LUYAN YU

📞 +1 (737) 346-7295   ✉ luyan.yu@utexas.edu   ☁ www.yuluyan.com

EDUCATION

University of Texas at Austin   Aug. 2017 – May 2022 (expected)
Ph.D. Candidate in Physics
Jointly appointed by the Center for Theoretical and Computational Neuroscience
GPA (to date): 3.98/4.00

Nanjing University   Sep. 2013 – Jul. 2017
B.S. in Physics
GPA: 4.7/5.0,   Ranking: 2/93

RESEARCH EXPERIENCE

For more details, please visit www.yuluyan.com/projects.

Probabilistic Model of Spiking Neural Network (link)   Feb. 2019 – Present
Graduate Research with Professor Thibaud Taillefumier   *Austin, TX, USA*

· Modelled spiking neural networks with replica mean field approximation and proposed corresponding mean field equations in the form a novel type of delayed differential equations.
· Developed efficient algorithms for calculating statistics of a neural network with arbitrary topologies.

Tropical Geometry of Phylogenetic Trees (link)   Feb. 2019 – Present
Graduate Research with Professor Ngoc Tran Mai   *Austin, TX, USA*

· Proved Bernstein's characterization for the extremality of phylogenetic trees as vertices of tropical polytope is sufficient if and only if the tree has 3 leaves. (see publication)

Secure Computation of Deep Neural Networks   Jul. 2019 – Jan. 2020
Course Research Project with Professor Risto Miikkulainen   *Austin, TX, USA*

· Implemented the secure element-wise integer vector multiplication and polynomial evaluation using the basic operations supported by Zhou-Wornell homomorphic encryption in python with MXNet.
· Propsed and implemented the adaptive evaluation of the non-linear activation layer to reduce accuracy loss ($< 0.3\%$ in MNIST benchmark) introduced by the randomness in encryption.

Learning with Tensor Networks   Jan. 2019 – Aug. 2019
Course Research Project with Professor Chandrajit Bajaj   *Austin, TX, USA*

· Implemented the classification algorithm using tensor networks (MPS, PEPS) in python.
· Compared the performance with LDA classifier and systematically studied the parametric dependence of the classification performance.

Reinforcement Learning with quantum Boltzmann machine (link)   Sep. 2016 – Jul. 2017
Undergraduate Thesis with Professor Shengjun Wu   *Nanjing, China*

· Decovered a new phenomenon that quantum restricted Boltzmann machine could overcome local minima occurred during reinforcement learning and used the grid world problem as an benchmark.

Topological Transition in Topological Insulator by Antiferromagnetism Jul. 2016 – Sep. 2016
UCLA-CSST Cross-disciplinary Program with Professor Kang L. Wang   *Los Angeles, CA, USA*

- Discovered a non-trivial topological phase transition process in anti-ferromagnetic and topological insulator trilayer structure and numerically recreate the behavior using non-equilibrium Green's function method. (see publication)
- Developed symbolic calculation package in Mathematica of tight binding model and implemented recursive Green's function method for acceleration.

Localization in Quantum Random Walk (link)   Jan. 2015 – Nov. 2015
Undergraduate Research with Professor Shengjun Wu   *Nanjing, China*

- Proved a key mathematical theorem related to generalized Riemann-Lebesgue lemma for the theoretical existence of the localization phenomenon of quantum walks. (see publication)
- Implemented symbolic simulation package in Mathematica.

PUBLICATIONS

Journals

- **Yu, L.** (2019). *Extreme rays of the ℓ^∞-nearest ultrametric tropical polytope.* Linear Algebra and its Application, 587, 23-44.
- He, Q. L.*, Yin, G.*, **Yu, L.***, Grutter, A. J., Pan, L., Chen, C., Che, X., Yu, G., Zhang, B., Shao, Q., Stern, A. L., Casas, B., Xia, J., Han, X., Kirby, B. J., Lake, R. K., Law, K. T., & Wang, K. L. (2018). *Topological transitions induced by antiferromagnetism in a thin-film topological insulator.* Physics Review Letter, 121(9), 096802. (*These authors contributed equally.)
- Lyu, C., **Yu, L.**, & Wu, S. (2015). *Localization in quantum walks on a honeycomb network.* Physical Review A, 92(5), 052305.

Book Chapters

- Long, H., **Yu, L.**, Sun, R., Wang, S., & Zhou, H. (2018). 2015 Problem 5: Two Balloons. International Young Physicists' Tournament: Problems & Solutions 2015, 31.
- **Yu, L.**, Zhou, Z., Zhu, Z., Gao, W., & Wang, S. (2016). 2014 Problem 12: Cold Balloon. International Young Physicists' Tournament: Problems & Solutions 2014, 113.
- Zhao, W., **Yu, L.**, Chen, L., Wang, S., & Zhou, H. (2016). 2014 Problem 15: Oil Stars. International Young Physicists' Tournament: Problems & Solutions 2014, 133.
- Fan, W., **Yu, L.**, Wang, S., & Gao, W. (2016). 2014 Problem 3: Twisted Rope. International Young Physicists' Tournament: Problems & Solutions 2014, 29.

TALKS AND PRESENTATIONS

Extreme rays of the phylogenetic tropical polyhedra   Jun. 2020 (scheduled)
2020 SIAM SIAM Conference on Discrete Mathematics (invited talk)   *Portland, OR, USA*

Delayed differential equation from replica-mean-field limit of exponential model Jan. 2020
17th Annual Theoretical and Computational Neuroscience Conference   *Houston, TX, USA*

Extreme rays of the ℓ^∞-nearest ultrametric tropical polytope   Nov. 2019
The 2nd Annual Meeting of the SIAM Texas Louisiana Section (invited talk)   *Dallas, TX, USA*

HONORS

Scholarships

· Provost's Graduate Excellence Fellowship 2017–2022, University of Texas at Austin, Texas, USA
· UCLA-CSST Scholarship 2016, University of California, Los Angeles, USA
· Baosteel Education Scholarship, 5 in Nanjing University 2016, Bao Steel Education, China
· National Scholarship, for top 0.2% in China 2014, Ministry of Education, China
· Elite Scholarship, for top 1% in department 2014–2016, Nanjing University, China

Awards

· Meritorious Winner 2015, Mathematical Contest in Modeling, USA
· Bronze Medal Winner 2014, University Physics Competition, USA
· First Award Winner 2014, Taiwan College Physicists' Tournament, Taiwan, China
· Elite Program Member 2013, Nanjing University, China

COURSES (SELECTED)

Physics

· Quantum Field Theory, Solid State Physics, Many Body Theory
· Computational Physics, Quantum Information Science
· Optics, Particle Physics, Nuclear Physics, Astronomy, Electronic Circuits
· Quantum Mechanics, Electromagnetic Theory, Statistical Mechanics, Classical Mechanics

Mathematics

· Mathematical Neuroscience, Tropical Mathematics, Stochastic Process, Numerical Analysis
· Mathematical Methods for Physics, Real Analysis and Functional Analysis, Differentiable Manifold and Lie Groups
· Calculus, Linear Algebra, Probability Theory and Mathematical Statistics

Computer Science

· Neural Networks, Geometry in Data Science
· Neural Networks and Deep Learning, Machine Learning (by Stanford University on Coursera)

TEACHING EXPERIENCES

· Teaching Asistant of PHY117M Mechanics Fall 2017 & Spring 2018, Physics Dept.
· Mentor of Numerical ODE Fall 2018, Directed Reading Program of Math Dept.
· Mentor of Computaional Astronomy Spring 2020, Directed Reading Program of Physics Dept.
· Tutor of General Physics Fall 2019 – Present

TECHNICAL SKILLS

Languages & Tools C++, Python, Mathematica, Javascript, HTML
Tools LaTeX, Microsoft Office, Adobe Illustrator & Photoshop