

# Mark Santolucito

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## Research Interests

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Program Synthesis/Verification, Data Science, Software Engineering, Security, Computer Music

## Education

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### Yale University

Computer Science Ph.D. - Advisor: Ruzica Piskac

New Haven, CT

2020 (Expected)

### Yale University

Computer Science M.S. - Advisors: Paul Hudak†, Ruzica Piskac

New Haven, CT

2013–2015

Relevant Coursework: Software Analysis and Verification, Formal Semantics, Data Mining, Syntax Design, Compilers, Category Theory, Sound Synthesis

### Amherst College

Computer Science B.A. & Music B.A., Cum Laude

Amherst, MA

2009–2013

Advisors: Scott Kaplan, Jason Robinson

## Professional Experience

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### Amazon

SDE Intern - AWS Security Automation

New York, NY

Summer 2018

Applying my research on configuration file analysis to use machine learning to automatically build CloudFormation verification tools for code quality and security.

### Geumgang University

Visiting Faculty

Nonsan, South Korea

Feb 2016–Aug 2016

Worked with other faculty and administration to design four-year curriculum map for new Computer Science major at the university. Taught three courses of my own design in a mix of Korean and English.

### World Scholars, LLC

Co-Founder, CTO

New Haven, CT

Feb 2017–

Co-founded an international educational exchange that has hosted more than 75 students in 4 separate programs with a revenue of \$60,000 USD so far in 2018. Designed curriculum, taught lectures, and managed technical operations.  
[www.worldscholars.global](http://www.worldscholars.global)

## Awards and Honors

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### Associates in Teaching

Yale CTL

Fall 2019

The competitive Associates in Teaching (AT) program, allows doctoral students work jointly with a cooperating faculty member to conceptualize or redesign, plan, and deliver an undergraduate course.

### AAAS/Science Program for Excellence in Science

AAAS

Oct. 2018

Awards deserving graduate students and postdocs working in the life sciences with a one-year sponsored membership in AAAS/Science.

### Advanced Graduate Leadership Program

Yale University

2018–

A program designed to provide doctoral students with experience and training beyond the research lab. Also provides \$3000 to fund additional career development.

### Accelerator Funding

TSAIL City Center for Innovation

Jan 2018

Awarded \$1000 from the Yale Entrepreneurship center to fund project and participate in accelerator program. Lead a team of four undergraduates to build free-space optics (laser) based mesh network to deliver secure and uncensored internet to infrastructure poor areas.

**Rohan Fellow***Yale University**2017-2018*

Graduate School funding support provided by the Theres and Dennis M. Rohan Fellowship Fund at Yale.

**Heidelberg Laureate Forum***Young Researcher Award**Oct. 2017*

An invitation and funding to attend the 5th HLF with Turing Award winners and Fields Medalists.

**Student Research Competition***FMCAD**Oct. 2016*

3rd Place Award for best student presentation.

**Carle Fellow***Yale University**2014-2015*

Graduate School funding support provided by the Robert Willets Carle Scholarship Fund at Yale.

**Travel Funding Awards**

Summer schools: SSFT15, OPLSS2015, SAT/SMT2015, VTSA2017, ProbProg2017

Conferences: USENIX Security 2019, CAV2015/16/17, ICFP2015, POPL2016, FMCAD2016.

**Best Undergraduate Thesis***Amherst College**May 2013*

Awarded to the student who has written the best Computer Science thesis of the graduating class.

**Lerner Piano Prize***Amherst College**May 2013*

Awarded to the student who has achieved an exceptional level of ability and expressivity in the musical arts.

**Copeland Commission***Amherst College**March 2013*

Collaborating with Prof. of Music Stephanie Robinson, to create a motion tracking sound-art installation for "Art in the Place of Art".

**Pease Research Fellowship***Amherst College**Fall 2012*

In recognition and support of research in Representations of Media and Media Technology.

**Dean of Faculty Funding***Amherst College**June 2012*

Grant for undergraduate thesis research in Media Technology.

**Teaching Experience**

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- CPSC334: Creative Embedded Systems  
Co-Instructor/Co-Course Designer

*Fall 2019*  
Yale University
  - CS101: Intro to Computer Science  
Instructor/Course Designer

*Spring 2016*  
Geumgang University
  - CS201: Object Oriented Programming  
Instructor/Course Designer

*Spring 2016*  
Geumgang University
  - CS032: Computer Music  
Instructor/Course Designer

*Spring 2016*  
Geumgang University
  - CPSC432/MUSI427: Computer Music Sound Synthesis  
Teaching Fellow

*Spring 2019, Spring 2018*  
Yale University
  - CPSC431/MUSI428: Algorithmic Computer Music  
Teaching Fellow

*Fall 2019, Fall 2017, Spring 2015*  
Yale University
  - CPSC134/MUSI372: Programming Musical Applications  
Teaching Fellow

*Fall 2015*  
Yale University
  - CPSC112: Intro to Android App Development  
Teaching Fellow

*Fall 2014*  
Yale University

## Student Project Advising

Nathan Nuñez, REU Summer Research '19 - An online interface for live programming by example  
Maxwell Levatich, Summer Research '19 - Language agnostic SMT-based program repair  
Kairo Morton, Summer Research '19 - Neural Network guided grammar selection for SyGuS  
Nicholas Shoemaker, Independent Research '18/9 - Program transformations for MSP430  
Elven Shum, Summer Research '19 - TSL synthesis for Android Apps with RxKotlin  
Vivek Goplan, Summer Research '18 - Synthesizing SDNs as Functional Reactive Programs  
Ryan Lim, BS Thesis '18 - Protecting Strong Anonymity in Mesh Networks  
Kate Rogers, BS Thesis '18 - Synthesizing DSP Filters on Non-Commutative Sound Samples [6]  
Drew Goldman, Independent Research '18 - On the Usability of Programming-By-Example for Scripting Tasks [7]  
Halley Young, REU Summer Research '17 - Musical Refinement Types  
Aeden Lombardo, REU Summer Research '17 - Synthesizing Music Synthesis [6]  
Haohong Xu, BS Thesis '17 - Optimization of Synthesized Functional Reactive Programs  
Aaron Shim, BS Thesis '16 - Towards Error-Free Configuration Files: A Learning Based Approach [8]  
Marvin Qian, BS Thesis '15 - Representative Example Generation for Cooperative Programming

## Invited Talks

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<i>Facebook Faculty Networking Event, San Francisco, USA</i> Automated Firewall Repair and Verification.	<i>June 2019</i>
<i>NYC CS Fair, NY, USA</i> How to Play Your Laptop Like an Instrument: Live Coding for Music	<i>March 2019</i>
<i>Code441 Hackathon, Hamilton, Bermuda</i> Applications of Association Rule Learning and Neural Networks	<i>Dec 2018</i>
<i>IBM PL Day, Yorktown Heights, USA</i> Learning to Verify Infrastructure as Code.	<i>Dec 2018</i>
<i>Xerox PARC, Palo Alto, USA</i> Language Learning for Verification of Configuration Files	<i>Oct 2018</i>
<i>New England Programming Languages Symposium, Cambridge, USA</i> Digital Signal Processing Programming-by-Example.	<i>Sept 2018</i>
<i>Verification and Synthesis for Software Evolution at ETAPS, Greece</i> Learning Models of Configuration Correctness.	<i>Apr 2018</i>
<i>Learning in Verification Workshop at ETAPS, Greece</i> Using Machine Learning to Synthesize Specifications for Configuration Files	<i>Apr 2018</i>
<i>IBM PL Day, Yorktown Heights, USA</i> Synthesizing Functional Reactive Programs.	<i>Dec 2017</i>
<i>Roslyn High School, NY, USA</i> Majoring in Computer Science - the Why and How.	<i>Nov 2017</i>
<i>Instituto Superior Técnico (IST), Portugal</i> Language Learning for Verification of Configuration Files.	<i>May 2017</i>
<i>Saarland University, Germany</i> Verifying Configuration Files with Examples.	<i>Sept 2016</i>
<i>Monthly Music Hackathon, NYC</i> Workshop on Algorithmic Composition with Euterpea.	<i>Jan 2015</i>

## Service

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### Program Committee

SYNT 2019, ML4PL 2018, FARM 2016

### Publicity Chair

FARM 2017, FARM 2016

## Journal Referee

TOPLAS 2017

## Reviewer

IMWUT 2019, NIME 2019

## Subreviewer

iFM 2018, SMT 2017, ESOP 2017, ICDCIT 2016, VSTTE 2015

## Artifact Evaluation Committee

PLDI 2018

## Organizer

CAV 2017 Buddy System, CAV 2016 Buddy System, CAV 2015 Buddy System

## Yale CS Social Leader

Organize the weekly CS socials in the department 2016-2017

## Publications (📖 indicates published proceedings, ↓<sub>Z</sub><sup>A</sup> indicates alphabetic author ordering)

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[1] 📖 **Live programming by example.**

Mark Santolucito, William T. Hallahan, and Ruzica Piskac.

In *Extended Abstracts of the 2019 CHI Conference on Human Factors in Computing Systems*, May 2019.

[2] 📖 ↓<sub>Z</sub><sup>A</sup> **Temporal stream logic: Synthesis beyond the bools.**

Bernd Finkbeiner, Felix Klein, Ruzica Piskac, and Mark Santolucito.

In *International Conference on Computer Aided Verification (CAV)*, July 2019.

[3] ↓<sub>Z</sub><sup>A</sup> **System design with TSL.**

Bernd Finkbeiner, Felix Klein, Ruzica Piskac, and Mark Santolucito.

In *SYNT workshop at CAV*, July 2019.

[4] 📖 ↓<sub>Z</sub><sup>A</sup> **Synthesizing functional reactive programs.**

Bernd Finkbeiner, Felix Klein, Ruzica Piskac, and Mark Santolucito.

In *Haskell Symposium*, October 2019.

[5] **Statically verifying continuous integration configurations.**

Mark Santolucito, Jialu Zhang, Ennan Zhai, and Ruzica Piskac.

CoRR, abs/1805.04473, 2018.

<http://arxiv.org/abs/1805.04473>.

[6] 📖 **Programming-by-example for audio: Synthesizing digital signal processing programs.**

Mark Santolucito, Kate Rogers, Aedan Lombardo, and Ruzica Piskac.

In *Functional Art and Music (FARM) at ICFP*, 2018.

[7] 📖 **Programming by example: Efficient, but not "helpful".**

Mark Santolucito, Drew Goldman, Allyson Weseley, and Ruzica Piskac.

In *PLATEAU at SPLASH 2018*, 2018.

Also presented at SYNT 2018.

[8] 📖 **Synthesizing configuration file specifications with association rule learning.**

Mark Santolucito, Ennan Zhai, Rahul Dhodapkar, Aaron Shim, and Ruzica Piskac.

*Proc. ACM Program. Lang.*, 1(OOPSLA), October 2017.

[9] 📖 🏆 **Version space learning for verification on temporal differentials.**

Mark Santolucito.

In *International Symposium on Software Testing and Analysis (ISSTA)*, 2017.

Also presented as poster at FMCAD 2016 Student Research Competition, 3rd Place Award.

[10] 📖 ↓<sub>Z</sub><sup>A</sup> **Vehicle platooning simulations with functional reactive programming.**

Bernd Finkbeiner, Felix Klein, Ruzica Piskac, and Mark Santolucito.

In *Safe Control of Autonomous Vehicles Workshop at CPSWeek*, 2017.  
<https://arxiv.org/abs/1803.10383>.

[11]  **Probabilistic automated language learning for configuration files.**

Mark Santolucito, Ennan Zhai, and Ruzica Piskac.

In *International Conference on Computer Aided Verification (CAV)*, 2016.

[12]  **Media Modules: Intermedia Systems in a Pure Functional Paradigm.**

Mark Santolucito, Donya Quick, and Paul Hudak.

In *International Computer Music Conference (ICMC)*, 2015.

[13] **Using javascript as an intermediate language for FRP.**

Mark Santolucito and Ruzica Piskac.

2015.

Poster at ICFP Student Research Competition.

[14]   **Real-time interactive music in haskell.**

Paul Hudak, Donya Quick, Mark Santolucito, and Daniel Winograd-Cort.

In *Functional Art and Music (FARM) at ICFP*, 2015.

[15] **Communalizing the interfaces of single player games.**

Mark Santolucito and Maria Hwang.

2014.

Extended abstract in Digital Games Research Association Conference.

[16]  **Raid the fridge!: Promoting healthy eating habits through the game Monster Appetite.**

Maria Hwang, Pantiphar Chantes, and Mark Santolucito.

2014.

Extended Abstract and Poster at Games Learning and Society 10, Best in Show Award.

[17] **Simquabbin project: Game-based environmental science education in a virtual world.**

Mark Santolucito and Scott Payne.

2013.

Extended Abstract and Poster at Games Learning and Society 9.

[18]  **Designing a community to support long-term interest in programming for middle school children.**

Kyle J. Harms, Jordana H. Kerr, Michelle Ichinco, Mark Santolucito, Alexis Chuck, Terian Kosciak, Mary Chou, and Caitlin L. Kelleher.

In *Proceedings of the 11th International Conference on Interaction Design and Children*, IDC '12, New York, NY, USA, 2012. ACM.