SERVICE STATEMENT

MILTON LIN

My service work has focused on enriching educational experiences, fostering mentorship, and supporting inclusive academic environments. As I progress toward a postdoctoral position, I remain committed to advancing these values in both teaching and research.

Service to Teaching

University Courses. At Johns Hopkins, I have gained extensive teaching experience:

- Teaching Assistant for various courses, including Honors Linear Algebra, Graduate Algebra, Introduction to Proofs, Calculus I and II.
- Instructor for Honors Calculus I, where I developed lecture notes [1], designed course syllabus, and had my own teaching assistant.
- Instructor of SOUL (Special Opportunities for Undergraduate Learning), a self-designed 1-credit course focusing on the mathematical foundations and interpretability of neural networks.

Directed Reading Program (DRP). At Johns Hopkins, I co-organized the Directed Reading Program (DRP), which offers mentorship to a diverse student body. Notable mentorships include:

- Nick Lombardi (2022): Junior mathematics major, covered basic elliptic curve properties and Chapter 5 of Silverman's *The Arithmetic of Elliptic Curves*.
- Orisis Zheng (2023): Senior physics major, explored algebraic geometry with *Sheaves in Geometry and Logic*. Now a Ph.D. student at Montana State University.
- Spencer Huang and Dev Lalwani (2023): Sophomore applied mathematics majors, focused on mechanistic interpretability of vision models [2].
- Viggy Vanchinathan (2024): Junior biomedical engineering major, collaborated on experiments related to *Progress measures for grokking via mechanistic interpretability*.

Graduate Student Supervision. I value the educational process and currently advise Yashi Jain (main supervisor, David Savitt). We are currently exploring relative Langlands in the context of p-adic categorical Langlands as developed by Emerton, Gee, Hellmann et al.

Future Efforts in Teaching. I aim to continue my work with DRP, empowering underrepresented students to explore advanced mathematical topics in an encouraging environment.

[1] https://cwlin4916.github.io/Trees/JHU_2023/Teaching_honors_single_variable_2023/AS_110_113_Honors_Calculus_v1.pdf

[2] https://distill.pub/2020/circuits/zoom-in/

Service to Research

My research collaborations span diverse fields, bringing together ideas from mathematics, physics, AI, and cognitive science. I am committed to fostering inclusive and interdisciplinary environments, where diverse perspectives can shape innovative research directions.

Collaboration. My collaborative projects span diverse research areas, reflecting my commitment to exploring various field of mathematics and promote collaboration.

- [Has+24] Integral aspects of Fourier duality: Collaboration with four graduate students across four universities, led by Ben Moonen.
- [ILZ24] Geometric Casselman Shalika: Joint work with Ashwin Iyengar and Konrad Zou on representation theory identities.
- Ongoing work with Yuta Takaya (University of Tokyo) on mixed characteristic aspects of Relative Langlands, [BSV].

Graduate Seminars. I actively engage in and organize graduate seminars, fostering a collaborative learning environment. Recent activities include:

- Fall 2024: I gave talks in K-theory seminar on the paper of dualizable categories, following recent advancement of Efimov, [Efi24] and also Number Theory learning seminar George Boxer's thesis, [Box15].
- Spring 2024: I was participant and speaker in both E-theory seminar which studied Gross-Hopkins Periods map and Number Theory seminar which studied the works of Francis Brown on motivic periods, [Bro14].
- Fall 2023, I was seminar organizer for Prismatic Cohomology[3]; I gave talks in the Topological Quantum Field Theory seminar, Representation Theory seminar, and Topology Seminar (on Dieudonné modules).

For older talks I refer to my CV.

Conference Engagements. I actively participate in professional development through conferences and extended programs, details of which are available in my CV. Highlights include:

- Attendance at numerous workshops, summer schools, and professional meetings across varied topics.
- Participation in semester-long programs, such as MSRI's Higher Categories program (2020) and Bonn's Arithmetic Geometry Trimester Program.

Cross-disciplinary Engagement. Collaborations across disciplines have expanded my perspectives. I have engaged in:

- Foundational research on memory networks with cognitive science researcher Chris Hillar (Redwood Research Berkeley) and Muhan Gao (Johns Hopkins University).
- Creation of multimodal synthetic datasets with Chutong Meng (George Mason University) [4], particularly in the context of low resource languages.
- Bias mitigation in language models with Cole Molloy and Lois Wong [5].

[3] https://nmasuda2.github.io/prismatic-seminar.html
[4] https://cwlin4916.github.io/Trees/NLP/small_project_writeups/SLU_multilingual_project.pdf
[5] https://cwlin4916.github.io/Trees//NLP/small_project_writeups/debate_bias_mitigation.pdf

Summary

My service requires active engagement, support, and adaptability. I am committed to expanding this inclusive culture in my future teaching, mentoring, and research.

References

[Box15] Boxer, George. *Torsion in the Coherent Cohomology of Shimura Varieties and Galois Representations*. 2015. arXiv: 1507.05922 [math.NT]. URL: https://arxiv.org/abs/1507.05922 (cit. on p. 2).

[Bro14] Brown, Francis. *Motivic periods and the projective line minus three points*. 2014. arXiv: 1407.5165 [math.NT]. URL: https://arxiv.org/abs/1407.5165 (cit. on p. 2).

[BSV] Ben-Zvi, David, Sakellaridis, Yiannis, and Venkatesh, Akshay. "Relative Langlands duality". In: () (cit. on p. 2).

[Efi24] Efimov, Alexander I. *K-theory and localizing invariants of large categories*. 2024. arXiv: 2405.12169 [math.KT]. URL: https://arxiv.org/abs/2405.12169 (cit. on p. 2).

[Has+24] Hasan, Junaid, Hassan, Hazem, Lin, Milton, Manivel, Marcella, McBeath, Lily, and Moonen, Ben. *Integral aspects of Fourier duality for abelian varieties*. 2024. arXiv: 2407.06184 [math.AG]. URL: https://arxiv.org/abs/2407.06184 (cit. on p. 2).

[ILZ24] Iyengar, Ashwin, Lin, Milton, and Zou, Konrad. *Geometric Casselman-Shalika in mixed characteristic*. 2024. arXiv: 2408.07953 [math.AG]. URL: https://arxiv.org/abs/2408.07953 (cit. on p. 2).