

LEILA WEHBE

lwehbe@cmu.edu
<http://www.cs.cmu.edu/~lwehbe>

Current Position

Tenure Track Assistant Professor, August 2018 - now
Carnegie Mellon University

Core: Machine Learning Department, School of Computer Science

Core: Neuroscience Institute

Affiliated: Department of Psychology, Computational Biology Department

Previous Positions

Postdoctoral Researcher, August 2015 – July 2018
University of California, Berkeley

Helen Wills Neuroscience Institute

Advised by Jack Gallant

Education

Carnegie Mellon University, August 2015

School of Computer Science

PhD in Machine Learning

Special Track in the Center for the Neural Basis of Cognition

Advised by Tom Mitchell

PhD thesis: The Time and Location of Natural Reading Processes in the Brain

American University of Beirut, June 2009

Faculty of Engineering and Architecture

B.Eng. in Electrical and Computer Engineering

Minors in Biology and Biomedical Engineering

Awards and Scholarships

- **Collaborative Research in Computational Neuroscience (CRCNS)**, 2021
- **Google Faculty Research Award**, 2018
- **Multimodal Neuroimaging Training Program Fellowship**, 2011-2012
- **Rothberg Research Award in Human Brain Imaging**, 2011-2012
- **The Full Merit Scholarship from the American University of Beirut**, 2005-2009

Peer-Reviewed Publications

- Jain N, Wang A, Henderson MM, Lin R, Prince JS, Tarr MJ, **Wehbe L. Selectivity for food in human ventral visual cortex.** Accepted at *Nature Communications Biology*, 2023.

- Jain S, Vo V, **Wehbe L**, Huth A. **Computational language modeling and the promise of in silico experimentation.** *Neurobiology of Language*, 2023.
- Herholz P, Fortier E, Toneva M, Farrugia N, **Wehbe L**, Borghesani V. **A roadmap to reverse engineering real-world generalization by combining naturalistic paradigms, deep sampling, and predictive computational models.** *Neurons, Behavior, Data Science, and Theory*, 2023.
- Toneva M, Mitchell T, **Wehbe L**. **Combining computational controls with natural text reveals new aspects of meaning composition.** *Nature Computational Science* 2022.
- Wu S, Ramdas A and **Wehbe L**. **Brainprint: identifying individuals from Magnetoencephalograms.** *Communication Biology*, 2022.
- Toneva M*, Williams J*, Bollu A, Dann C and Wehbe L. **Same Cause; Different Effects in the Brain.** *Causal Learning and Reasoning Conference (CLearR)*, 2022.
- Reddy A and **Wehbe L**. **Can fMRI reveal the representation of syntactic structure in the brain?** *Proceedings of the Conference on Neural Information Processing Systems (NeurIPS)*, 2021.
- Ravishankar S, Toneva M, **Wehbe L**. **Single-trial MEG data can be denoised through cross-subject predictive modeling.** *Frontiers In Computational Neuroscience*, 2021.
- **Wehbe L**, Blank I, Shain C, Futrell R, Levy R, von der Malsburg T, Smith N, Gibson E, Fedorenko E. **Incremental language comprehension difficulty predicts activity in the language network but not the multiple demand network.** *Cerebral Cortex*, 2021.
- Zha X, **Wehbe L**, Sciabassi R, Mace Z, Liang Y, Yu A, Leonardo J, Cheng B, Hillman T, Chen D, Riviere C. **A Deep Learning Model for Automated Classification of Intraoperative Continuous EMG.** *IEEE Transactions on Medical Robotics and Bionics*, 2020.
- Toneva M*, Stretcu O*, Poczos B, **Wehbe L**, Mitchell T. **Modeling Task Effects on Meaning Representation in the Brain via Zero-Shot MEG Prediction.** *Proceedings of the Conference on Neural Information Processing Systems (NeurIPS)*, 2020.
- Toneva M, **Wehbe L**. **Interpreting and improving natural-language processing (in machines) with natural language-processing (in the brain).** *Proceedings of the Conference on Neural Information Processing Systems (NeurIPS)*, 2019.
- Schwartz D, Toneva M, **Wehbe L**. **Inducing brain-relevant bias in natural language processing models.** *Proceedings of the Conference on Neural Information Processing Systems (NeurIPS)*, 2019.
- Wang A, Tarr M and **Wehbe L**. **Neural Taskonomy: Inferring the Similarity of Task-Derived Representations from Brain Activity.** *Proceedings of the Conference on Neural Information Processing Systems (NeurIPS)*, 2019.

- Chen H, Hu C, **Wehbe L** and Lin S. **Self-Discriminative Learning for Unsupervised Document Embedding**. *Proceedings of the Conference of the North American Chapter of the ACL (NAACL), 2019, oral presentation.*
- Fyshe A, Sudre G, **Wehbe L**, Rafidi N, Mitchell T. **The Semantics of Adjective Noun Phrases in the Human Brain**. *Human Brain Mapping, 2019.*
- **Wehbe L**, Fyshe A, Mitchell T. **Language processing in the brain: Mapping neural activity to language meaning**. *Language in Interaction: the human language faculty from genes to behavior, MIT Press, 2019.*
- Murphy B, **Wehbe L**, Fyshe A. **Decoding Language from the Brain**. *Language, Cognition, and Computational Models, Cambridge University Press, 2018.*
- **Wehbe L**, Ramdas A, Steorts R, Shalizi C. **Regularized Brain Reading with Shrinkage and Smoothing**. *Annals of Applied Statistics, 2015.*
- Ramdas A*, **Wehbe L***. **Nonparametric Independence Testing for Small Sample Sizes**. *Proceedings of the International Joint Conference on Artificial Intelligence (IJCAI), 2015, oral presentation.*
- Fyshe A, **Wehbe L**, Talukdar P, Murphy B, Mitchell T. **A Compositional and Interpretable Semantic Space**. *Proceedings of the Conference of the North American Chapter of the ACL (NAACL), 2015, oral presentation.*
- **Wehbe L**, Murphy B, Talukdar P, Fyshe A, Ramdas A, Mitchell T. **Simultaneously uncovering the patterns of brain regions involved in different story reading subprocesses**. *PLOS ONE, 2014.*
- **Wehbe L**, Vaswani A, Knight K, Mitchell T. **Aligning context-based statistical models of language with brain activity during reading**. *Proceedings of the Conference on Empirical Methods in Natural Language Processing (EMNLP), 2014, oral presentation.*
- Sudre G, Pomerleau D, Palatucci M, **Wehbe L**, Fyshe A, Salmelin R, Mitchell T. **Tracking neural coding of perceptual and semantic features of concrete nouns**. *Neuroimage, 2012.*

Workshop Papers, Posters and Demonstrations

- Reddy A, **Wehbe L**. **Syntactic representations in the human brain: beyond effort-based metrics**. *Society for the Neurobiology of Language, SNL 2020 poster.*
- Bollu A, Toneva M, **Wehbe L**. **Investigating different alignment methods between natural and artificial neural networks for language processing**. *Society for the Neurobiology of Language, SNL 2020 poster.*
- **Wehbe L**, Huth A, Deniz F, Kieseler M, Gallant J. **BOLD predictions: automated simulation of fMRI experiments**. *Organization for Human Brain Mapping, OHBM 2017 poster and talk. CCN 2018 poster. Merit Travel Grant awarded.*

- Tseng C, **Wehbe L**, Deniz F, Gallant J. **Different contextual effects modulate the representation of word meaning in the human brain.** *Society for the Neurobiology of Language, SNL 2017 poster.*
- **Wehbe L***, Nunez-Elizalde A*, Huth A, Deniz F, Bilenko F, Gallant J. **Deep multi-view representation learning of brain responses to natural stimuli.** *Cognitive Computational Neuroscience, CCN 2017 poster.*
- **Wehbe L***, Nunez-Elizalde A*, Huth A, Deniz F, Bilenko F, Gallant J. **Deep multi-view representation learning of brain responses to natural stimuli.** *Computational and Systems Neuroscience, COSYNE 2017 poster. Merit Travel Grant awarded.*
- **Wehbe L**, Huth A, Deniz F, Kieseiler M, Gallant J. **BOLD predictions: automated simulation of fMRI experiments.** *NeurIPS 2016 demonstration track.* Demonstration of the online engine: <https://boldpredictions.gallantlab.org/>.
- **Wehbe L**, Blank I, Mahowald K, Furell R, Piantadosi S, Tily H, Gallee J, Vishnevetsky A, Gibson E, Kanwisher N, Fedorenko E. **Neural activity in the fronto-temporal language system predicts online language comprehension difficulty.** *Society for the Neurobiology of Language, SNL 2015 poster.*
- **Wehbe L**, Vaswani A, Knight K, Mitchell T, **The dynamics of information integration in the brain during story reading,** *Society for the Neurobiology of Language, SNL 2014 poster.*
- **Wehbe L**, Murphy B, Talukdar P, Fyshe A, Ramdas A, Mitchell T. **Mapping the Reading Brain.** *NeurIPS 2013 Women in Machine Learning workshop, WiML poster.*
- **Wehbe L**, Talukdar P, Murphy B, Fyshe A, Sudre G, Mitchell T. **Tracking Story Reading in the Brain.** *NeurIPS 2012 Machine Learning and Interpretation in Neuroimaging, MLINI Workshop, oral presentation.*
- Fyshe A, Sudre G, **Wehbe L**, Murphy B and Mitchell T. **Decoding Word Semantics from Magnetoencephalography Time Series Transformations.** *NeurIPS 2012 Machine Learning and Interpretation in Neuroimaging, MLINI Workshop.*
- **Wehbe L**, Mitchell T. **Decomposing Neural Activity into Contributions from Distinct Tasks.** *Society for Neuroscience, SFN 2011 poster.*

Invited Talks

- **Response-optimized deep neural network models of higher-order visual cortex reveal strong semantic selectivity.** Columbia University, 2022.
- **Relating brain representations to percepts and behavior.** Cornell, 2022.
- **Reverse engineering representations in real brains using artificial neural networks.** BIRS workshop, 2022.
- **Testing neurobiology-of-language theories in the wild with NLP,** NYU, 2021.
- **Can human brain recordings help us design better AI models?** MBZUAI, 2021.
- **Can human brain recordings help us design better AI models?** Google, 2021.
- **From language models to human brains and back again.** University of Montreal, 2021.

- **Neural networks and brains: going beyond simple alignment.** Pitt Hackathon/BrainHack, 2020.
- **From language models to human brains and back again.** Facebook AI Brain meeting, 2020.
- **From language models to human brains and back again.** TTIC, 2020.
- **Neural networks and brains: going beyond simple alignment.** Janelia C&T seminar, 2020.
- **From language models to human brains and back again.** SMILES workshop, 2020.
- **Natural language in real brains and artificial neural networks.** Sociedad Argentina de Investigación en Neurociencias, 2020.
- **From language models to human brains and back again.** NLP group seminar series, University of Washington, 2020.
- **Natural language in real brains and artificial neural networks.** LTI colloquium, 2020.
- **Natural language in real brains and artificial neural networks.** Montreal AI and Neuroscience (MAIN) conference, 2019.
- **Using insights from the human brain to interpret and improve NLP models.** Semantic Processing and Semantic Knowledge workshop, Dartmouth, 2019.
- **Using insights from the human brain to interpret and improve NLP models.** Mila, 2019.
- **Machine Learning for automating analysis of big data in Neuroscience.** Machine Learning in Neuroscience: Fundamentals and Possibilities, SfN online conference, 2019.
- Invited keynote. **Language representations in human brains and artificial neural networks.** Cognitive Modeling and Computational Linguistics NAACL workshop, 2019.
- **Language representations in human brains and artificial neural networks.** Petuum, 2019.
- **What do naturalistic language experiments offer us?** CIMeC, University of Trento, 2018.
- Invited keynote. **Language representations in human brains and artificial neural networks.** First Blackbox NLP workshop, EMNLP 2018.
- **Studying the brain basis of language with naturalistic experiments: opportunities, challenges and progress.** Caltech, 2018.
- **Studying the brain basis of language with naturalistic experiments: opportunities, challenges and progress.** IBM research, 2018.
- **Studying the brain basis of language with naturalistic experiments: opportunities, challenges and progress.** Cornell University, 2018.
- **Studying the brain basis of language with naturalistic experiments: opportunities, challenges and progress.** Duke University, 2018.
- **Studying the brain basis of language with naturalistic experiments: opportunities, challenges and progress.** Stanford University, 2018.
- **Language and the brain: opportunities, challenges and progress.** ETH Zurich, 2018.
- **Language and the brain: opportunities, challenges and progress.** Carnegie Mellon University, 2018.
- **Naturalistic language experiments: opportunities, challenges and progress.** University of Michigan Ann Arbor, 2018.
- **Modeling brain responses to natural language stimuli.** University of Western Ontario, 2018.
- **Language and the brain: naturalistic paradigms and complex prediction problems.** Georgia Tech, 2018.
- **Modeling brain responses to natural language stimuli.** University of Illinois at Urbana-Champaign, 2017.

- **Modeling brain responses to natural language stimuli.** Society for the Neurobiology of Language conference, 2017.
- **Modeling brain responses to natural language stimuli.** Fordham University, 2017.
- Lecture. **Language processing in the brain: Mapping neural activity to language meaning**, with A. Fyshe. Language in Interaction summer school, Donders Institute, 2016.
- **Mapping the Reading Brain.** *AI with the best* online conference, 2016.
- **Harry Potter and the Activity in the Brain.** *Learning and the Brain* conference on the Science of Imagination, 2016.
- Oral Presentation. **A spatio-temporal map of reading processes in the brain.** NeurIPS WiML workshop, 2015.
- Oral Presentation. **Nonparametric Independence Testing for Small Sample Sizes.** IJCAI 2015.
- Oral Presentation. **One-step hypothesis testing for functional neuroimaging.** SAND7 2015.
- **Uncovering Meaning Construction and Representation in the Reading Brain.** Information Science Institute, University of Southern California, 2014.
- Oral Presentation. **Aligning context-based statistical models of language with brain activity during reading.** EMNLP 2014.
- **Predicting Brain Activity During Story Reading, Kanwisher Lab,** Brain and Cognitive Science Department. Massachusetts Institute of Technology, 2014.
- Invited talk to highlight Brain Initiative at Carnegie Mellon. **Harry Potter and the Reading Brain.** *Ceilidh Weekend*, 2014.
- **Tracking Story Reading in the Brain.** Reading and Learning Group, University of Pittsburgh, 2013.

Teaching

- **Instructor.** 10-701 *Introduction to Machine Learning (PhD)*. Carnegie Mellon University, Spring 2019, Spring 2020, Fall 2022.
- **Instructor.** 07-400 *Research Practicum in Computer Science*. Carnegie Mellon University, Spring 2022.
- **Instructor.** 07-300 *Research and Innovation in Computer Science*. Carnegie Mellon University, Fall 2021.
- **Instructor.** 10-730/85-430 *Advanced AI and Brain Seminar*. Carnegie Mellon University, Spring 2021.
- **Instructor.** 10-315 *Introduction to Machine Learning (SCS Majors)*. Carnegie Mellon University, Spring 2021.
- **Instructor.** 10-718 *Data Analysis (MS+PhD)*. Carnegie Mellon University, Fall 2019.
- **Instructor.** *Data Science for Cognitive Neuroscience (Undergrad)*. UC Berkeley, Spring 2017. Co-Instructor with F. Deniz and M. Lescroart.
- **Instructor.** *Data Science for Cognitive Neuroscience (Undergrad)*. UC Berkeley, Fall 2016. Co-Instructor with F. Deniz and C. Holdgraf.
- **Instructor.** *Computational Neuroscience by the Mediterranean*. American University of Beirut, January 2016.
- **Teaching Assistant.** 10-701 *Machine Learning (PhD)*. Carnegie Mellon University, Fall 2013, taught by A. Smola and G. Gordon.
- **Teaching Assistant.** 10-701 *Machine Learning (PhD)*. Carnegie Mellon University, Spring 2013, taught by A. Smola and B. Póczos.
- **Teaching Assistant.** *Multi-modal Neuroimaging Training Program*. Joint program between Carnegie Mellon University and University of Pittsburgh, Summer 2013.

- **Teaching Assistant.** *Design and Analysis of Algorithms (Undergrad)*. American University of Beirut, Spring 2009, taught by L. Bazzi.
- **Tutor.** Math, Chemistry, Physics and Biology for students in grades 8 to 12, 2005-2009.

Mentorship

- **Current Postdoc:** Margaret Henderson (co-advised with Michael Tarr, awarded the 2021-2023 Neuroscience Institute Distinguished Postdoctoral Fellowship).
- **Current PhD students:** Jennifer Williams, Aria (Yuan) Wang (co-advised with Michael Tarr), Ruogu Lin, Andrew Luo (co-advised with Michael Tarr), Tara Pirnia (co-advised with Bonnie Nozari), Joel Ye (co-advised with Rob Gaunt), Yuchen Zhou (co-advised with Michael Tarr).
- **Previous Master's Student:** Nathan Anderson (co-advised with Anna Fisher), Nidhi Jain, Nathan Anderson (co-advised with Anna Fisher), Anand Bollu, Aniketh Reddy, Srinivas Ravishankar.
- **Previous Undergraduate students:** Kimberly Lo, Stephanie You, Aditri Bhagirath, William Yang, Zachary Nowak.
- **Graduate thesis committee member:** Mostafa Abdou (U. of Copenhagen), Robert Vargas, Stefan Andjelkovic (UPitt), Qiong Zhang, Daniel Schwartz, Rui Sun, Maryam Honari Jahromi (University of Victoria, masters).
- **PhD Alumni:** Mariya Toneva (co-advised with Tom Mitchell, Assistant Professor at the Max Plank Institute for Software Systems).

Service

- **CMU Faculty Senate.** Machine Learning Department representative, 2021-2023.
- **Member and main organizer.** *Machine Learning Department Diversity Equity and Inclusion Committee*. Carnegie Mellon University, 2020-2022.
- **Member.** *Machine Learning Department Faculty Search Committee*. Carnegie Mellon University, 2019-2020, 2020-2021.
- **Area Chair.** (NeurIPS, EMNLP, ICLR).
- **Reviewer.** academic journals (PNAS, Nature Neuroscience, Neuroimage, Journal of Experimental Psychology: General, Journal of Neurolinguistics, Biological Psychiatry, Journal of Neuroscience, Neuroscience Biobehavioral Reviews, Scientific Reports, Language, Cognition and Neuroscience, Nature Communications, PLOS Computational Biology, Scientific Data, Transactions of the Association for Computational Linguistics (TACL), Neurobiology of Language, Nature Human Behavior) and conferences (*IJCAI, EMNLP, NeurIPS, CCN, ICLR, ICML, ACL*).
- **Program Committee.** Cognitive Computational Neuroscience (CCN) 2022.
- **Co-organizer.** *ICLR How Can Findings About the Brain Improve AI Systems?* Workshop, 2021.
- **Co-organizer.** brAIIn seminar, Carnegie Mellon University, 2020-2021.
- **Co-organizer.** *CVPR Minds vs. Machines: How far are we from the common sense of a toddler?* Workshop, 2020.
- **Member.** *Neuroscience Institute Faculty Search Committee*. Carnegie Mellon University, 2019-2020.
- **Co-organizer.** *NeurIPS Context and Compositionality in Biological and Artificial Neural Systems* Workshop, 2019.

- **Member.** *Machine Learning Department Admissions Committee.* Carnegie Mellon University, 2018-2019.
- **Main organizer.** *NeurIPS Representation Learning in Artificial and Biological Neural Networks Workshop,* 2016.
- **Co-organizer.** *NeurIPS Machine Learning and Interpretation in NeuroImaging Workshop,* 2014-2015.
- **Member.** *President's Student Advisory Council.* Carnegie Mellon University, 2013-2014.
- **Member.** *Machine Learning Department Admissions Committee.* Carnegie Mellon University, 2013-2014.
- **Organizing member.** *Machine Learning Lunch Seminar (2011-2013) and chief organizer (2013-2014),* Carnegie Mellon University.

Selected Press Coverage

- **New Scientist.** Brain scans reveal the areas that light up when we look at food, 2022.
- Covered in the NeurIPS conference AI research tour on **ZDNet**, 2019.
- Interviewed in **Artificial Intelligence, Perspectives from Leading Practitioners in AI and the Science of the Brain**, by Jack Clark, O'Reilly Media 2017.
- **Associated Press.** Lab-coated Muggles use Harry Potter to study brain, picked up by more than 300 news outlets, 2014.
- **Time.** Reading Harry Potter Provides Clues to Brain Activity, 2014.
- **Scientific American.** How our Brains Process Books, 2014.
- **Futurity.** Scans map the brain as people read 'Harry Potter', 2014.
- **Bioscience Technology.** Reading Leaves a Dramatic Imprint on the Brain, 2014.
- **NSF Science Now.** EPISODE 29.
- **Science News for Students.** Harry Potter reveals secrets of the brain, 2015.
- **Huffington Post.** What Harry Potter Can Teach Us About Neuroscience, 2014.
- **Trib Live.** Reading Harry Potter provides clues to brain activity, CMU researchers say, 2014.