MICHELE SVANERA PH.D.

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RESEARCH INTERESTS

Wandering across Neuroscience and Artificial Intelligence, I apply recent advances in Deep Learning to improve our understanding of the brain. Alongside, I develop better and faster brain imaging tools improving data analysis pipelines for ultra-high resolution MRI (7 Tesla).

EXPERIENCE

Research Associate   July 2019 - Present
University of Glasgow (UK)

⬦   Development of new tools for brain MRI analysis at 3T and 7T; focusing on segmentation, I developed a tool that performs better and faster than any automatic method available and it has been approved by experts. More on the project website.

⬦   Novel approach for early visual cortex modelling. Challenging DL models and the human brain to solve same (visual) tasks, I obtained a new promising way to compare DL with brain data (see project website).

Research Assistant   May 2017 - June 2019
University of Glasgow (UK)

I addressed the goal to understand the brain activities (fMRI) in relation with movie stimulus applying recent advances in machine learning. Duties included: Development of experimental procedures, design and programming of behavioural and f/MRI experiments (3 and 7 Tesla), recording and analysing of the results, developing new multivariate-analysis procedures, review of current literature in relevant fields, presenting at conferences, and participating in the writing up of the results.

International experiences

Functional Brain Center, Sourasky center, Tel Aviv (Israel)   June - Sep. 2016
I spent few months in Israel opening a new line of research on Deep Learning approaches for fMRI analysis, in collaboration with prof. Talma Hendler. In the meantime, I taught more than 20 hours of Introduction to Deep Learning to the entire department.

Maastricht Brain Imaging Centre, Maastricht (The Netherlands)   June - Dec. 2015
These six months, in collaboration with prof. Rainer Goebel, gave me my first immersion in the field of Neuroscience. We worked together on the reconstruction of audio-visual features based on fMRI signal, using one of the biggest fMRI dataset ever collected.

EDUCATION

Doctoral program (Ph.D.)   Oct. 2011 - Oct. 2013
Machine Learning & Computer Vision at University of Brescia, Italy.
During my Ph.D., I tried to combine three great passions of mine: AI, neuroscience, and movies. The result of this long journey allowed me to exploit movie representations as *trait d'union* to study AI and Neuroscience. The thesis, titled *"Movies and the brain: learning video content representation for cinema studies and neuroscience"* shows how representation learning can help find suitable numerical representations to use in fMRI data analysis and cinema studies.

Master of Science (M.Sc. Eng.)   Oct. 2011 - Oct. 2013
Telecommunication Engineering at University of Brescia, Italy.
Master thesis: Methods and models for the synthesis and representation of 3D surfaces.
Relevant courses: information theory, digital modulation and channel coding, system identification and data analysis, image processing and visualisation, digital systems for signal processing, multimedia information coding, digital audio processing, remote sensing data analysis.

Bachelor of Science (B.Sc. Eng.) Sep. 2006 - Sep. 2011

Electronic Engineering at University of Brescia, Italy.

Bachelor thesis: Development of eye tracking technique software.

Relevant courses: linear algebra, mathematical analysis, analysis of differentiation and integration, statistical methods, probability, multivariable calculus, electromagnetic theory, waves and diffraction, operative systems, informatics, electronic engineering, analogue and digital electronics, communication systems.

TEACHING AND MENTORING

Fundamentals of computer graphics 2014 - 2017

Master course - T.A.

Main topics: geometric modelling, rendering and illumination, rasterization, texture mapping, volumetric rendering. Libraries: OpenGL and Unity, in python and C++. SW: Blender.

Digital image processing 2014 - 2016

Master course - T.A.

Main topics: geometric transformations, filtering, edge detection, image segmentation, morphological operators, feature extraction (ex. SIFT), source coding principles. Libraries: OpenCV in python and C++.

Master thesis supervisions

Two examples of supervisions include:

Deep learning methods for MRI data analysis 2019

In this thesis, we adopted a weakly-supervised learning strategy to develop a tool to produce accurate multi-structure segmentation results in only few seconds. The outcome of the work is "CEREBRuM: a fast and fully-volumetric Convolutional Encoder-decodeR for weakly-supervised sEgmentation of BRain strUctures from out-of-the-scanner MRI" published in *Medical Image Analysis*. The former student is now Ph.D. student at Harvard Medical School.

Hair detection, segmentation, and hairstyle classification in the wild 2017

In this thesis, we tackled the problem of hair analysis (detection, segmentation, and hairstyle classification) from unconstrained view by relying only on textures. The outcomes of the work are "Hair detection, segmentation, and hairstyle classification in the wild" published in: *Image and Vision Computing* and "Figaro, hair detection and segmentation in the wild" presented at *ICIP-2016*. The former student is now Senior AI Algorithm Developer at Huawei Technologies.

KEY PUBLICATIONS

Bontempi, D., S. Benini, A. Signoroni, **M. Svanera***, and L. Muckli*****. "CEREBRUM: a fast and fully-volumetric Convolutional Encoder-decodeR for weakly-supervised sEgmentation of BRain strUctures from out-of-the-scanner MRI". *Medical Image Analysis* (link).

Svanera M., Morgan, A., Petro, L., Muckli, L. A Self-Supervised Deep Neural Network for Image Completion Resembles Early Visual Cortex fMRI Activity Patterns for Occluded Scenes. *Journal of Vision*(link).

Svanera M., S. Benini, G. Raz, T. Hendler, R. Goebel, and G. Valente. "Transfer learning of deep neural network representations for fMRI decoding". *Journal of Neuroscience Methods* (link).

PROGRAMMING SKILLS

★ ★ ★ ★ ★	★ ★ ★ ★ ☆	★ ★ ★ ☆ ☆	★ ★ ☆ ☆ ☆
python, bash, 🐧	Matlab, LaTex	C, C++, Java	PHP, HTML, CSS, MySQL, R