Lucas Bang

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Last update on August 1, 2022

Harvey Mudd College
Computer Science Department
301 Platt Blvd
Claremont, CA 91711 USA

EDUCATION

University of California, Santa Barbara
Ph.D. in Computer Science — JUNE 2018
DISSERTATION: AUTOMATIC SOFTWARE SIDE-CHANNEL ANALYSIS
RESEARCH ADVISOR: TEVFIK BULTAN
COMMITTEE: BEN HARDEKOPF, ÖMER EĞECIĞLU

University of Nevada, Las Vegas
M.S. in Computer Science — MAY 2013
THESIS: AN IMPROVED COMPETITIVE RATIO OF THE (2N,N)-SERVER PROBLEM ON THE LINE
RESEARCH ADVISOR: LAWRENCE L. LARMORE
COMMITTEE: WOLFGANG BEIN, MATT PEDERSEN

University of Nevada, Las Vegas
B.A. in Computer Science and B.S. in Mathematics — AUGUST 2010

APPOINTMENTS

Harvey Mudd College — CLAREMONT, CA
Assistant Professor, Department of Computer Science — July 2018 – present

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RESEARCH INTERESTS

Quantitative, combinatorial, and human-centered program analysis; model counting; quantitative information flow.

TEACHING

Harvey Mudd College

Programming Languages (CS 131)	Fa20$^\varepsilon$, Sp21$^\varepsilon$, Fa21, Sp22, Fa22
Applied Logic (CS 181U)	Sp20$^\alpha$
Software Verification (CS 181F)	Fa18$^\alpha$
Data Structures and Program Development (CS 70)	Sp19$^\beta$, Fa19$^\gamma$, Sp20$^\delta$
Computer Science Clinic (CS/CSM 183/184)	Fa18, Sp19, Fa19, Sp20, Fa20, Sp21, Fa21
Independent Study (CS186): Quantitative Program Analysis, 9 students	Fa19, Sp20, Fa20, Sp21, Fa21
Independent Study (CS186): Tools for Haskell Programming, 1 student	Sp21
Independent Study (CS186): Computationalism in STEM, 4 students	Fa20, Sp21
Independent Study (CS186): Robot Movement Simulation, 4 students	Fa21
Independent Study (CS186): Image Compression Profiling, 3 students	Fa21
Independent Study (CS186): Automated Theorem Proving for Group Theory, 1 student	Fa21

$^\alpha$developed by me, $^\beta$with Christopher Stone, $^\gamma$with Julie Medero, $^\gamma$with Erin Talvitie and Beth Trushkowsky, $^\varepsilon$with Ben Wiedermann

University of California, Santa Barbara
Introduction Computer Science (CS 16)	Su14
Computer Science TA Training (CS 501)	Fa14

University of Nevada, Las Vegas
Programming for Scientists and Engineers (CS 117)	Sp13

Student Mentorship

Publications listed.

Harvey Mudd College, Undergraduate Student Research

- Mara Downing ('20) (Su19, Fa19, Sp20, Su20)   [C11, C12, C14, C13]
- Chris Thompson ('22) (Su19)   [C11]
- Abtin Molavi ('22) (Su19, Fa19, Sp20, Su20, Fa20)   [C13, C14, C12]
- Tommy Schneider ('19) (Su19)   [C13]
- Devon Frost (Scripps '20) (Su19)   [C15]
- Shannon Steele (CMC '20) (Su19, Su20)   [C15]
- Gabe Bessler ('20) (Sp19, Fa19, Sp20, Su20, Fa20)   [C16]
- Selasi Adzeze ('19) (Sp19)
- Sofiane Dissem ('22) (Su20, Fall2020)   [C16, C17]
- Sofia Devin ('22) (Fa19, Sp20, Su20, Fa20)   [C16, C17]
- Josh Cordova ('22) (Fa19, Sp20, Su20, Fa20)   [C16]
- Ibrahim Abughararh ('22)(Su20)   [C16]
- Emily Lu (Scripps '22)(Su20, Fa20)   [C16]
- Shaheen Cullen-Baratloo ('23) (Su20, Fa20)   [C16]
- Mia Taylor ('22) (Su20, Fa20)
- Laurel Newman ('20) (Su20)
- Ishaan Gandhi ('21) Sp21
- Ingrid Tsang ('22) (Sp21)
- Jennifer Granados (CMC '23) (Su21)
- Clara Brandt (Mt. Holyoke '22) (Su21)
- Diego Esparza (Williams '22) (Su21)
- Hannah Friedman ('23) (Su21)
- Aldrin Feliciano ('23) (Su21)
- Adi Bhargava ('23) (Su21, Fa21)   [C17]
- Eli Pregerson ('24) (Su21)   [C17]
- Max Mingst ('22) (Su20, Fa20)
- Saavan Patel ('25) Fa21
- Isabel MacGinnitie ('23) Fa21
- Alina Hu ('24) Fa21
- William La ('22) Fa21
- Qing Yang ('23) Fa21
- Alan Wu ('25) Fa21
- Devon Tao ('25) Fa21
- Forrest Bicker ('25) Fa21

Publications

Undergraduate research advisees underlined.

Published Proceedings (Peer-Reviewed)

[C17] <u>Sofiane Dissem</u>, <u>Eli Pregerson</u>, <u>Adi Bhargava</u>, and <u>Josh Cordova</u> **Lucas Bang**. "Program Path Complexity and Code Comprehension." In *PLATEAU '21: 12th annual workshop on the intersection of HCI and PL*, 2021.

[C16] <u>Gabriel Bessler</u>, <u>Josh Cordova</u>, <u>Shaheen Cullen-Baratloo</u>, <u>Sofiane Dissem</u>, <u>Emily Lu</u>, <u>Ibrahim Abughararh</u>, <u>Sofia Devin</u>, and **Lucas Bang**. "Metrinome: Path Complexity Predicts Symbolic Execution Path Explosion." In *ICSE '21: 43rd International Conference on Software Engineering*. ACM, 2021.

[C15] <u>Devon Frost</u>, <u>Shannon Steele</u>, and **Lucas Bang**. "Virtually Constrained Dancing: Encoding Language in Movement and Sound." In *MOCO '20: 7th International Conference on Movement and Computing, virtual [Jersey City, NJ, USA], July 15-17, 2020*, pages 12:1–12:4. ACM, 2020.

[C14] <u>Abtin Molavi</u>, <u>Mara Downing</u>, <u>Tommy Schneider</u>, and **Lucas Bang**. "MCBAT: a practical tool for model counting constraints on bounded integer arrays." In Prem Devanbu, Myra B. Cohen, and Thomas Zimmermann, editors, *ESEC/FSE '20: 28th ACM Joint European Software Engineering Conference and Symposium on the Foundations of Software Engineering, Virtual Event, USA, November 8-13, 2020*, pages 1596–1600. ACM, 2020.

[C13] <u>Abtin Molavi</u>, <u>Tommy Schneider</u>, <u>Mara Downing</u>, and **Lucas Bang**. "MCBAT: Model Counting for Constraints over Bounded Integer Arrays." In Maria Christakis, Nadia Polikarpova, Parasara Sridhar Duggirala, and Peter Schrammel, editors, *Software Verification - 12th International Conference, VSTTE 2020, and 13th International Workshop, NSV 2020, Los Angeles, CA, USA, July 20-21, 2020, Revised Selected Papers*, volume 12549 of *Lecture Notes in Computer Science*, pages 124–143. Springer, 2020.

[C12] <u>Mara Downing</u>, <u>Abtin Molavi</u>, and **Lucas Bang**. "Symbolic Execution + Model Counting + Entropy Maximization = Automatic Search Synthesis." In Jean-François Raskin and Davide Bresolin, editors, *Proceedings 11th International Symposium on Games, Automata, Logics, and Formal Verification, GandALF 2020, Brussels, Belgium, September 21-22, 2020*, volume 326 of *EPTCS*, pages 50–65, 2020.

[C11] <u>Mara Downing</u>, <u>Chris Thompson</u>, and **Lucas Bang**. "Strategy Synthesis for Deduction Games." *Conference on Artificial Intelligence and Interactive Digital Entertainment (AIIDE) Workshop on Artificial Intelligence for Strategy Games*, 2019.

[C10] Seemanta Saha, William Eiers, Ismet Burak Kadron, **Lucas Bang**, and Tevfik Bultan. "Incremental Adaptive Attack Synthesis." *Java Path Finder Workshop*, 2019.

[C9] Nicolás Rosner, Ismet Burak Kadron, **Lucas Bang**, and Tevfik Bultan. "Profit: Detecting and Quantifying Side Channels in Networked Applications." In *26th Annual Network and Distributed System Security Symposium, NDSS 2019, San Diego, California, USA, February 24-27, 2019*, 2019.

[C8] Nestan Tsiskaridze, **Lucas Bang**, Joseph McMahan, Tevfik Bultan, and Timothy Sherwood. "Information Leakage in Arbiter Protocols." In *Automated Technology for Verification and Analysis - 16th International Symposium, ATVA 2018, Los Angeles, CA, USA, October 7-10, 2018, Proceedings*, pages 404–421, 2018.

[C7] **Lucas Bang**, Nicolás Rosner, and Tevfik Bultan. "Online Synthesis of Adaptive Side-Channel Attacks Based On Noisy Observations." In *2018 IEEE European Symposium on Security and Privacy, EuroS&P 2018, London, United Kingdom, April 24-26, 2018*, pages 307–322, 2018.

[C6] Abdulbaki Aydin, William Eiers, **Lucas Bang**, Tegan Brennan, Miroslav Gavrilov, Tevfik Bultan, and Fang Yu. "Parameterized model counting for string and numeric constraints." In *Proceedings of the 2018 ACM Joint Meeting on European Software Engineering Conference and Symposium on the Foundations of Software Engineering, ESEC/SIGSOFT FSE 2018, Lake Buena Vista, FL, USA, November 04-09, 2018*, 2018.

[C5] Quoc-Sang Phan, **Lucas Bang**, Corina S. Pasareanu, Pasquale Malacaria, and Tevfik Bultan. "Synthesis of Adaptive Side-Channel Attacks." In *30th IEEE Computer Security Foundations Symposium, CSF 2017, Santa Barbara, CA, USA, August 21-25, 2017*, pages 328–342, 2017.

[C4] **Lucas Bang**, Abdulbaki Aydin, Quoc-Sang Phan, Corina S. Pasareanu, and Tevfik Bultan. "String analysis for side channels with segmented oracles." In *Proceedings of the 24th ACM SIGSOFT International Symposium on Foundations of Software Engineering, FSE 2016, Seattle, WA, USA, November 13-18, 2016*, 2016.

[C3] Abdulbaki Aydin, **Lucas Bang**, and Tevfik Bultan. "Automata-Based Model Counting for String Constraints." In *Computer Aided Verification - 27th International Conference, CAV 2015, San Francisco, CA, USA, July 18-24, 2015, Proceedings, Part I*, pages 255–272, 2015.

[C2] **Lucas Bang**, Abdulbaki Aydin, and Tevfik Bultan. "Automatically computing path complexity of programs." In *Proceedings of the 2015 10th Joint Meeting on Foundations of Software Engineering, ESEC/FSE 2015, Bergamo, Italy, August 30 - September 4, 2015*, pages 61–72, 2015.

[C1] **Lucas Bang**, Wolfgang W. Bein, and Lawrence L. Larmore. "R-LINE: A Better Randomized 2-Server Algorithm on the Line." In *Approximation and Online Algorithms - 10th International Workshop, WAOA 2012, Ljubljana, Slovenia, September 13-14, 2012, Revised Selected Papers*, pages 120–130, 2012.

Published Journal Articles (Peer-Reviewed)

[J2] Seemanta Saha, Ismet Burak Kadron, William Eiers, **Lucas Bang**, and Tevfik Bultan. "Attack Synthesis for Strings using Meta-Heuristics." *ACM SIGSOFT Software Engineering Notes*, 43(4):56, 2018

[J1] **Lucas Bang**, Wolfgang W. Bein, and Lawrence L. Larmore. "R-LINE: A better randomized 2-server algorithm on the line." *Theor. Comput. Sci.*, 605:106–118, 2015

TALKS AND APPEARANCES

[T7] "The Next Challenge: Model Counting Modulo Theories." MC2021 Model Counting Competition: Workshop on Counting and Sampling 2021, Virtual Event, July 6th, 2021.

[T6] Panelist. "SAT and Synthesis." ESEC/FSE '20: 28th ACM Joint European Software Engineering Conference and Symposium on the Foundations of Software Engineering, Virtual Event, USA, November 8-13, 2020.

[T5] "Online Synthesis of Adaptive Side-Channel Attacks Based On Noisy Observations." IEEE European Symposium on Security and Privacy, London, UK, April 26, 2018.

[T4] "Synthesis of Adaptive Side-Channel Attacks." IEEE Computer Security Foundations Symposium, Santa Barbara, CA, August 24, 2017.

[T3] "String Analysis for Side Channels with Segmented Oracles." ACM SIGSOFT International Symposium on the Foundations of Software Engineering, Seattle, WA, November 15, 2016.

[T2] "Tutorial: Automata-based String Analysis." ACM SIGPLAN conference on Programming Language Design and Implementation, Santa Barbara, California, June 13, 2016.

[T1] "Automatically Computing Path Complexity of Programs." Joint Meeting of the European Software Engineering Conference and the ACM SIGSOFT Symposium on the Foundations of Software Engineering, Bergamo, Italy, September 2, 2015

GRANTS

[G3] Collaborative Research: SHF: Small: Automated Quantitative Assessment of Testing Difficulty
Co-PI with Tevfik Bultan (UCSB). Approved for three years, 2021-2023, $128,480.

[G2] Research Experience for Undergraduates: Harvey Mudd REU Site in Computer Systems
Co-PI with George Montañez (HMC). Approved for 3 years, 2020-2022, $377,348.

[G1] Claremont Colleges Center for Teaching and Learning Course Activity Grant
Joint proposal with Julie Medero for CS70. $2660, Fall 2019.

SOFTWARE

MC-BAT
Project role: Research mentor
Description: Solves model-counting problems over the theory of bounded integer arrays.
Relevant publications: [C13, C14]

Metrinome
Project role: research mentor
Description: Metrinome computes an upper bound on the number of feasible paths through the control flow graph of Java, C, and Python programs. Metrinome predicts path exploration costs of symbolic execution. This software subsumes APC (see below).
Relevant publications: [C16, C17]

ABC: Automata-Based model Counter
Role: contributor, original developer
Description: Computes the number of models for constraints over the theory of strings.
Relevant publications: [C6,C3,C4,C10]

APC: Asymptotic Path Complexity
Role: lead developer
Description: Computes an upper bound on the number of feasible paths through the control flow graph of Java programs. Deprecated. Subsumed by Metrinome (see above).
Relevant publications: [C2]

PROFESSIONAL ACTIVITIES

Reviewer

International Colloquium on Automata, Languages and Programming (ICALP)	2021
Transactions on Software Engineering (TSE)	2019
Transactions on Software Engineering Methodology (ToSEM)	2019
International Conference on Automated Software Engineering (ASE)	2020
International Conference on Computer Aided Verification (CAV)	2020

Program Committee Member

International Symposium on Software Testing and Analysis (ISSTA)	2020

Conference Session Chair

Java Path Finder (JPF) Workshop	Nov 2018
International Conference on Foundations of Software Engineering (FSE), Security Session	Nov 2018
Security Session, International Symposium on Software Testing and Analysis (ISSTA)	Jul 2020

SERVICE AND OUTREACH

Harvey Mudd College

Workshop Leader, HMC Women Engineers and Scientists of Tomorrow (WEST) Confernece	Sp22
Featured Professor, HMC Future Achievers in Science and Technology (FAST)	Sp21
Participant, Admitted Student Outreach	Sp21
Committee Member, Watson Fellowship Selection Committee	Sp20
Committee Member, HMC Teaching and Learning Committee	Fa19, Sp20, Fa21
Panelist, HMC Project Decode: First Generation College Student Panel	Fa20
Guest Speaker, Common Threads: HMC First Generation College Students	Sp19
Faculty Advisor, Living Learning Community	2019-present
Faculty Host, Women In STEM (WISTEM)	Sp19
Faculty Guest, Common Threads: First Generation Low-Income College Student Lunch	Sp19

Computer Science Department

Coordinator, Computer Science Summer Research	Su20, Su21
Coordinator, Computer Science Grad School Info Session and Panel	Su20, Su21
Organizer, Computer Science Grader / Tutor Training	Fa20, Sp21, Fa21, Sp22
Subcommittee Member, Computer Science Curriculum Subcommittee	Sp21, Fa21, Sp22
Subcommittee Member, Computer Science Senior Exit Interviews	Sp21
Subcommittee Member, Computer Science Student Awards Subcommittee	Sp20, Sp21

Broader Community Outreach and Service

Faculty Mentor, Claremont McKenna Impact Scholar Program	Su20
Workshop Leader, Gateway To Exploring Mathematical Sciences (GEMS)	Sp19, Fa19