HAMIDREZA ABBASPOURAZAD

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EDUCATION

PhD, Electrical Engineering, University of Southern California, Los Angeles, USA *2015 - Present*
Adviser: Professor Maryam M Shanechi (http://nseip.usc.edu)

MSc, Computer Science, University of Southern California, Los Angeles, USA *2018 - 2020*
GPA: 3.97/4.00

BSc, Electrical Engineering, Sharif University of Technology, Tehran, Iran *2010 - 2015*
GPA: 18.92/20 (class of 2015 top 3 students)
Minor in Economics

High School Diploma in Physics and Mathematics, Energy High School, Tehran, Iran *2006 - 2010*
GPA: 19.98/20 (class of 2010 top student)

HONORS AND ACHIEVEMENTS

Ranked **2nd** among more than 270,000 competitors in nationwide BSc exam (known as *Konkoor*), Iran *2010*
Member of *Iran's National Elites Foundation (INEF)* *2010 - Present*
Member of *Exceptional Talents Community of Sharif University of Technology* *2015 - Present*

RESEARCH INTERESTS

Statistical machine learning, Time-series dynamics, Representation learning, Computational neuroscience

RESEARCH EXPERIENCE

Neural Systems Engineering and Information Processing Lab (NSEIP) *2015 - Present*
University of Southern California, Los Angeles, California
Adviser: Professor Maryam M Shanechi (http://nseip.usc.edu)
We develop statistical machine learning tools to study brain and improve neurotechnology. My main focus is building and investigating learning algorithms to infer and study low-dimensional representations of high-dimensional neural time-series.

PUBLICATIONS

Journal papers

Hamidreza Abbaspourazad, Mahdi Choudhury, Yan Wong, Bijan Pesaran and Maryam Shanechi, "Multiscale low-dimensional motor cortical state dynamics predict naturalistic reach-and-grasp behavior", ***Nature Communications***, 2021 (link)(USC story)

Omid G. Sani, **Hamidreza Abbaspourazad**, Yan Wong, Bijan Pesaran and Maryam Shanechi, "Modeling behaviorally relevant neural dynamics enabled by preferential subspace identification", ***Nature Neuroscience***, 2020 (link)(USC story)

Hamidreza Abbaspourazad, Han Lin Hsieh and Maryam Shanechi, "A Multiscale dynamical modeling and identification framework for spike-field activity", ***IEEE Trans. Neural Syst. Rehabil. Eng.***, 2019 (link)

Conference papers

Hamidreza Abbaspourazad, Yan Wong, Bijan Pesaran, Maryam Shanechi, "Identifying multiscale hidden states to decode behavior", *IEEE Engineering in Medicine and Biology Society*, 2018 (selected for oral presentation)

Hamidreza Abbaspourazad, Han Lin Hsieh, Maryam Shanechi, "Multiscale modeling of dependencies between spikes and fields", *Asilomar Conference on Signals, Systems, and Computers*, 2017 (selected for oral presentation)

Hamidreza Abbaspourazad and Maryam Shanechi, "An unsupervised learning algorithm for multiscale neural activity", *IEEE Engineering in Medicine and Biology Society*, 2017 (selected for oral presentation)

Conference abstracts

Han Lin Hsieh, **Hamidreza Abbaspourazad**, Yan Wong, Bijan Pesaran, Maryam Shanechi, "A nonlinear geometric dynamical modeling framework for neural population activity", in Computational and Systems Neuroscience (COSYNE), 2021

Hamidreza Abbaspourazad, Mahdi Choudhury, Yan Wong, Bijan Pesaran, Maryam Shanechi, "Multiscale low-dimensional neural dynamics explain naturalistic 3D movements", in Computational and Systems Neuroscience (COSYNE), 2020

Hamidreza Abbaspourazad, Yan Wong, Bijan Pesaran, Maryam Shanechi, "Dynamical characteristics of simultaneously-recorded spike and LFP activities underlying movement", in Annual meeting, Society for Neuroscience (SfN), 2019

Hamidreza Abbaspourazad, Yan Wong, Bijan Pesaran, Maryam Shanechi, "Identifying multiscale hidden dynamics to decode movement", in Annual meeting, Society for Neuroscience (SfN), 2018

Hamidreza Abbaspourazad and Maryam Shanechi, "Learning the dependencies between spikes and fields in multiscale modeling", in Annual meeting, Society for Neuroscience (SfN), 2017

Hamidreza Abbaspourazad and Maryam Shanechi, "A new modeling framework for multiscale neural activity underlying behavior", in Annual meeting, Society for Neuroscience (SfN), 2016

TEACHING EXPERIENCE

Head Teaching Assistant, **Probability and Statistics**	Fall 2014
Teaching Assistant and Assignment Designer, **Principles of Electrical Engineering**	Fall 2014
Teaching Assistant and Assignment Designer, **Principles of Economics**	Spring 2013
Head Teaching Assistant, **Signals and Systems**	Spring 2012
Labratory Assistant, **Analog Circuits**	Spring 2012
Labratory Assistant, **Logic Circuits and Digital Systems**	Spring 2012
Head Teaching Assistant, **Electrical Circuit Theory**	Fall 2012

TECHNICAL STRENGTHS

Modeling and Analysis	Statistical machine learning, Deep learning, Time-series dynamical modeling
Software & Tools	Python, Tensorflow, Matlab, C++, SQL, HTML

PROJECTS

<u>Research</u>

Developing deep auto encoding models to understand brain dynamics 2020 - Present

I am implementing dynamic variational auto encoders to better understand and predict brain recording time-series. (using Python and Tensorflow)

Recapitulating neural manifolds with recurrent neural networks (RNN) 2019 - 2020

I implemented RNNs imitating what the brain does in generating the actual naturalistic movements performed by non-human primates and we uncovered a similar low-dimensional manifold in RNNs high-dimensional artificial neurons compared to that in real brain neurons during the same task. (using Python and Tensorflow)

Discovering similarities and differences in the low-dimensional dynamics of spiking and local field potentials (LFP) activity during naturalistic movements 2018 - 2019

We implemented unsupervised learning algorithms to extract low-dimensional representations of neural time-series. We then applied these learning algorithms on non-human primates brain recordings, in form of binary (spiking activity) and continuous (LFP activity) time-series. We discovered similarities in dynamics across both recordings, indicating a multiscale control of movement in the motor cortex. (using Matlab)

An unsupervised learning algorithm to learn low-dimensional dynamical representations from mixed binary-continuous time-series 2016 - 2018

I implemented an Expectation-Maximization based algorithm to learn low-dimensional representation from high-dimensional and mixed continuous-binary time-series. We applied this algorithm on mixed spiking-LFP recordings from non-human primates and showed improvements over conventional methods. (using Matlab)

<u>Others</u>

IPDB.page 2019 - Present

A website for summarizing, listing and discussing academic publications

Design and implementation of disentangled variational auto encoders 2019

Design and implementation of deep semantic segmentation for natural images 2019

Design and implementation of recurrent neural networks for past-to-future prediction 2019

Design and implementation of different learning algorithms for House price prediction for a Kaggle open dataset 2017

SELECTED COURSES

Representation learning, Deep learning, Artificial intelligence, Analysis of Algorithms, Probabilistic machine learning, Estimation theory, Game theory, Natural Language Processing, Database Systems

SERVICE

Reviewed multiple papers for IEEE TII, IEEE NER, IEEE Access and IEEE CJECE.

INTERESTS

Soccer (former USC Futsal team member), HIIT exercises, Sport events, Movies, Video games

REFERENCES

Professor Maryam M Shanechi (http://nseip.usc.edu, shanechi(at)usc(dot)edu)