineer**, Bragi GmbH, IoT & wearables company.
Development and deployment of Machine Learning pipelines infrastructure for Edge computing. Development of Machine Learning models along their lifetime. Sensor integration and rapid prototyping for IoT; Machine Learning applied to gesture recognition.

Education

2013–2017 **PhD in Computational Neuroscience**, Plymouth University, Investigation of symbolic neural computation through theory of Dynamical Systems. Neural implementations of Turing Computation, and computation with Heteroclinic Networks (see projects).
Principal Supervisor: Dr. Serafim Rodrigues

2012–2013 **MSc in Robotics**, Plymouth University, *First Class*. Key courses: Computer Vision, Neural Networks, Natural Language Interfaces, Behaviour-based Robotics, Information Visualization, Design of Interactive Systems.
Principal Supervisor: Dr. Andy Wills

2011–2012 **Scientific collaborator at Laboratory of Autonomous Robotics and Artificial Life**, Italian National Research Council, Rome (CNR), Investigating emerging behaviours from systems of evolving agents.
Principal Supervisor: Prof. Domenico Parisi

2008–2011 **BSc in Psychology**, University of Bologna, *Congratulatory First Class (GPA 28.5/30)*. Bachelor's thesis involved the design, carrying out and statistical analysis of an experiment on decision making under uncertainty, specifically involving Kahneman & Tversky's prospect theory.
Principal Supervisor: Prof. Giuseppe Di Pellegrino

Selected Projects

See my web page at `http://giov.dev/projects` for more.

Machine Learning

Bragi nanoAI nanoAI is a cutting-edge software toolchain developed for rapid development and deployment of efficient ML algorithms for embedded, ultra-low power edge devices (see `http://www.bragi.net/intelligent-edge/`). I have been part of the nanoAI project since its conception, and have contributed heavily to many of its key features. In particular, I was involved in much of the development of the Python side of the toolchain, concerned with the creation of machine learning pipelines tailored to IoT use-cases, handling time-series sensor data.

Computer Vision with SUSTAIN SUSTAIN is a formal model of categorization with roots in psychology, used to model human data. It is based on a clustering principle with an additional focus on attention in the model. I successfully applied SUSTAIN to a computer vision categorization task. I showed that a naive implementation of SUSTAIN performs better than a naive application of a Support Vector Machine trained with the same representation (bag-of-words on local features).

Neural Turing Computation This is my theoretical contribution to the search for neural networks that can perform arbitrary algorithmic computation, an important field of research in connectionism and machine learning (see publications)

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Robotics and Interactive Systems

Teleoperation of robot arm Designed and implemented a teleoperation system for a Mitsubishi industrial robot arm using a Microsoft Kinect camera. Skeleton tracking is performed through the Kinect framework (camera and libraries), and defined movements are captured and translated to commands to the arm. In this way, an operator can perform live control of the robot arm.

Music Hands Integration of flexor and pressure sensor data from "Data Glove" and conversion to MIDI signal in order to control parameters of various effects in a Digital Audio Workstation. The glove can be used by singers to experiment with the production of new sounds with great precision and intuitive control. See https://youtu.be/hJbCw08MH4M.

Numerical Simulations and Data Analysis

Heteroclinic Computation Networks Study of neuronal networks with important dynamic properties for computation and storage of information. On a technical level, this project involved the simulation of neuronal networks, the collection of large amounts of data, their storage, analysis and visualization. See repository.

Publications

2016 **A modular architecture for transparent computation in recurrent neural networks**, *Carmantini, G. S., beim Graben, P., Desroches, M., & Rodrigues, S.*, Neural Networks 85, 85-105.

2015 **Turing Computation with Recurrent Artificial Neural Networks**, *Carmantini, G. S., beim Graben, P., Desroches, M., & Rodrigues, S.*, NIPS workshop – Cognitive Computation: Integrating Neural and Symbolic Approaches. Retrieved from http://arxiv.org/abs/1511.01427.

2014 **Machine learning of visual object categorization: an application of the SUSTAIN model**, *Carmantini, G. S., Cangelosi, A., & Wills, A. J.*, In Proceedings of the 36th Annual Conference of the Cognitive Science Society.

Selected Talks

2015 **Turing Computation with Recurrent Artificial Neural Networks**, *Contributed Talk at CoCo@NIPS 2015, Cognitive Computation: Integrating Neural and Symbolic Approaches. Twenty-ninth Annual Conference on Neural Information Processing Systems (NIPS)*, Montreal, Canada.

2014 **Machine learning of visual object categorization: an application of the SUSTAIN model.**, *Contributed talk at 36th Annual Conference of the Cognitive Science Society (CogSci)*, Quebec City, Canada.

Teaching

2015 **Theory of Computation**, Taught this module (∼26 hours of teaching) to a class of second year students from a Computer Science Bachelor's degree. The course is available online, see http://giov.dev/teaching.html.

Technical Skills

My GitHub page: http://www.github.com/TuringMachinegun

Python High-intermediate knowledge of the core language, scientific computing with Numpy, and advanced visualization with Matplotlib. High-Intermediate knowledge of the sklearn Machine Learning library.

ROS Intermediate knowledge of the Python framework.

C/C++ Basic knowledge. Optimization of slow Python code by integrating C and C++ through SWIG. Knowledge of Unix C/C++ ecosystem, such as the use of compilers, makefiles, etc.

Linux Basic knowledge of the system, of some of its key command line facilities and general workflow in terms of software development.

Ipython/Jupyter notebooks Use of literate programming for research reproducibility and communication.

Other Proficiency self-rated with a score from 1 to 10: OpenCV(5), Emacs(6), Org-mode(7), Python Multiprocessing(5), Python GUI Programming(4), CUDA(2), Bash(3), SWIG(4), Lisp(2), Google Protocol Buffers(4), Git(5)