

curriculum vitae of
Jacob Scott Laurel

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EDUCATION

Aug. 2017 – present	Ph.D. in Computer Science UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN Advisor: Sasa Misailovic Research area: Probabilistic and Differentiable Programming Languages, Abstract Interpretation, Neural Network Verification and Approximate Computing
Aug. 2012 – May 2017	B.S. in Mathematics (summa cum laude) UNIVERSITY OF ALABAMA AT BIRMINGHAM B.S.E.E in Electrical Engineering (summa cum laude) GPA: 3.95/4.0

WORK EXPERIENCE

July 2018 – Present	Research Assistant UNIVERSITY OF ILLINOIS URBANA-CHAMPAIGN Advisor: Sasa Misailovic
May 2019 – Aug. 2019	Ph.D. Research Intern NASA LANGLEY RESEARCH CENTER Mentors: Cesar Muñoz and Aaron Dutle Applied Program Analysis to quantify floating point error in probabilistic programs
May 2016 – Aug. 2016	Undergraduate Research Intern UNIVERSITY OF CENTRAL FLORIDA Helped develop a novel video summarization technique using LSTM Deep Neural Networks. Work published in <i>CVPR 2017</i> (10)

PUBLICATIONS

PEER-REVIEWED CONFERENCE AND JOURNAL PUBLICATIONS

1. **Jacob Laurel**, Brant Qian, Gagandeep Singh, Sasa Misailovic. Synthesizing Precise Static Analyzers for Automatic Differentiation. (**OOPSLA 2023**).
2. Rem Yang, **Jacob Laurel**, Sasa Misailovic, Gagandeep Singh. Provable Defense Against Geometric Transformations. In *11th International Conference on Learning Representations (ICLR 2023)*. Acceptance rate: 31%. Designated **notable, top 25% of papers**.
3. Vimuth Fernando, Keyur Joshi, **Jacob Laurel**, Sasa Misailovic. Dynamic Monitoring of Uncertainty for Distributed Asynchronous Programs with Diamont. *International Journal on Software Tools for Technology Transfer (STTT 2023)*.
4. Ashitabh Misra, **Jacob Laurel**, Sasa Misailovic. ViX: Analysis-driven Compiler for Efficient Low-Precision Differentiable Inference. In *Design Automation and Test in Europe (DATE 2023)*. Full Paper Acceptance rate: 25%.
5. **Jacob Laurel**, Rem Yang, Shubham Ugare, Robert Nagel, Gagandeep Singh, Sasa Misailovic. A General Construction for Abstract Interpretation of Higher-Order Automatic Differentiation. In *Object-Oriented Programming, Systems, Languages, and Applications (OOPSLA 2022)*. Acceptance rate: 31%.
6. **Jacob Laurel**, Rem Yang, Gagandeep Singh, Sasa Misailovic. A Dual Number Abstraction for Static Analysis of Clarke Jacobians. In *Symposium on Principles of Programming Languages (POPL 2022)*. Acceptance rate: 23%.
7. Vimuth Fernando, Keyur Joshi, **Jacob Laurel**, Sasa Misailovic. Diamont: Dynamic Monitoring of Uncertainty for Distributed Asynchronous Programs. In *21st International Conference on Runtime Verification (RV 2021)*. Acceptance rate: 38%.

8. **Jacob Laurel**, Rem Yang, Atharva Seghal, Shubham Ugare, Sasa Misailovic. Statheros: A Compiler for Efficient Low-Precision Probabilistic Programming. In *58th Design Automation Conference (DAC 2021)*. Acceptance rate: 23%.
9. **Jacob Laurel**, Sasa Misailovic. Continualization of Probabilistic Programs with Correction. In *29th European Symposium on Programming (ESOP 2020)*. Acceptance rate: 31%.
10. Aidean Sharghi, **Jacob Laurel**, Boqing Gong. Query-Focused Video Summarization: Dataset, Evaluation, and A Memory Network Based Approach. In *Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition (CVPR 2017)*. Acceptance rate: 29%.

POSTERS

11. **Jacob Laurel**. Exact Quantification of Continuity Correction Error in Probabilistic Programs. Poster presented at *1st International Conference on Probabilistic Programming (PROBPROG 2018)*.

HONORS AND AWARDS

2023-2024	UIUC Mavis Future Faculty Fellowship (\$ 2000 Award)
2023	UIUC CS Department Graduate Student Outstanding Ambassador (\$ 100 Award)
2017-Present	UIUC Sloan UCEM Scholarship (\$ 40,000 Award)
2012-2017	UAB Presidential Honors List for 4.0 GPA during semester
2012-2016	UAB Presidential Scholarship as National Hispanic Recognition Program Scholar
2015	UAB School of Engineering Dupuis Scholarship
2015	UAB School of Engineering Undergraduate Research Award for Honors Research
2013	Inducted into Tau Beta Pi Engineering Honor Society

TALKS AND PRESENTATIONS

Summer 2023	Invited Talk: <i>A General Construction for Abstract Interpretation of Higher-Order Automatic Differentiation</i> - UCF CRCV Seminar (host: Niels Da Vitoria Lobo)
Fall 2022	<i>A General Construction for Abstract Interpretation of Higher-Order Automatic Differentiation</i> - UIUC Compilers Seminar
Summer 2022	Invited Talk: <i>Abstract Interpretation for Differentiable Programming</i> - Stanford Software Seminar (host: Clark Barrett)
Fall 2021	Invited Talk: <i>Abstract Interpretation for Differentiable Programming</i> - UC Berkeley Formal Methods Seminar (host: Sanjit Seshia)
	<i>Statheros: A Compiler for Efficient Low-Precision Probabilistic Programming</i> - UIUC Compilers Seminar

TEACHING EXPERIENCE

Spring 2023	UIUC CS 477 Formal Software Development Methods (Guest Lecture)
Fall 2019	UIUC CS 421 Programming Languages and Compilers (Teaching Assistant)
Spring 2019	UIUC CS 126 Software Design Studio (Teaching Assistant)
Fall 2018	UIUC CS 173 Discrete Structures (Teaching Assistant)
Spring 2018	UIUC CS 374 Algorithms and Models of Computation (Teaching Assistant)
Spring 2014	UAB ECE 312 Electrical Systems (Undergraduate Course Assistant)

RESEARCH MENTORING

Feb. 2020-May 2023	Rem Yang (BS, UIUC) - Co-author on (6,8,2,5)
Mar. 2020-May 2021	Atharva Seghal (BS, UIUC) - Co-author on (8)
May. 2021-May 2023	Robert Nagel (BS, UIUC) - Co-author on (5)
Nov. 2020 -present	Shubham Ugare (PhD, UIUC) - Co-author on (8,5)

May, 2022 -present	Ashitabh Misra (PhD, UIUC) - Co-author on (4)
Jan. 2023 -present	Brant Qian (BS, UIUC/ZJU) - Co-author on (1)
May 2023 -present	Jonah Black (BS UIUC)

SERVICE

Summer 2023	Reviewer - WFMML 2023
Summer 2023	Mentor for UIUC Accelerated Learning and Engineering Research Training (ALERT) Program
Mar. 2023	Graduate Ambassador and Panelist for session on Diversity and Inclusivity for UIUC CS Visit Day
Fall 2022 - Spring 2023	Graduate Student Representative for UIUC's CS Graduate Study Committee
Summer 2022	Reviewer - ECCV 2022
Summer 2022	Artifact Evaluation Committee - SAS 2022
Fall 2021	Panelist for UIUC's Society of Hispanic Professional Engineers Graduate Student Panel
Summer 2021	Artifact Evaluation Committee - OOPSLA 2021
Mar. 2020	Graduate Ambassador for UIUC CS Visit Day
Jan. 2020	Graduate Volunteer for UIUC School of Engineering Undergraduate Research Expo
Fall 2019	Organizer - UIUC Brett Daniel Software Engineering Seminar

OPEN-SOURCE SOFTWARE

I have led the development of the following open-source software libraries:

AbstractAD: AbstractAD is a parametric abstract interpretation of higher-order differentiable programs that allows for expressive abstract domains (like Zonotopes), published in 5. It is available at <https://github.com/uiuc-arc/AbstractAD>

DeepJ: DeepJ is a sound abstract interpretation of Clarke Generalized Jacobians, published in 6. It is available at <https://github.com/uiuc-arc/DeepJ>

Statheros: Statheros is a compiler for fixed-point probabilistic programming, published in 8. It is available at <https://github.com/uiuc-arc/Statheros>

OTHER EXPERIENCES

Dec. 2020	Attended (virtually) Microsoft Research Ph.D. Summit as UIUC LEAP Fellow
Fall 2019	Attended Sloan Institute on Teaching and Mentoring Conference in Atlanta, GA
Fall 2019	Attended Midwest PL Summit at Purdue University
Summer 2018	Attended Oregon Programming Languages Summer School (OPLSS)