Qinsi Wang

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RESEARCH INTERESTS

- Formal analysis of probabilistic systems & statistical model checking
- Formal analysis of stochastic hybrid systems & stochastic SMT-solving
- Formal methods for systems biology
- Combine model checking techniques with machine learning methods for the study of biological systems and probabilistic causal models

PROFESSIONAL EMPLOYMENT

2017.12 – present **Independent Postdoc Researcher**, Computer Science Department, Carnegie Mellon University, USA
Solving the probabilistic inference problems for multiple types of causal models using statistical model checking, and Developing machine learning methods to generate probabilistic counterexamples for statistical model checking.

2016.10 – 2017.11 **Postdoc Researcher**, Computer Science Department, Carnegie Mellon University, USA
Developing statistical analysis methods for learning the underlying causality of rule-based models for intracellular signaling.

2010.9 – 2016.9 **Research Assistant**, Computer Science Department, Carnegie Mellon University, USA
Graduate research in formal methods.

Fall 2011 **Research Intern, Verification and Automatic Reasoning Group**, Microsoft Research, Cambridge, UK
Worked with Jasmin Fisher to build an efficient bounded model checker for Qualitative Networks. Resulted in publication of paper on resulting BioCheck+ system in CAV, and the filing of a patent.

EDUCATION

2010.9 – 2016.9 **Ph.D. Computer Science**
Computer Science Department, Carnegie Mellon University, USA
Advisor: Prof. Edmund M. Clarke (2007 Turing Award Owner)
Thesis title: "Formal Methods for Biological Systems: Languages, Algorithms, and Applications"

2007.9 – 2010.7 **M.S. Computer Science**
Institute of Software, Chinese Academy of Sciences, China
Advisor: Prof. Guangyuan Li
Thesis title: "Constructing Transition-based Generalized Timed Büchi Automata for Metric Interval Temporal Logic"

2002.9 – 2006.7 **A.B. Computer Science**
International Institute of Software, Wuhan University, China
Supervisor: Prof. Shuliang Wang
Thesis title: "Analysis of Association Rules at Various Granularity Levels"

Grants, Awards and Honors

- **Grant Title: World Modelers by Defense Advanced Research Projects Agency (DARPA) Awarded: $ 973,945**, 2017-2021.
- **Richard King Mellon Foundation Presidential Fellowship in the Life Sciences**, 2015–2016.
- **Excellent Student Award (top 5%)**, Chinese Academy of Sciences, 2007–2008.
- **Best Bachelor Thesis Award**, Hubei Province, 2006.
- **The 1st Creative Software Design Contest-2nd Place**, Wuhan University, 2006.
- **Excellent Student Award (top 5%)**, Wuhan University, 2002–2005.

Publications

In Submission

- **Qinsi Wang**, Ziqiang Yuan. *Probabilistic Counterexample Generation for Statistical Model Checking against Causal Networks*.
- Ziqiang Yuan, **Qinsi Wang**. *SMC4WM: Solving Probabilistic Temporal Inference Problems for Causal Networks using Statistical Model Checking*.
- **Qinsi Wang**, Jean Yang. *KaStat: Studying the Fine-grained Inference in Kappa Rule-based Models using Statistical Methods*.

Refereed Conference/Workshop/Journal Publications

- Kai-Wen Liang, **Qinsi Wang**, Cheryl A. Telmer, Divyaa Ravichandran, Peter Spirtes, Natasa Miskov-Zivanov. *Methods to Expand Cell Signaling Models using Automated Reading and Model Checking*. Accepted to CMSB 2017: the 15th Conference on Computational Methods in Systems Biology, 2017.
- Md. Ariful Islam, Hyun-Kyung Lim, Nicola Paoletti, Houssam Abbas, Zhihao Jiang, Jacek Cyranka, Rance Cleaveland, Sicun Gao, Edmund M. Clarke, Radu Grosu, Rahul Mangharam, Elizabeth Cherry, Flavio H. Fenton, Richard A. Gray, James Glimm, Shan Lin, **Qinsi Wang**, Scott A. Smolka. *CyberCardia project: Modeling, Verification and Validation of Implantable Cardiac Devices*. 2016 IEEE International Conference on Bioinformatics and Biomedicine: 1445-1452.

- Md. Ariful Islam, **Qinsi Wang**, Edmund Clarke, Scott Smolka, Ramin Hasani, Radu Grosu and Ondrej Balun. *Probabilistic Reachability Analysis of the Tap Withdrawal Circuit in Caenorhabditis elegans*. HLDVT2016: the 18th IEEE International High-Level Design Validation and Test Workshop, Santa Cruz, California, U.S.A., October 7-8, 2016.

- Natasa Miskov-Zivanov, Paolo Zuliani, **Qinsi Wang**, Edmund Clarke, James Faeder. *High-level modeling and verification of cellular signaling.* HLDVT2016: the 18th IEEE International High-Level Design Validation and Test Workshop, Santa Cruz, California, U.S.A., October 7-8, 2016.

- **Qinsi Wang**, Natasa Miskov-Zivanov, Bing Liu, James Faeder, Michael T. Lotze, Edmund M. Clarke. *Formal Modeling and Analysis of Pancreatic Cancer Microenvironment*. CMSB 2016: Computational Methods in Systems Biology, Cambridge, UK, Sep 21-23, 2016.

- **Qinsi Wang**, Soonho Kong, Sicun Gao, Edmund M. Clarke. *SReach: A Probabilistic Bounded δ-Reachability Analyzer for Stochastic Hybrid Systems*. CMSB 2015: Computational Methods in Systems Biology, Nantes, France, Sep 16-18, 2015.

- **Qinsi Wang**, Natasa Miskov-Zivanov, Cheryl Telmer, Edmund M. Clarke. *Formal Analysis Provides Parameters for Guiding Hyperoxidation in Bacteria using Phototoxic Proteins*. GLSVLSI 2015, Pittsburgh, Pennsylvania, USA, May 20-22, 2015.

- Edmund M. Clarke, **Qinsi Wang**. 2^5 *Years of Model Checking*. Ershov Memorial Conference 2014: 26-40.

- Ronald Watro, Kerry Moffitt, Talib Hussain, Daniel Wyschogrod, John Ostwald, Derrick Kong, Clint Bowers, Eric Church, Joshua Guttman, **Qinsi Wang**, *Ghost Map: Proving Software Correctness using Games*. SECURWARE 2014: The Eighth International Conference on Emerging Security Information, Systems and Technologies, Lisbon, Portugal, November 16-20, 2014.

- Koen Claessen, Jasmin Fisher, Samin Ishtiaq, Nir Piterman, **Qinsi Wang** (alphabetical order), *Model-Checking Signal Transduction Networks through Decreasing Reachability Sets*. CAV 2013: 25th International Conference on Computer Aided Verification, Saint Petersburg, Russia, July 13?19, 2013.

- Haijun Gong, **Qinsi Wang**, Paolo Zuliani, James R. Faeder, Michael Lotze, *Symbolic Model Checking of Signaling Pathways in Pancreatic Cancer*. BICoB 2011: 3rd International Conference on Bioinformatics and Computational Biology, New Orleans, Louisiana USA, March 23-25, 2011.

- Haijun Gong, Paolo Zuliani, **Qinsi Wang**, Edmund M. Clarke, *Formal analysis for logical models of pancreatic cancer*. CDC-ECE 2011, Orlando, FL, USA: 4855-4860.

- **Qinsi Wang**, *Constructing Transition-based Generalized Timed Büchi Automata for Metric Interval Temporal Logic*. Journal of Computer Engineering and Design, 2011.

Invited Publications

- **Qinsi Wang**, Edmund M. Clarke. *Formal Modeling of Biological Systems*. Invited paper to HLDVT2016: the 18th IEEE International High-Level Design Validation and Test Workshop, Santa Cruz, California, U.S.A., October 7-8, 2016.

THESES

- **Qinsi Wang**. it Model Checking for Biological Systems: Languages, Algorithms, and Applications. Thesis for the Doctoral Degree (2016.9).
- **Qinsi Wang**. *Constructing Transition-based Generalized Timed Büchi Automata for Metric Interval Temporal Logic*. Master's Thesis (2010.7).
- **Qinsi Wang**. *Analysis of Association Rules at Various Granularity Levels*. Bachelor's Thesis (2006.7).

OTHER

- Soonho Kong, **Qinsi Wang**, Gabriel Weisz. *Aggressive TCP Slow Start*. School of Computer Science, Carnegie Mellon University, 2010.
- Dan Howarth, **Qinsi Wang**, Yue Yu. *High Dimensional Structure Learning of Undirected Graphical Models with Correlated Variables*. School of Computer Science, Carnegie Mellon University, 2012.

SOFTWARE

- **SMC4WM**: a statistical model checker solving the probabilistic inference problems for multiple types of causal models, such as (multidimensional) Dynamic Bayesian Networks, Bayesian Networks, and Probabilistic Boolean Networks. It has also implemented several model search methods to generate probabilistic counterexamples for statistical model checking against these causal models.
  https://github.com/rachelwang/SMC4WM
- **KaStat**: a statistical analyzer for Kappa models. Currently, it carries out the types of analyses: estimating the probability of a certain type of influence between two given Kappa rules, and outputting the causal core that contributes most to the existence of the influence between the given Kappa rules.
  https://github.com/rachelwang/KaStat
- **SReach**: a bounded model checker for hybrid systems with parametric uncertainty, and probabilistic hybrid automata with additional randomness.
  https://github.com/dreal/SReach
- **GhostMap**: a crowd-sourced, online game for formal analysis of the correctness of C programs.
  http://verigames.com/
- **BioCheck+**: a biological modeling and analyzing tool that illustrates signaling pathways and checks cellular properties.
  http://biomodelanalyzer.research.microsoft.com/
- **MITLCon**: a convertor from Real-Time Temporal Logic to Timed Automata.
- **CATV/LTL**: a Linear Temporal Logic (LTL) model checker for Timed Automata.
  http://lcs.ios.ac.cn/~ligy/tools/CTAV_LTL/
- **ARDM_VG**: an analyzer of association rules at various granularity levels.

PROFESSIONAL SERVICE

PC chair:
- Workshop on Formal Methods for Biological and Biomedical Systems - FMBBS16

PC member:
- The 12th International Conference on Advanced Data Mining and Applications (ADMA16)
- The 8th International Workshop on Static Analysis for Systems Biology (SASB17)
- The 13th International Conference on Advanced Data Mining and Applications (ADMA17)

Conference/Journal reviewer:
- IEEE/ACM Transactions on Computational Biology and Bioinformatics, 2018
- Theoretical Computer Science Journal, Elsevier, 2018
- The 13th International Conference on Advanced Data Mining and Applications (ADMA17)
- Theoretical Computer Science Journal, Elsevier, 2017
- Information Sciences Journal, Elsevier, 2017
- The 12th International Conference on Advanced Data Mining and Applications (ADMA16)
- The 4th International Workshop on Hybrid Systems Biology (HSB 2015)
- Computational Studies of Immune System Function, Computational Biology, 2014
- The 11th International Conference on Quantitative Evaluation of Systems (QEST 2014)
- International Conference on Computer Aided Verification (CAV 2013)
- Mathematical Tools of Soft Computing, Mathematical Problems in Engineering, 2013
- The 50th IEEE Conference on Decision and Control & 11th European Control Conference (CDC-ECC 2011)

Conference service:
- The 15th Asia-Pacific Software Engineering Conference (APSEC 2008)
- The 1st International Conference on Advanced Data Mining and Applications (ADMA 2005)

ACADEMIC ADVISING

- Ziqiang Yuan, working on the DARPA World Modeler project, 2018. 8 - present.
- Harshita Meena (Summer Intern), "Causal Analysis of Cellular Models", 2018.
- Kai-Wen Liang, "Methods to Expand Cell Signaling Models using Automated Reading and Model Checking", 2016
- Boya Lai, "The Effect of Estrogen in the Fluctuation of Species Population in Ecosystem", 2015

TEACHING

Spring 2014 — **Teaching Assistant**
CMU Automated Program Verification and Testing
Designed and graded assignments and final projects, held recitations, and gave a guest lecture for this graduate-level program verification course.

Fall 2012 — **Teaching Assistant**
CMU Automated Program Verification
Designed and graded assignments and held recitations for this graduate-level program verification course.

Fall 2004 **Teaching Assistant**
WHU Software Engineering
Designed and graded assignments and held labs for this undergraduate-level software engineering course.

CONFERENCE TALKS AND POSTERS

- **SMC4WM: Solving Probabilistic Temporal Inference Problems for Causal Networks using Statistical Model Checking.** DARPA World Modelers PI Meeting, Jul 30 - Aug 1, 2018.
- **Formal Analysis for Hybrid Causal Models.** DARPA World Modelers Kick Off Meeting, Jan 28 - Jan 31, 2018.
- **CyberCardia Project: Modeling, Verification and Validation of Implantable Cardiac Devices.** FMBBS 2016 (IEEE BIBM 2016), Shenzhen, China, Dec 18, 2016.
- **Formal Modeling and Analysis of Pancreatic Cancer Microenvironment.** CMSB 2016, Cambridge, UK, Sep 21-23, 2016.
- **SReach: A Probabilistic Bounded Delta-Reachability Analyzer for Stochastic Hybrid Systems.** CMSB 2015, Nantes, France, Sep 16-18, 2015.
- **Formal Analysis Provides Parameters for Guiding Hyperoxidation in Bacteria using Phototoxic Proteins.** GLSVLSI 2015, Pittsburgh, Pennsylvania, USA, May 20-22, 2015.
- **SReach: Combining SMT-based Model Checking and Statistical Tests.** Clarke Symposium, September 2014, Pittsburgh, US.
- **Poster: GhostMap - Proving Software Correctness using Games.** The 3rd Crowd Sourced Formal Verification (CSFV), Automated Program Analysis for Cybersecurity (APAC), and High-Assurance Cyber Military Systems (HACMS) Joint PI Meeting, Stevenson, WA, July 22-26, 2013.
- **Poster: Extending the Semantics of the Rule-based Modeling Language for Multi-level Biological Models.** CRA-W Graduate Cohort Workshop, Bellevue, Washington, April 13-14, 2012.
- **Poster: Construction and Analysis of A Multicellular Model of the Pancreatic Cancer Micro-environment.** CMACS Mid-Term Site Visit Review, Carnegie Mellon University, November 3-4, 2011.
- **A Multicellular Model of the Pancreatic Cancer Microenvironment.** Computational Modeling and Analysis for Complex Systems (CMACS) PI Review Meeting, University of Maryland, April 28-29, 2011.

REFERENCES

Professor **Edmund M. Clarke**
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en-us/people/jfisher/

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