

# HAMIDREZA ABBASPOURAZAD

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Los Angeles, California

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## EDUCATION

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**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

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Ranked **2<sup>nd</sup>** 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

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

## RESEARCH EXPERIENCE

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**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.

## INDUSTRY EXPERIENCE

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**Apple Inc.** *May 2021 - Present*  
AI/ML intern at human interface design (HID) health incubation team

- Utilize a suite of analytic methods, ranging from traditional exploratory data analysis to statistical inference, clustering, and deep learning model development
- Prototyping and building data pipelines and analysis tools to traverse large data sets
- Investigate hypothesis regarding personal physiology and population-level health trends

## PUBLICATIONS

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### 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

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Head Teaching Assistant, <b>Probability and Statistics</b>	Fall 2014
Teaching Assistant and Assignment Designer, <b>Principles of Electrical Engineering</b>	Fall 2014
Teaching Assistant and Assignment Designer, <b>Principles of Economics</b>	Spring 2013
Head Teaching Assistant, <b>Signals and Systems</b>	Spring 2012
Laboratory Assistant, <b>Analog Circuits</b>	Spring 2012
Laboratory Assistant, <b>Logic Circuits and Digital Systems</b>	Spring 2012
Head Teaching Assistant, <b>Electrical Circuit Theory</b>	Fall 2012

## TECHNICAL STRENGTHS

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<b>Modeling and Analysis</b>	Statistical machine learning, Deep learning, Time-series dynamical modeling
<b>Software &amp; Tools</b>	Python, Tensorflow, Matlab, C++, SQL, HTML

## PROJECTS

### Research

**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)

## **Others**

### **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**

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

## **SERVICE**

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

## **INTERESTS**

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

## **REFERENCES**

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Professor Maryam M Shanechi (<http://nseip.usc.edu>, [shanechi\(at\)usc\(dot\)edu](mailto:shanechi(at)usc(dot)edu))