John Thickstun

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Current Position

- **Cornell University** — Ithaca, NY
  Assistant Professor - Department of Computer Science — *July 2024 - Present*

Education

- **Stanford University** — Palo Alto, CA
  Postdoctoral Scholar - Stanford Artificial Intelligence Laboratory — *September 2021 - June 2024*
  - Advised by Percy Liang (joint Computer Science & Statistics).
- **University of Washington** — Seattle, WA
  Ph.D. in Computer Science and Engineering — *August 2021*
  - Advised by Sham M. Kakade (joint Computer Science & Statistics) and Zaid Harchaoui (Statistics).
  - Doctoral Committee: Sham M. Kakade, Zaid Harchaoui, Noah A. Smith, Sewoong Oh, Lalit Jain.
  - Dissertation: Leveraging Generative Models for Music and Signal Processing.
- **University of Washington** — Seattle, WA
  M.Sc. in Computer Science and Engineering — *December 2017*
  - Coursework in Optimization, Algorithms, Learning Theory, Information Theory, Reinforcement Learning.
- **Brown University** — Providence, RI
  Sc.B. Magna cum Laude with Honors in Applied Mathematics — *May 2013*
  - Advised by Björn Sandstede and Eugene Charniak.
  - Coursework in Machine Learning, Computer Vision, Natural Language Processsing, Probability Theory, Stochastic Processes, Real and Complex Analysis, Operator Theory.
- **Hamilton College Bridge Program** — Clinton, NY
  (High School Credit) — *2005-2007*
  - Coursework in Programming Languages, Computer Architecture, Operating Systems, Abstract Algebra.

Major Grants and Awards

- ACL Outstanding Paper Award: 39 / 3872 paper submissions (2023).
- Stanford HAI Google Cloud Credits Grant: $15,000 (2022).
- Neurips Outstanding Paper Award: 6 / 9122 paper submissions (2021).
- Qualcomm Innovation Fellowship: $100,000 (2020).
- NSF Graduate Research Fellowship: $138,000 (2017-2019).
- Brown University Distinguished Senior Thesis Prize (university-wide award, 2013).
- Sigma Xi Scientific Honor Society (2013).

Teaching

- Predoctoral Instructor (Instructor of Record). UW CSE599i: Generative Models (Autumn, 2020).
  - Created a new course offering covering advances in generative modeling from 2010-2020.
  - Developed course materials from scratch including lecture notes, slides, and homework.
  - Top-decile teaching reviews: 4.9/5.0 overall course quality with a 53% response rate (16/30 students).
- Teaching Assistant (University of Washington)
  - CSE547: Machine Learning for Big Data (Spring, 2016).
  - CSE546: Machine Learning (Autumn, 2015).

- Guest Lecturer (University of Washington)
  - STAT558: Statistical Machine Learning for Data Scientists (Spring 2020).
  - CSE490: An Introduction to Deep Learning (Autumn, 2018).
  - STAT558: Statistical Machine Learning for Data Scientists (Spring 2018).
  - CSE546: Machine Learning (Spring 2018).
  - CSE547: Machine Learning for Big Data (Spring, 2016).

Research Advising and Mentoring

PhD Students

- Rohith Kuditipudi, Stanford University.
  - Rohith and I co-authored a paper appearing in TMLR 2024, and a post on the Stanford CRFM blog.
- Megha Srivastava, Stanford University.
  - Megha and I co-authored a paper appearing in TMLR 2023, and a post on the Stanford CRFM blog.
- Xiang Lisa Li, Stanford University.
  - Lisa and I co-authored a paper appearing at Neurips 2022.
- Vivek Jayaram, University of Washington.
  - Vivek and I co-authored two papers appearing at ICML 2020, and ICML 2021.

Masters Students

- Nic Becker, Stanford University, Class of 2025.
  - Nic and I co-authored a workshop paper appearing in GenAICHI 2024.

Undergraduate Students

- Katherine Li, Stanford University, Class of 2026.
  - CURIS summer research student, 2023.
- Jasmine Gonzales, Stanford University, Class of 2025.
  - CURIS summer research student, 2023.
- Harsh Verma, University of Washington, Class of 2019.
  - Harsh and I co-authored a paper appearing at ISMIR 2019.

Professional Experience

- **Snowcrash** - Generative Music AI — Los Angeles, CA
  Advisor — *December 2023 - Present*
  - Provided technical guidance on training generative models of music.
- **Clear Ventures** - Technology Venture Capital — Palo Alto, CA
  DeepTech Fellow — *September 2022 - May 2023*
- **Panjandrum.ai** - Virtual Music Avatars — Seattle, WA
  Advisor — *October 2019 - May 2021*
  - Provided advice and technical strategy for applications of machine learning to music and visual production.
- **University of Washington** — Seattle, WA
  Graduate Researcher - Computer Science and Engineering — *September 2015 - August 2021*
  - Built a track-record of machine learning research with publications at ICML, Neurips, ICLR, ICASSP, ISMIR.
  - Created the current best music transcription model in the MIREX Multi-F0 Challenge.
  - Designed, built, and administered a GPU computing cluster to support two research groups ($\sim$ 40 GPUs).
- **Amazon** — Seattle, WA
  Applied Science Intern - Amazon Music Machine Learning — *June 2019 – Aug. 2019*
  - Hosts: Ted Sandler, Ben London.

  - Built a recommendation model using deep contextual bandits to sequence tracks on Amazon Music stations.
  - Used counterfactual risk minimization to train models off-policy from logged user interaction data.

- **Bracebridge Capital** - Fixed Income Arbitrage Hedge Fund — Boston, MA
  Quantitative Developer (Lead Developer) - Quantitative Research — *July. 2013 – May 2015*
  - Led and mentored a team of three software engineers developing C++ software infrastructure.
  - Maintained models governing a billion dollar asset backed structured product portfolio.
  - Organized front-office data acquisition, coordinating between research, vendors, the trading floor, and IT.
  - Built in-house models of implied volatilities and sensitivities, with applications to rates products.

- **Bracebridge Capital** — Boston, MA
  Summer Analyst - Quantitative Research — *June 2012 – Aug. 2012*
  - Rebuilt a legacy Excel product model using modern technologies: C#, Postgres, and JavaScript.
  - Completed a quant training course on valuation and risk models, with a focus on fixed income products.

- **Sirius Software** - Database Vendor — Cambridge, MA
  Software Engineer - Systems Software Engineering — *Jan. 2008 – May 2012*
  - Wrote compiler extensions for a database bytecode query language used by 1000+ developers worldwide.
  - Developed core system libraries for reporting, parsing, and web, supporting applications with millions of users.
  - Delivered international on-site programmer training and product demonstrations.
  - Linux systems administration: DNS, backups, software updates, security, documentation wiki.

Academic Service

- Program Committee:
  - International Society for Music Information Retrieval, 2024.
- Journal Reviewer:
  - IEEE Transactions on Pattern Analysis and Machine Intelligence 2024.
  - ACM Computing Surveys 2023.
  - Journal of Creative Music Systems 2022, 2023.
  - IEEE Signal Processing Letters 2022.
  - Transactions of the International Symposium on Music Information Retrieval 2021, 2022.
- Conference Reviewer:
  - Conference on Language Modeling 2024.
  - International Conference on Learning Representations 2022, 2023, 2024.
  - International Conference on Machine Learning 2018, 2021, 2022.
  - Advances in Neural Information Processing Systems 2016, 2020, 2021, 2022, 2023, 2024.
- Workshop Reviewer:
  - ICLR Workshop on Mathematical and Empirical Understanding of Foundation Models, 2024.
  - NeurIPS Workshop on Machine Learning Safety, 2022.
- UW CSE Application Reader, PhD Admissions: 2018, 2019, 2020.
  - Screened and reviewed 30-50 PhD applications annually for the UW CSE Machine Learning group.
- UW CSE Machine Learning Graduate Student Recruiting Activities Coordinator: 2018, 2019.
  - Planned and organized on-campus recruiting events and activities for 100+ current and prospective students.
- UW CSE Graduate Social Co-Chair, 2017.
  - Organized weekly student social events for the Allen School graduate student community.
  - Worked to create inclusive activities that are accessible and appealing to our diverse community of students.
- Stanford CS Undergraduate Mentoring, 2021-2022.
  - This program provides early research mentoring to undergraduate students from underrepresented groups.
  - Met regularly with my mentee during the 2021-2022 academic year.
- Co-founder and organizer of the UW Machine Learning and Optimization Reading Group.

- Organized and scheduled speakers for a weekly seminar for 5 years (2015-2020).
- In 2020, this seminar grew into the regular meeting of ADSI/ IFDS, funded by an NSF Tripods grant.

Outreach

- The IFML Podcast: Meet the research team behind MAUVE
  - May 22, 2024: The inaugural episode of the IFML podcast (Institute for Foundations of Machine Learning).
- California Assembly Briefing: What's Real in the Technology Combating Deepfakes?
  - May 20, 2024: An information-gathering panel discussion for staffers to the California State Assembly.
  - I was invited as a panelist to share my expertise on the topic of text watermarking.
- Press Play: Carol Reilly and the Robots, April 6 & 7, 2024
  - I premiered a musical composition co-composed with the Anticipatory Music Transformer.
  - In collaboration with Carol Reilly and performers from the San Francisco Symphony Orchestra.
- Stanford Student-Applicant Support Program (SASP) 2022.
  - Provided feedback on PhD applications to prospective Stanford students from under-represented groups.
- UW CSE Pre-Application Mentorship Service (PAMS) 2021.
  - Mentored prospective applicants to the UW PhD program from historically marginalized groups.
- Academic Research Panels:
  - June 2021: Howard University Karsh STEM Scholars Research Panel for Incoming First-Year Students
  - March 2021: UW CSE PhD Student Experience Panel for Admitted Graduate Students
  - February 2020: CSE 142 Careers in Research Panel for First-Year Computer Science Students
  - May 2018: ACM Research Night for UW Undergraduate Students

Publications and Preprints

Theses

1. Leveraging Generative Models for Music and Signal Processing.
   University of Washington Dissertation.
   Paul G. Allen School of Computer Science & Engineering, 2021.
   John Thickstun.
2. Statistical Inference on Music with Applications to the Transcription Problem.
   Brown University Senior Thesis.
   Department of Applied Mathematics, 2013.
   Brown University **Distinguished Senior Thesis Award** (university-wide award).
   John Thickstun.

Journal Publications

1. Robust Distortion-free Watermarks for Language Models.
   Transactions on Machine Learning Research (**TMLR**) 2024. Acceptance rate: 46%
   Rohith Kuditipudi, John Thickstun, Tatsunori Hashimoto, Percy Liang.
2. Anticipatory Music Transformer.
   Transactions on Machine Learning Research (**TMLR**) 2024. Acceptance rate: 46%
   John Thickstun, David Hall, Chris Donahue, Percy Liang.
3. MAUVE Scores for Generative Models: Theory and Practice.
   Journal of Machine Learning Research (**JMLR**) 2023. Acceptance rate: 17%
   Krishna Pillutla, Lang Liu, John Thickstun, Sean Welleck, Swabha Swayamdipta, Rowan Zellers, Sewoong Oh, Yejin Choi, Zaid Harchaoui.

4. Evaluating Human-Language Model Interaction.
   Transactions on Machine Learning Research (**TMLR**) 2023. Acceptance rate: 46%
   Mina Lee, Megha Srivastava, Amelia Hardy, John Thickstun, Esin Durmus, Ashwin Paranjape, Ines Gerard-Ursin, Xiang Lisa Li, Faisal Ladhak, Frieda Rong, Rose E. Wang, Minae Kwon, Joon Sung Park, Hancheng Cao, Tony Lee, Rishi Bommasani, Michael Bernstein, Percy Liang.

Conference Publications

1. Backpack Language Models.
   In Annual Meeting of the Association for Computational Linguistics (**ACL**) 2023. Acceptance rate: 23.5%
   Outstanding Paper Award: 39 / 3872 paper submissions.
   John Hewitt, John Thickstun, Christopher D. Manning, Percy Liang.
2. Melody Transcription via Generative Pre-Training.
   In International Symposium on Music Information Retrieval (**ISMIR**) 2022. Acceptance rate: 43.3%
   Chris Donahue, John Thickstun, Percy Liang.
3. Diffusion-LM Improves Controllable Text Generation.
   In Advances in Neural Information Processing Systems (**Neurips**) 2022. Acceptance rate: 25.6%
   Selected for **Oral Presentation**.
   Xiang Lisa Li, John Thickstun, Ishaan Gulrajani, Percy Liang, Tatsunori B. Hashimoto.
4. MAUVE: Measuring the Gap Between Neural Text and Human Text using Divergence Frontiers.
   In Advances in Neural Information Processing Systems (**Neurips**) 2021. Acceptance rate: 25.7%
   Outstanding Paper Award: 6 / 9122 paper submissions.
   Krishna Pillutla, Swabha Swayamdipta, Rowan Zellers, John Thickstun, Sean Welleck, Yejin Choi, Zaid Harchaoui.
5. Parallel and Flexible Sampling from Autoregressive Models via Langevin Dynamics.
   In International Conference on Machine Learning (**ICML**) 2021. Acceptance rate: 21.5%
   Vivek Jayaram*, John Thickstun* (*equal contribution).
6. Faster Policy Learning with Continuous-Time Gradients.
   In Learning for Dynamics & Control (**L4DC**) 2021.
   Samuel Ainsworth, Kendall Lowrey, John Thickstun, Zaid Harchaoui, Siddhartha Srinivasa.
7. An Information Bottleneck Approach for Controlling Conciseness in Rationale Extraction.
   In Empirical Methods in Natural Language Processing (**EMNLP**) 2020. Acceptance rate: 24.5%
   Bhargavi Paranjape, Mandar Joshi, John Thickstun, Hannaneh Hajishirzi, Luke Zettlemoyer.
8. Source Separation with Deep Generative Priors.
   In International Conference on Machine Learning (**ICML**) 2020. Acceptance rate: 21.8%
   Vivek Jayaram*, John Thickstun* (*equal contribution).
9. Convolutional Composer Classification.
   In International Symposium on Music Information Retrieval (**ISMIR**) 2019. Acceptance rate: 45.1%
   Harsh Verma, John Thickstun.
10. Coupled Recurrent Models for Polyphonic Music Composition.
    In International Symposium on Music Information Retrieval (**ISMIR**) 2019. Acceptance rate: 45.1%
    John Thickstun, Zaid Harchaoui, Dean P. Foster, Sham M. Kakade.
11. Invariances and Data Augmentation for Supervised Music Transcription.
    In International Conference on Acoustics, Speech, and Signal Processing (**ICASSP**) 2018. Acceptance rate: 49.7%
    Selected for **Oral Presentation**.
    John Thickstun, Zaid Harchaoui, Dean P. Foster, Sham M. Kakade.
12. Frequency Domain Convolutions for Multiple F0 Estimation.
    MIREX Abstract (Technical Report) 2017.
    John Thickstun, Zaid Harchaoui, Dean P. Foster, Sham M. Kakade.
13. MusicNet: Learning Features of Music from Scratch.
    In International Conference on Learning Representations (**ICLR**) 2017. Acceptance rate: 39.1%
    John Thickstun, Zaid Harchaoui, Sham M. Kakade.

Workshop Papers

1. Designing Live Human-AI Collaboration for Musical Improvisation.
   In Generative AI and HCI Workshop at CHI (**GenAICHI**), 2024.
   Nic Becker, Ryan Louie, John Thickstun, Percy Liang.

Pre-print Reports

1. Reconstruction of Visual Images from Murine Retinal Ganglion Cell Spiking Activity using Convolutional Neural Networks.
   Under Review, 2023. BioRxiv Preprint Report 2022.06.10.482188.
   Tyler Benster, Darwin Babino, John Thickstun, Matthew Hunt, Xiyang Liu, Zaid Harchaoui, Sewoong Oh, Russell N. Van Gelder.

Invited Talks

- Robust Distortion-free Watermarks for Language Models
  - Google Algorithms Seminar - New York, NY - 7/2/2024
  - Google Differential Privacy Seminar - Mountain View, CA - 7/12/2023
- Mechanisms and Metaphors for Interactions with AI
  - Stories for the Future Workshop - Stanford University - 5/17/2024
- Control Mechanisms for Generative Models
  - Cornell - Ithaca, NY - 4/9/2024
  - Cornell Tech - New York City, NY - 4/8/2024
  - Boston University - Boston, MA - 3/25/2024
  - UC San Diego - La Jolla, CA - 2/28/2024
- Anticipation and the Anticipatory Music Transformer
  - Grinnell College - Grinnell, IA - 05/02/2024
  - Spotify - New York, NY - 04/24/2024
  - University of Wisconsin - Madison, WI - 11/10/2023
  - MIT - Cambridge, MA - 10/30/2023
  - Harvard - Cambridge, MA - 10/27/2023
  - UC San Diego - La Jolla, CA - 8/23/2023
- Advancing the Capabilities of Generative AI: Two Vignettes
  - Radix Trading - Chicago, IL - 6/8/2023
- Generative Models for Controllable Content Creation
  - CLEAR Ventures - Palo Alto, CA - 10/24/2022
  - Meta - New York, NY - 10/18/2022
- Audio Source Separation with Deep Generative Priors
  - Mila - Quebec, Canada - 8/19/2022
- Classifier-Guided Controllable Text Generation with Diffusion-LM
  - AI2 - Seattle, WA - 8/3/2022
- Generative Modeling of Classical Western Music
  - SAIL - Stanford University - 12/4/2020
- Source Separation with Deep Generative Priors
  - ICML - Vienna, Austria - 7/14/2020
- Robust Generative Modeling in Diverse Modalities
  - CSE Colloquium - UW Seattle - 10/31/2019
- Automatic Music Transcription
  - CS Department - Brown University - 5/1/2013

- Introducing the Janus XmlParser
  - Sirius User Group - St. Louis, MO - 5/2/2010
- Tokenization and Collection Objects
  - Centrelink - Canberra, Australia - 3/23/2010

Media Coverage

The Anticipatory Music Transformer

- San Francisco Chronicle - Beethoven meets AI as music enters a new technological moment.
- The Baltimore Sun - BSO partners with tech firm to perform music composed by artificial intelligence .
- The AudioCipher Blog - Beethoven meets AI as music enters a new technological moment.

Watermarking Language Models

- Brookings - Detecting AI fingerprints: A guide to watermarking and beyond.

MusicNet

- TechCrunch - MusicNet aims to give machine learning algorithms a taste for Beethoven.
- The Times of London - Bach to the future: computer will finish composer's work.
- A Tempo with Rachel Katz (WWFM Radio) - Computers and music.
- CNET - Bach to the future: AI, meet classical music.
- CIFAR - Learning algorithms find a new music teacher.
- RouteNote - How do you advance machine learning? Teach them Beethoven and Bach.
- Technical.ly - AI can't replace the violinist's hands, but it can generate musical compositions for the BSO.
- UW Today - What makes Bach sound like Bach? New dataset teaches algorithms classical music.

Open Source Contributions

- Stanford CRFM Mistral
  - https://github.com/stanford-crfm/mistral
  - A framework for replicable training of GPT-2 scale Transformer models.
  - I contributed abstractions for training models over non-text datasets including, for example, music.
- HuggingFace Datasets
  - https://github.com/huggingface/datasets/
  - A Python library of natural language processing datasets and utilities.
  - I contributed model evaluation metrics that implement the MAUVE algorithm for measuring the quality of machine-generated text.
- FIFE Engine
  - https://github.com/fifengine/fifengine
  - A multi-platform isometric game engine written in C++ with Python bindings for scripting.
  - I was an early core contributor from 2007-2008 with 241 commits touching all aspects of the engine.

Blog Posts

- A Closer Look at Human-LM Interactions in Information-Seeking Contexts - 2023/10/11
  - The CRFM Blog - Stanford Center for Research on Foundation Models
- Robust Distortion-free Watermarks for Language Models - 2023/07/30
  - The CRFM Blog - Stanford Center for Research on Foundation Models
- Anticipatory Music Transformer: A Controllable Infilling Model for Music - 2023/06/16
  - The CRFM Blog - Stanford Center for Research on Foundation Models