

Michele Svanera

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Research Interests

At the core of my research interests there is a question: Will we ever be able to replicate (a part of) the brain? I do not have an answer, only more questions. How does the human vision work? Can current Artificial Intelligence models explain brain activity? Can we create an artificial network that mimics some brain functions? How can we advance brain imaging methods? Wandering across Cognitive Neuroscience and Artificial Intelligence (specifically Deep Learning), I address the goal of understanding human vision conducting behavioural, f/MRI, and computational modelling studies. For more insights on my research, please visit my [personal website](#).

Experience

2019

Research Associate, *School of Psychology & Neuroscience*, University of Glasgow (UK).

- ◊ Application of recent methods on correlation analysis to test predictive coding theories on the functional connectivity organisation of early visual cortex activation elicited by watching movies.
- ◊ 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. More on the [project website](#).
- ◊ 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](#).

2019

2017

Research Assistant, *Institute of Neuroscience and Psychology*, 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.

Education

2017

2014

Doctoral program (Ph.D.), Department of Information Engineering, 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.

International experiences

Visiting PhD

*Functional Brain Center, Sourasky center, Tel Aviv (Israel):
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.
(2016)*

Visiting PhD

*Maastricht Brain Imaging Centre, Maastricht (Netherlands):
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.
(2015)*

2011 2013

Master of Science (M.Sc. Eng.),

Telecommunication Engineering, 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.

2006 2011

Bachelor of Science (B.Sc. Eng.),

Electronic Engineering, 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

Teaching

2014 2017

Fundamentals of computer graphics, Master course.

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

2014 2015

Digital image processing, Master course.

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

Supervision

Two examples of supervisions are:

2019

Deep learning methods for MRI data analysis, Master thesis.

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.

2016

Hair detection, segmentation, and hairstyle classification in the wild, Master thesis.

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.

Journal Publications

2021

M. Svanera, S. Benini, D. Bontempi, and L. Muckli. "CEREBRUM-7T: Fast and Fully-volumetric Brain Segmentation of 7 Tesla MR Volumes". In: *Human Brain Mapping*. URL: <https://rocknroll187q.github.io/cerebrum7t/>.

2021

M. Svanera, A.T. Morgan, L.S. Petro, and L. Muckli. "A self-supervised deep neural network for image completion resembles early visual cortex fMRI activity patterns for occluded scenes". In: *Journal of Vision* 21.7, pp. 5–5. DOI: <https://doi.org/10.1167/jov.21.7.5>.

2020

Bontempi, D., S. Benini, A. Signoroni, L. Muckli*, and **M. Svanera***. "CEREBRUM: a fast and fully-volumetric Convolutional Encoder-decodeR for weakly-supervised sEgmen-tation of BRain strUctures from out-of-the-scanner MRI". In: *Medical Image Analysis* 62, p. 101688. DOI: <https://doi.org/10.1016/j.media.2020.101688>.

2019

Bálint, K.A., Gal Raz, Valente G, **M. Svanera**, and S. Benini. "A Robust Neural Fingerprint of Cinematic Shot-Scale". In: *Projections* 13.3, pp. 23 –52. DOI: [10.3167/proj.2019.130303](https://doi.org/10.3167/proj.2019.130303).

2019

Svanera M., S. Benini, G. Raz, T. Hendler, R. Goebel, and G. Valente. "Transfer learning of deep neural network representations for fMRI decoding". In: *Journal of Neuroscience Methods*. DOI: [10.1016/j.jneumeth.2019.108319](https://doi.org/10.1016/j.jneumeth.2019.108319).

2019

Svanera M., M. Savardi, A. Signoroni, K.A. Bálint, and S. Benini. "Who is the film's director? Automatic style recognition based on shot features". In: *IEEE MultiMedia Magazine*. DOI: [10.1109/MMUL.2019.2940004](https://doi.org/10.1109/MMUL.2019.2940004).

2018

Muhammad, U. R., **M. Svanera**, R. Leonardi, and S. Benini. "Hair detection, segmen-tation, and hairstyle classification in the wild". In: *Image and Vision Computing* 71, pp. 25 –37. DOI: [10.1016/j.imavis.2018.02.001](https://doi.org/10.1016/j.imavis.2018.02.001).

2017

Raz, G., **M. Svanera**, N. Singer, G. Gilam, M. B. Cohen, T. Lin, R. Admon, T. Gonen, A. Thaler, R. Y. Granot, R. Goebel, S. Benini, and G. Valente. "Robust inter-subject audiovisual decoding in functional magnetic resonance imaging using high-dimensional regression". In: *NeuroImage*. DOI: [10.1016/j.neuroimage.2017.09.032](https://doi.org/10.1016/j.neuroimage.2017.09.032).

2016

Benini, S., **M. Svanera**, N. Adami, R. Leonardi, and K.A. Bálint. "Shot Scale Distri-bution in Art Films". In: *Multimedia Tools and Applications*. DOI: [10.1007/s11042-016-3339-9](https://doi.org/10.1007/s11042-016-3339-9).

2016

Gordiychuk, A., **M. Svanera**, S. Benini, and P. Poesio. "Size distribution of micro bubbles for a venturi type bubble generator: effect of different parameters on bubble mean size , statistics of the distribution". In: *Experimental Thermal and Fluid Science*. DOI: [10.1016/j.expthermflusci.2015.08.014](https://doi.org/10.1016/j.expthermflusci.2015.08.014).

Conference Publications

2019

Bontempi, D., S. Benini, A. Signoroni, L. Muckli*, and **Svanera M.***. "Fast Brain MRI Segmentation Using a Volumetric Deep Learning Approach". In: *2019 Conference on Cognitive Computational Neuroscience (CCN)*.

2018

Svanera M., A. T. Morgan, L. S. Petro, and L. Muckli. "Unsupervised deep neural network for fMRI feedback modelling". In: *2018 Conference on Cognitive Computational Neuroscience (CCN)*. URL: <https://ccneuro.org/2018/proceedings/1055.pdf>.

2016

Svanera M., S. Benini, G. Raz, T. Hendler, R. Goebel, and G. Valente. "Deep driven fMRI decoding of visual categories". In: *NIPS Workshop on Representation Learning in Artificial and Biological Neural Networks (MLINI, 2016)*. URL: <https://arxiv.org/abs/1701.02133>.

2016

Svanera M., U. Riaz Muhammad, R. Leonardi, and S. Benini. "Figaro, hair detection and segmentation in the wild". In: *Proceedings of IEEE International Conference on Image Processing (ICIP, 2016)*. DOI: 10.1109/ICIP.2016.7532494.

2015

Svanera M., S. Benini, N. Adami, R. Leonardi, and K.A. Bálint. "Over-the-Shoulder Shot Detection in Art Films". In: *13th International Workshop on Content-Based Multimedia Indexing (CBMI, 2015)*. DOI: 10.1109/CBMI.2015.7153627.

Certifications

- Build Basic Generative Adversarial Networks (DeepLearning.AI, coursera.org)
- Deep Neural Networks with PyTorch (IBM, coursera.org)
- Deep Learning Specialization (DeepLearning.AI, coursera.org)
- Machine Learning (Stanford, coursera.org)
- Networked Life (University of Pennsylvania, coursera.org)
- Social Network Analysis (University of Michigan, coursera.org)
- Process Mining: Data science in Action (Eindhoven University of Technology, coursera.org)
- Statistical Analysis of fMRI Data (Johns Hopkins University, coursera.org)
- Mining Massive Datasets (Stanford University, coursera.org)
- Applied Regression Analysis (Ohio State University, coursera.org)
- Applied Logistic Regression (Ohio State University, coursera.org)

Languages

Italian Native speaker
English Proficient user

Mother Tongue
Daily practice, all work performed in English

Programming Skills

★★★★★
python, bash, 

★★★★☆
Matlab, LaTeX

★★★☆☆
C, C++, Java

★★☆☆☆
PHP, HTML, CSS,
MySQL, R

OS experience

GNU/Linux ★★★★★☆
MacOS ★★★★★
Windows ★★★★★

Interests

Hobby Reading, cooking, PC strategy games, walking, and homebrewing.
Sport Football, swimming, running, cycling, yoga, squash, and bouldering.

References

Post-doc PI

Prof. Lars Muckli
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Ph.D. Advisor

Prof. Sergio Benini
University of Brescia, Italy
✉ sergio.benini@unibs.it