

# “Tony” Runzhe Yang

Researcher @ Susquehanna | PhD, Princeton \*23

<http://runzhe-yang.science>

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## 💡 Research Expertise

Reinforcement Learning / Natural Language Processing / Deep Learning / Computational Finance / Game Theory / Theoretical and Computational Neuroscience

## 🏢 Industry Positions

**Susquehanna International Group (SIG)** ⟨2023 – Present⟩

*Machine Learning Scientist & Quantitative Researcher*

**⟨AI Startup⟩** ⟨2023⟩

*Co-Founder & Chief Scientist*

## 🎓 Education

**Princeton University, USA** Sept. 2018 – Sept. 2023

*Doctor of Philosophy (Ph.D.)* in Computer Science & Neuroscience

Advisors: [Prof. Sebastian Seung](#) and [Prof. Karthik Narasimhan](#)

**Shanghai Jiao Tong University, China** Sept. 2014 – Jun. 2018

*Honors Bachelor of Science (B.Sc. Hons)* in Computer Science

Graduated from [ACM Class](#), a highly selective program for CS talent in China.

## 🔬 Research Experience

**Machine Learning Scientist** at [Susquehanna International Group](#) ⟨2023 – Present⟩

- ⟨state-of-the-art time series modeling and high-frequency trading strategies.⟩

**Co-Founder and Chief Scientist** at **⟨AI Startup⟩** ⟨2023⟩

- **LLM Agents:** designed and implemented the first prototype of a multi-agent LLM system that searches for the latest threat reports online, generates SIEM and XDR queries, and detects ransomware attacks.

**Research Assistant** at [Seung Lab](#), Princeton University Sept. 2018 – Sept. 2023






















- Mentored by [Prof. Sebastian Seung](#) on Computational Neuroscience and Machine Learning
- **I. Cortex-Inspired Machine Learning:** (1) designed unsupervised representation learning algorithms that satisfy biological constraints. (2) analyzed the convergence and duality of the “correlation game” algorithm and neural networks with Hebbian feedforward excitation and anti-Hebbian lateral inhibition. **II. Connectomics:** (3) contributed to multiple milestones of neuroscience: the largest reconstruction mouse primary visual cortex, and the first complete reconstruction of an adult brain; (4) analyzed the various topological properties of biological neural networks, including mouse visual cortex, zebrafish oculomotor circuit, fly whole brain, with the tools from complex networks. (5) developed semantic segmentation algorithms to detect soma, dendrites and axons of neurons, as well as glia cells.

**Research Assistant** at [Princeton NLP Group](#), Princeton University Sept. 2018 – Sept. 2023

- Mentored by [Prof. Karthik Narasimhan](#) on Natural Language Processing and Reinforcement Learning.
- **I. Reinforcement Learning (RL):** (1) developed one of the first deep multi-objective reinforcement learning algorithm that enables few-shot adaptation to new tasks; (2) incorporated Theory of Mind from cognitive science to RL-based negotiation systems for strategic dialogue generation. (3) designed an equilibrium-informed algorithm for generating optimal communication in multi-agent strategy games. **II. Large Language Models (LLMs):** (4) proposed a multi-agent framework of LLMs for knowledge self-discovery; (5) improved the inference throughput of neural networks with data multiplexing; (6) created a systematic, extendable text generation benchmark for LLMs.

- Summer Research Associate** at **Flatiron Institute**, Simons Foundation Jun. 2022 – Aug. 2022
- Mentored by **Prof. Dmitri "Mitya" Chklovskii** on Neuro-Inspired Machine Learning.
  - (1) implemented a general framework of unsupervised learning with Hebbian and anti-Hebbian plasticity; (2) designed a bio-plausible neural network algorithm for dynamical systems identification.
- Research Intern** at **Google Brain Team**, Google Research Jun. 2021 – Sept. 2021
- Mentored by **Yuan Cao** on Multi-Modal Large Language Models.
  - (1) analyzed visually grounded language models on pure natural language understanding tasks; (2) designed cognitive science inspired fine-tuning to improve model performance on GLUE benchmark.
- Research Intern** at **Institute for Computational Sustainability**, Cornell University Jun. 2017 – Feb. 2018
- Mentored by **Prof. Carla Gomes** on Artificial Intelligence and Computational Sustainability.
  - (1) established imitation refinement approach to improve imperfect data by mimicking; (2) proposed a game-theoretic crowdsourcing framework for better crowd workers' reliability; (3) developed a multi-armed bandit system to minimize expert annotation time for eelgrass wasting disease monitoring.
- Undergraduate Researcher** at **SJTU Speech Lab**, Shanghai Jiao Tong University Jul. 2016 – Jun. 2018
- Mentored by **Prof. Kai Yu** on Spoken Dialogue System and Reinforcement Learning.
  - (1) proposed the companion teaching framework for reinforcement learning based dialogue system to incorporate human teaching; (2) quantitatively measured the safety and efficiency of the on-line dialogue policy learning; (3) implemented natural language generation and dialogue manager modules.

## Peer-Reviewed Publications { **Computer Science** | **Computational Neuroscience** }

- J7** **Functional connectomics spanning multiple areas of mouse visual cortex.**
- **The MICrONS Consortium.**
  - **Nature**, 2025. {  **Paper** |  **Bib** |  **MICrONS Explorer** |  **featured on cover** }
- J6** **Network statistics of the whole-brain connectome of *Drosophila*.**
- Albert Lin\*, **Runzhe Yang\*** (equal contribution), Sven Dorkenwald, Arie Matsliah, Amy R. Sterling, Philipp Schlegel, Szi-chieh Yu, Claire E. McKellar, Marta Costa, Katharina Eichler, Alexander Shakeel Bates, Nils Eckstein, Jan Funke, Gregory S. X. E. Jefferis, Mala Murthy.
  - **Nature**, 2024. {  **Paper** |  **Bib** |  **FlyWire** |  **Code** }
- J5** **Neuronal wiring diagram of an adult brain.**
- Dorkenwald Arie Matsliah, Amy R Sterling, Philipp Schlegel, Szi-chieh Yu, Claire E. McKellar, Albert Lin, Marta Costa, Katharina Eichler, Yijie Yin, Will Silversmith, Casey Schneider-Mizell, Chris S. Jordan, Derrick Brittain, Akhilesh Halageri, Kai Kuehner, Oluwaseun Ogedengbe, Ryan Morey, Jay Gager, Krzysztof Kruk, Eric Perlman, **Runzhe Yang**, David Deutsch, Doug Bland, Marissa Sorek, Ran Lu, Thomas Macrina, Kisuk Lee, J. Alexander Bae, Shang Mu, Barak Nehoran, Eric Mitchell, Sergiy Popovych, Jingpeng Wu, Zhen Jia, Manuel Castro, Nico Kemnitz, Dodam Ih, Alexander Shakeel Bates, Nils Eckstein, Jan Funke, Forrest Collman, Davi D. Bock, Gregory S.X.E. Jefferis, H. Sebastian Seung\*, Mala Murthy\*, the FlyWire Consortium.
  - **Nature**, 2024. {  **Paper** |  **Bib** |  **FlyWire** |  **featured on cover** }
- J4** **Whole-brain annotation and multi-connectome cell typing of *Drosophila*.**
- Philipp Schlegel, ..., **the FlyWire Consortium**, Marta Costa, H. Sebastian Seung, Mala Murthy, Volker Hartenstein, Davi D. Bock\* & Gregory S. X. E. Jefferis\*.
  - **Nature**, 2024. {  **Paper** |  **Bib** |  **FlyWire** |  **Code** }
- J3** **Predicting modular functions and neural coding of behavior from a synaptic wiring diagram.**
- Ashwin Vishwanathan, Alexandro Ramirez, Jingpeng Wu, Alex Sood, **Runzhe Yang**, Nico Kemnitz, Dodam Ih, Nicholas Turner, Kisuk Lee, Ignacio Tartavull, William M. Silversmith, Chris S. Jordan, Celia David, Doug Bland, Mark S. Goldman, Emre R. F. Aksay, H. Sebastian Seung, the Eyewirers
  - **Nature Neuroscience**, 2024. {  **Paper** |  **Bib** }
- C9** **COLLIE: Systematic construction of constrained text generation tasks..**
- Shunyu Yao\*, Howard Chen\*, Austin W. Hanjie\*, **Runzhe Yang\*** (equal), Karthik Narasimhan.
  - In proceedings of the **ICLR 2024** conference. {  **Paper** |  **Bib** |  **Code** }

**J2 Cyclic structure with cellular precision in a vertebrate sensorimotor neural circuit.**

- **Runzhe Yang**, Ashwin Vishwanathan, Jingpeng Wu, Nico Kemnitz, Dodam Ih, Nicholas Turner, Kisuk Lee, Ignacio Tartavull, William M. Silversmith, Chris S. Jordan, Celia David, Doug Bland, Amy Sterling, Mark S. Goldman, Emre R.F. Aksay, H. Sebastian Seung, the Eyewirers.
- **Current Biology** 2023. { [Paper](#) | [Bib](#) }

**A3 Neuronal Circuits for Robust Online Fixed-Point Detection.**

- **Runzhe Yang**, David Lipshutz, Tiberiu Tesileanu, Johannes Friedrich, Dmitri Chklovskii.
- In proceedings of the **COSYNE 2023** conference. { [Abstract](#) | [Poster](#) }

**C8 DataMUX: Data Multiplexing for Neural Networks.**

- Vishvak Murahari, Carlos Jimenez, **Runzhe Yang**, Karthik Narasimhan.
- In proceedings of the **NeurIPS 2022** conference. { [Paper](#) | [Bib](#) | [Code](#) }

**J1 Reconstruction of Neocortex: Organelles, Compartments, Cells, Circuits, and Activity.**

- Nicholas Turner\*, Thomas Macrina\*, Alexander Bae\*, **Runzhe Yang\***, Alyssa Wilson\*, Casey Schneider-Mizell\*, Kisuk Lee\*, Ran Lu\*, Jingpeng Wu\*, Agnes Bodor\*, Adam Bleckert\*, Derrick Brittain\*, Emmanouil Froudarakis\*, Sven Dorkenwald\*, Forrest Collman\*, Nico Kemnitz\* (equal contribution) ... Jacob Reimer, Andreas Tolias, Clay Reid, Nuno da Costa, Sebastian Seung
- **Cell**, 2022. { [Paper](#) | [MICrONS Explore](#) }

**A2 Modularity, Graded Connectivity, and Recurrence in a Vertebrate Sensorimotor Neural Circuit.**

- **Runzhe Yang**, Ashwin Vishwanathan, Mark Goldman, Emre Aksay, and Sebastian Seung.
- Selected Poster at the **Neuronal Circuits 2022** conference. { [Abstract](#) | [Poster](#) }

**C7 Improving Dialog Systems for Negotiation with Personality Modeling.**

- **Runzhe Yang\***, Jingxiao Chen\* (equal contribution) and Karthik Narasimhan.
- Oral presentation, in proceedings of the **ACL 2021** conference. { [Paper](#) | [Bib](#) | [Code](#) }

**A2 Unsupervised Feature Discovery by Neural Networks with Disynaptic Recurrent Inhibition.**

- **Runzhe Yang**, Kyle Luther and H. Sebastian Seung.
- Selected talk in the **NAISys 2020** conference. { [Abstract](#) | [Slides](#) }

**C6 A Generalized Algorithm for Multi-Objective Reinforcement Learning and Policy Adaptation.**

- **Runzhe Yang**, Xingyuan Sun and Karthik Narasimhan.
- In proceedings of the **NeurIPS 2019** conference. { [Paper](#) | [Bib](#) | [Code](#) }

**C5 Unsupervised Learning by a "Softened" Correlation Game: Duality and Convergence.**

- **Runzhe Yang**, w/ Kyle Luther and Sebastian Seung (theoretical paper, invited).
- In proceedings of the **ACSSC 2019** conference. { [Paper](#) | [Bib](#) }

**C4 Imitation Refinement for X-Ray Diffraction Signal Processing.**

- Junwen Bai, Zihang Lai, **Runzhe Yang**, Yexiang Xue, John Gregoire and Carla Gomes.
- In proceedings of the **ICASSP 2019** conference. { [Paper](#) | [Bib](#) }

**A1 Mitochondrial Size Gradients in Cortical Neurons Suggested by 3D Electron Microscopy.**

- Nicholas L. Turner, **Runzhe Yang**, Agata Foryciarz, Kisuk Lee, William Silversmith, William Wong, Jingpeng Wu, Sven Dorkenwald, T. L. Lewis, Yusuke Hirabayashi, Franck Polleux, Nuno da Costa, R. Clay Reid, H. Sebastian Seung
- Poster in the **SfN 2018** conference. { [Abstract](#) | [Poster](#) }

**C3 Affordable On-line Dialogue Policy Learning.**

- **Runzhe Yang\***, Cheng Chang\* (equal authorship), Lu Chen, Xiang Zhou and Kai Yu.
- In proceedings of the **EMNLP 2017** conference. { [Paper](#) | [Bib](#) | [Appendix](#) }

**C2 Agent-Aware Dropout DQN for Safe and Efficient On-line Dialogue Policy Learning.**

- Lu Chen, Xiang Zhou, Cheng Chang, **Runzhe Yang** and Kai Yu.
- In proceedings of the **EMNLP 2017** conference. { [Paper](#) | [Bib](#) | [Appendix](#) }

**C1 On-line Dialogue Policy Learning with Companion Teaching.**

- Lu Chen, **Runzhe Yang**, Cheng Chang, Zihao Ye, Xiang Zhou and Kai Yu.
- In proceedings of the **EACL 2017** conference. { [Paper](#) | [Bib](#) | [Poster](#) }

## Selected Manuscripts { [Computer Science](#) | [Computational Neuroscience](#) }

- M14** LLMs are Superior Feedback Providers: Bootstrapping Reasoning for Lie Detection with Self-Generated Feedback. (2024) { [ArXiv](#) | [Bib](#) | [Kaggle Dataset](#) }  
- Tanushree Banerjee, Richard Zhu, **Runzhe Yang**, Karthik Narasimhan.
- M10** The Socratic Method for Self-Discovery in Large Language Models. (2023)  
- **Runzhe Yang** and Karthik Narasimhan. { [Blog](#) }
- M3** Imitation Refinement. (2018) { [ArXiv](#) | [Bib](#) | [Code](#) }  
- **Runzhe Yang**\*, Junwen Bai\* (equal authorship), Yexiang Xue, John Gregoire and Carla Gomes.
- M1** Pedagogical Value-Aligned Crowdsourcing: Inspiring the Wisdom of Crowds via Interactive Teaching.  
- **Runzhe Yang**, Yexiang Xue and Carla Gomes. (2017) { [Manuscript](#) | [Appendix](#) | [Code](#) }

## Selected Talks { [Computer Science](#) | [Computational Neuroscience](#) }

- T7** Modularity and Cyclic Structure in a Vertebrate Sensorimotor Neural Circuit. (2022) { [Slides](#) }  
- Invited talk at **ICERM Workshop: Topological and Dynamical Analysis of Brain Connectomes**.
- T6** Improving Dialog Systems for Negotiation with Personality Modeling. (2021) { [Slides](#) }  
- Oral presentation at **ACL-IJCNLP 2021**.
- T5** Unsupervised Feature Discovery by Neural Networks with Disynaptic Recurrent Inhibition. (2020)  
- Selected talk at **NAISys 2020**. { [Slides](#) }
- T4** Multiscale and Multimodal Reconstruction of Cortical Structure and Function (2020) { [Slides](#) }  
- Invited talk at **Center for Computational Neuroscience, Flatiron Institute**.
- T3** Generating Strategic Dialogue for Negotiation with Theory of Mind (2020) { [Slides](#) }  
- Invited talk at Amazon Research Seminar
- T2** Multi-Objective Reinforcement Learning (2020) { [Slides](#) }  
- Open talk for general exam at **Computer Science Department, Princeton University**
- T1** Bridging the Duality Gap between Neural Networks with Hebbian/Anti-Hebbian Plasticity and the Correlation Game Principle (2019)  
- Invited presentation at **Asilomar 2019: Neuroscience-Inspired ML Session**.

## Patents

- P3** Methods for Data Multiplexing in Neural Networks.  
- Inventors: Karthik Narasimhan, Vishvak Murahari, Carlos Jimenez, **Runzhe Yang**, Ameet Deshpande, Yushan Su, Kai Li.  
- Assignee: Princeton Univ. [[WO2023154558A1](#) | [G Patents](#)]
- P2** Online Dialogue Strategy Optimization with Multitask Learning.  
- Inventors: Kai Yu, Cheng Chang, **Runzhe Yang**, Lu Chen, Xiang Zhou  
- Assignee: SJTU, AISpeech Co., Ltd. [[CN107357838A](#) | [G Patents](#)]
- P1** The Cold Starting System and Method for Dialog Strategy Optimization.  
- Inventors: Kai Yu, Lu Chen, Xiang Zhou, Cheng Chang, **Runzhe Yang**.  
- Assignee: SJTU, AISpeech Co., Ltd. [[CN107342078A](#) | [G Patents](#)]

## Voluntary Service

- Active reviewer for AI/ML journals and conferences: JAIR, JMLR, JAMMAS, NeurIPS, ICLR, ICML, etc.
- Served as a voluntary columnist at **Neureality**, an NPO for popular AI and neuroscience.  
- Columnist, co-hosted the **Neuromancer** podcast on topics in neuroscience and ML.

Participated in Deep Learning and Reinforcement Learning text books translation:

- Yoshua Bengio, **Learning Deep Architecture for AI**, Chinese edition published [[a](#)]
- Sutton, R. S., Barto, A. G, **Reinforcement Learning: An Introduction**, Chinese edition published [[a](#)]

Contributed to the chess opening book for [Yixin](#), the strongest Gomoku/Renju AI in the world.

## Leadership

<b>President</b> of Association of Chinese Students and Scholars, Princeton	May 2020 – May 2022
<b>General Secretary</b> of Association of Chinese Students and Scholars, Princeton	June 2019 – May 2020
<b>President</b> of Zhiyuan Association for Science and Technology, SJTU.	June 2015 – Jun. 2018
<b>Chairperson</b> of ACM Honors Class of 2018, SJTU.	Sept. 2016 – Jun. 2018
<b>Co-organizer</b> of the 8th ACM-Class Student Academic Festival (ASAF2017).	June 2017
<b>Co-organizer</b> of the 2nd and 3rd INS-ZY Student Conference on Natural Science.	June 2015, Apr. 2016

## Teaching Experience

<b>Teaching Assistant</b> of COS485 @ Princeton: Neural Networks.	Feb. 2020 – June 2020
<b>Teaching Assistant</b> of COS484 @ Princeton: Natural Language Processing.	Sept. 2019 – Jan. 2020
<b>Teaching Assistant</b> of CS389 @ SJTU: Mathematics for the Information Age.	May 2018 – June 2018
<b>Teaching Assistant</b> of CS120 @ SJTU: Introduction to Computer Science.	Sept. 2016 – Jan. 2017

## Programming Skills

**Programming Languages:** Python, Mathematica, C/C++, Java, Lua, Verilog, Matlab  
**Deep Learning Toolkits:** PyTorch, Torch, MXNet, Tensorflow, Theano  
**Others:** Unix/Linux, L<sup>A</sup>T<sub>E</sub>X, Markdown, Jupyter notebook

## Honors and Awards

<b>Bell Labs Prize 2022</b> (2nd place) { <a href="#">📰 News</a> }	Nov. 2022
<b>SEAS Award for Excellence</b> of Princeton University { <a href="#">📰 News</a> }	Nov. 2021
<b>Excellent Graduate Award</b> of Shanghai (the highest award for graduates, top 1%)	May. 2018
<b>Excellent Bachelor Thesis</b> of Shanghai Jiao Tong University (top 1%)	Jun. 2018
<b>Zhiyuan Outstanding Student Scholarship</b> of Shanghai Jiao Tong University	Jun. 2018
<b>Academic Excellence Scholarship</b> of Shanghai Jiao Tong University (A-level, top 1%)	Oct. 2015, 2017
<b>Arawana Scholarship</b> (gpa ranking is in top 1%, awarded to 2 students out of 300+)	Oct. 2017
<b>1st prize</b> in "Hsue-shen Tsien Cup" Collegiate Science and Technology Contest	Apr. 2017
<b>Sunny Leadership Scholarship</b> (A-level, awarded to high leadership potential students)	Dec. 2016
<b>Leo KoGuan Scholarship</b> (top 4%, awarded to high scientific research potential students)	Nov. 2016
<b>United-Water Scholarship</b> (gpa & integrated ranking are both in top 4%)	Nov. 2015
<b>1st prize</b> in China Undergraduate Mathematical Contest in Modeling (Shanghai Division)	Oct. 2015