Stefano Recanatesi

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Education

University of Washington — Seattle, WA
Postdoctoral fellow – Shea-Brown lab. – Applied Mathematics Dept. — September 2019 –Current
Swartz Postdoctoral fellow – Physiology and Biophysics Dept. — September 2017 – 2019

University of Oregon — Eugene, OR
Postdoctoral fellow - Mazzucato lab. – Neuroscience and Mathematics Dep. — March 2019–Current

Weizmann Institue of Science — Rehovot, Israel
PhD in Theoretical Neuroscience — March 2013–August 2017

- Thesis: "Neural mechanisms of memory retrieval", Advisor Prof. Misha Tsodyks

Columbia University – Center for Theoretical Neuroscience — New-York, NY
Visiting student — January–June 2016

Scuola Normale Superiore – Physics Dep. — Pisa, Italy
MSc degree in Theoretical Physics 110-110 cum laude — September 2010–June 2012

- Thesis: "B and K physics observables in split-family SUSY", Advisor Prof. Gino Isidori

CERN – Theoretical Physics Dep. — Geneva, Switzerland
Vising Student under the supervision of Prof. Gino Isidori — February 2012 –June 2012

University of Geneva – Physics Dep. — Geneva, Switzerland
Student Exchange Student, supervision of Prof. Michele Maggiore — February 2012 –June 2012

Ecole Normale Superieure – Physics Dep. — Paris, France
Student Exchange Program — November 2011 –December 2011

Scuola Normale Superiore – Physics Dep. — Pisa, Italy
BSc degree in Physics — September 2007 –June 2010

- Thesis: "Ricerca di Supersimmetria con particelle pesanti, cariche, a lunga vita media", grade 110/110 cum laude, advisor Gigi Rolandi

Scholarships & Awards

- Swartz Postdoctoral Fellowship — 2017–2020
- Feinberg Graduate School Full Scholarship — 2013–2017
- Cosyne Travel Award — 2017
- Best Poster Award (Israeli Conference for Neuroscience — 2016
- CNN Summer School fellowship — 2014–2014
- Visiting student fellowship – University of Geneva — 2012–2012

- Visiting student fellowship – Ecole Normale Superieure 2011
- HCPS Travel Award 2011
- CERN Internship fellowship 2010
- Italian governmental award for excellent students 2008
- Scuola Normale Superiore Full Graduate Scholarship 2010
- Scuola Normale Superiore Full Undergraduate Scholarship 2007

Experience

CNN Summer School Shangai, China
Summer School student Summer 2016

– Research project: "A neural mechanism for confidence in decision making tasks", advisors Prof. Bill Newsome and Prof. Sophie Deneve

Cognitive Computing Group – IBM Watson Center Yorktown Heights, NY
Intership student under the supervision of Mattia Rigotti in Yurii Vlasov group August –October 2015

CERN Summer School Geneva, Switzerland
Intership program July –September 2020

– Research project: "$J/\Psi \rightarrow \mu\mu side bands substraction$", $advisor Sara Bolognesi$.

Publications

[1] **S. Recanatesi***, U. Pereira*, M. Murakami, Z. Mainen†, and L. Mazzucato†, "**Metastable attractors explain the variable timing of stable behavioral action sequences**", *Neuron*, 2022.

[2] P. Rich and **S. Recanatesi**, "**Path vectors: a neural code for sequential memory**", *Under Review in PNAS*, 2022.

[3] D. Dahmen*, **S. Recanatesi***, G. Ocker, X. Jia, M. Helias†, and E. Shea-Brown†, "**Strong coupling and local control of dimensionality across brain areas**", *bioRxiv / Under review in Nature*, 2021.

[4] **S. Recanatesi***, S. Bradde*, V. Balasubramanian+, N. Steinmetz†, and E. Shea-Brown†, "**A scale-dependent measure of system dimensionality**", *bioRxiv / Under review in Patterns*, 2021.

[5] **S. Recanatesi**, M. Farrell, G. Lajoie, S. Deneve, M. Rigotti†, and E. Shea-Brown†, "**Predictive learning as a network mechanism for extracting low-dimensional latent space representations**", *Nature Communications*, 2021.

[6] M. Farrell, **S. Recanatesi**, G. Lajoie, and E. Shea-Brown, "**Dynamic compression and expansion in a classifying recurrent neural network**", *bioRxiv / Under review in Nature Machine Intelligence*, 2021.

[7] D. Voina, **S. Recanatesi**, B. Hu, E. Shea-Brown†, and S. Mihalas†, "**Single circuit in V1 capable of switching contexts during movement using VIP population as a switch**", *Neural Computation*, 2021.

[8] M. Farrell, **S. Recanatesi**, C. Reid, S. Mihalas†, and E. Shea-Brown†, "**Autoencoder networks extract latent variables and encodethese variables in their connectomes**", *Neural Networks*, 2020.

[9] **S. Recanatesi***, M. Farrell*, G. Lajoie, and Shea-Brown, "**Local and global dimensionality of deep neural networks**", *bioRxiv, 2019.*

[10] **S. Recanatesi**, G. Ocker, M. Buice, and E. Shea-Brown, "**Dimensionality in recurrent spiking networks: global trends in activity and local origins in connectivity**", *Plos Computational Biology, 2019.*

[11] M. Naim*, M. Katkov*, **S. Recanatesi***, and M. Tsodyks, "**Emergence of hierarchical organization in memory for random material**", *Scientific Reports, 2019.*

[12] "**Memory states and transitions between them in attractor neural networks**", *Neural computation,*

[13] **S. Recanatesi**, M. Katkov, S. Romani, and M. Tsodyks, "**Neural Network Model of Memory Retrieval**", *Frontiers in Computational Neuroscience*, 2015.

[14] **S. Recanatesi*** and M. Buice*, "**Flexible cell-type specific encoding of visual and behavioral variables in mouse Visual cortex**", *In preparation.*

* co-first authorship
† co-senior authorship

Conferences & invited talks

Vision for action workshop (online) Julich, Germany
Invited Talk February 2021
- Title: : "Characterizing geometrical properties of action manifolds"

World wide theoretical neuroscience seminar Seattle, WA
Invited Talk December 2020
- Title: : "Linking dimensionality to computation in neural networks"

University of Oregon Eugene, OR
Invited Talk in Series "Brain and AI"
- Title: "Understanding the dimensionality of neural representations" April 2019

Neural Computation and Engineering Connection Seattle, WA
Invited Talk June –September 2018
- Title: "Signatures and mechanisms of low-dimensional neural predictive manifolds"

Computational Neuroscience Conference Seattle, WA
Invited Talk June –September 2018
- Title: : "Explaining the dimensionality of the activity in recurrent neural network through connectivity motifs"
- Poster: "Dimensionality in recurrent spiking networks"

Cosyne Salt Lake City – Lisbon
Conference in Computational Neuroscience 2016 –2020
- Poster: "Predictive learning model of hippocampal dynamics"
- Poster: "Signatures of low-dimensional neural predictive manifolds"
- Poster: "Metastable attractors explain the variable timing of stable behavioral action sequences"
- Poster: "Dimensionality control in the critical regime of balanced networks"

Israeli Conference for Neuroscience Eilat, Israel
Best Poster Award 2016
– Poster: "Memory States and transitions between them in attractor neural networks"

Winter School in Quantitative Systems Biology ICTP Trieste, Italy
2014
– Poster: "Neural network machinery of long term memory retrieval"

Teaching

- **Lesson "Attractor models of memory storage"** – Weizmann Institute of Science Spring 2017
  Neural models of Memory functions, Prof. Misha Tsodyks
- **Lesson "Echo State and Attractor Networks"** – University of Washington Spring 2019
  AMATH 422/522: Computational Modeling of Biological Systems, Prof. Eric Shea-Brown
- **Lesson "Machine learning models of information processing"** – University of Washington Spring 2018
  AMATH 534: Dynamics of Neurons and Networks

Mentoring

- **Matthew Farrell** – Graduate student in the Shea-Brown lab. 2017-2020
  Now PostDoc at Harvard, Cengiz lab. The projects aimed at characterizing neural represenations in multiple trained neural networks trained to solve specific tasks.
- **Doris Voina** – Graduate student in the Shea-Brown lab 2017-2020
  The project aimed at understanding how the visual circuit is able to switch between processing visual information with very different statistical properties. For example static and moving conditions.

Skills

– **Deep Learning:** Proficient in PyTorch, Torch, Keras, Theano

– **Professional software:** Proficienty in Python, Matlab, Mathematica, C++. Experience with R, Lua, Root.

– **Others:** Experience with Brian, XPP, Latex.

Languages

– **Italian:** native
– **English:** professional proficiency
– **TOEFL:** score of 112
– **Hebrew:** conversational level
– **ULPAN:** dalet level
– **French and German:** elementary level

Activities & Hobbies

- DEI committee Cosyne Conference, Lisbon 2022
- Volunteer mentor at juvenile detention center, Seattle September 2018-Present
- Volunteering in South Africa through international NGO September 2012-February 2013
- Master degree in Piano 2001–2012
  Conservatorio di Musica L. Campiani, Mantova

- Team soccer playing in professional youth teams 1995–2007

Principal References

– **Prof. Eric Shea-Brown:** Postdoctoral mentor.
University of Washington – Applied Mathematics
http://faculty.washington.edu/etsb/
etsb@washington.edu

– **Prof. Luca Mazzucato:** Postdoctoral mentor.
University of Oregon – Neuroscience Institute
https://www.mazzulab.com/
lmazzuca@uoregon.edu

– **Prof. Misha Tsodyks:** PhD advisor.
Weizmann Institute of Science – Neuroscience
https://webhome.weizmann.ac.il/home/bnmisha/
misha@weizmann.ac.il

– **Prof. Adrienne Farihall:** Senior collaborator.
University of Washington – Physiology and biophysics
https://fairhalllab.com/
fairhall@uw.edu

Additional references

– **Prof. Stefan Mihalas:** Senior collaborator.
Allen Institute for Brain Science
stefanm@alleninstitute.org

– **Prof. Sandro Romani:** Senior collaborator.
Janelia Research Campus
https://www.janelia.org/lab/romani-lab
romanis@janelia.hhmi.org

– **Prof. Nick Steinmetz:** Senior collaborator.
University of Washington – Biological structure Dept.
http://www.nicksteinmetz.com
nsteinme@uw.edu

– **Prof. Michael Buice:** Senior collaborator.
Allen Institute for Brain Science
michaelbu@alleninstitute.org