

# SHUFANG ZHU

Senior Research Associate

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## Education

- 09.14–03.20 **PhD in Software Engineering**, *East China Normal University*, Shanghai, China.
- **Advisor:** Prof. Geguang Pu
  - **Thesis:** Program Synthesis of Linear Temporal Logic over Finite Traces
  - **Committee:** Prof. Moshe Y. Vardi (Rice U.), Prof. Giuseppe De Giacomo (U. Oxford), Prof. Meng Sun (Peking U.) Prof. Naijun Zhan (Chinese Academy of Sci.) and Prof. Yuxin Deng (ECNU)
- 09.10–06.14 **BSc in Software Engineering**, *East China Normal University*, Shanghai, China.

## Current Position

- Since 02.23 **Senior Research Associate**, *Department of Computer Science*, University of Oxford, UK.
- **Mentor:** Prof. Giuseppe De Giacomo

## Previous Positions

- 12.20–11.22 **Research Associate**, *Depart. of Computer, Control and Management Engineering*, Sapienza University of Rome, Italy.
- **Mentor:** Prof. Giuseppe De Giacomo
- 05.20–10.20 **Junior Researcher**, *Shanghai Industrial Control Safety Innovation Technology Co. LTD*, China.
- **Mentor:** Prof. Geguang Pu
- 06.18–08.18 **Researcher Intern**, *OS Kernel Lab of Huawei*, China.
- **Mentors:** Dr. Ming Fu, Dr. Xin Gao
- 08.16–02.18 **PhD Researcher**, *Rice University*, USA.
- **Mentor:** Prof. Moshe Y. Vardi

## Research Interests

My research concerns interdisciplinary knowledge across artificial intelligence (AI) and formal methods (FM), focusing on automated reasoning, planning and synthesis.

## Teaching

- 07.23 **Lecturer**, *European Summer School on Artificial Intelligence ESSAI & ACAI*, Ljubljana, Slovenia,  
*Course:* Game-Theoretic Approach to Planning and Synthesis (MS/PhD level).
- 02.23 **Teaching Assistant**, *University of Oxford*, Oxford, UK,  
*Course:* Foundations of Self-Programming Agents (MS/PhD level).
- 07.22 **Lecturer**, *Sapienza University of Rome*, Rome, Italy,  
*Course:* Game-Theoretic Approach to Planning and Synthesis (Italian national PhD prog. in AI).
- 11.14 **Teaching Assistant**, *East China Normal University*, Shanghai, China,  
*Course:* Tools of Software Analysis and Verification (MS/PhD level).

## Research Mentoring

- 09.21–07.22 **Gianmarco Parretti**, *Master Student*, Sapienza University of Rome.
- **Thesis:** Symbolic best-effort synthesis for specifications in Linear Temporal Logic on finite traces

- 09.18-11.19 **Yingying Shi**, *Master Student*, East China Normal University.  
 ○ *Project*: Automata-based  $LTL_f$  reasoning
- 09.18-11.19 **Shengping Xiao**, *Undergraduate Student*, East China Normal University.  
 ○ *Project*: MONA-based  $LTL_f$  to DFA conversion

## Services for the Scientific Community

### Chair.

2023: AAAI Spring Symposium "On the Effectiveness of Temporal Logics on Finite Traces in AI"

### Program Committee.

2024: AAAI

2023: IJCAI, KR, FMCAD, ECAI

2022: AAAI, IJCAI

2021: AAAI

### Conference Paper Reviewer.

2023: CAV

2022: CSL

2019: ICALP

### Journal Paper Reviewer.

Artificial Intelligence Journal

Formal Methods in System Design

Mathematical Problems in Engineering

IEEE Access

### Conference Volunteer.

KR 2021, ATVA 2015 (Head Volunteer)

## Research Talks

### Reactive Synthesis of Linear Temporal Logic on Finite Traces.

- In the 12th workshop on Synthesis, 18/07/2023, Paris, France.
- In the 7th International Workshop "Women in Logic", 01/07/2022, Rome, Italy.

### On the Power of $LTL_f$ in Assured Autonomy.

- (Invited) In the Automata Group seminar, EPITA Research Laboratory (LRE), 07/07/2023, Online
- (Invited) In the OxCAV seminar, University of Oxford, 24/05/2023, Oxford, UK.
- (Invited) In the KRR seminar, University of Oxford, 15/05/2023, Oxford, UK.
- In the Annual Women In Computer Science Conference, 29/04/2023, Cambridge, UK.
- (Invited) In the Autonomous Systems Group seminar, University of Texas at Austin, 04/11/2022, Online.
- (Invited) In a seminar series, Sapienza University of Rome, 10/11/2022, Rome, Italy.

### Act for Your Duties but Maintain Your Rights.

- In the 19th International Conference on Principles of Knowledge Representation and Reasoning (KR), 03/08/2022, Haifa, Israel.

### $LTL_f$ Synthesis as AND-OR Graph Search: Knowledge Compilation at Work.

- In the 31st International Joint Conference on Artificial Intelligence (IJCAI), 29/07/2022, Vienna, Austria.
- In the VardiFest workshop: On the Not So Unusual Effectiveness of Logic, 31/07/2022, Haifa, Israel.

### Synthesis of Maximally Permissive Strategies for $LTL_f$ Specifications.

- In the 31st International Joint Conference on Artificial Intelligence (IJCAI), 29/07/2022, Vienna, Austria.

### Symbolic Approaches to $LTL_f$ Best-Effort Synthesis.

- In the 6th Workshop on Generalization in Planning (GenPlan), 23/07/2022, Vienna, Austria.

### **Finite-Trace and Generalized-Reactivity Specifications in Temporal Synthesis.**

- In the 31st International Joint Conference on Artificial Intelligence (IJCAI), 25/08/2022, Online
- In the 5th Workshop on Generalization in Planning (GenPlan), 19/08/2021, Online.
- In the 2021 edition of the Conference on Highlights of Logic, Games and Automata, 15/09/2021, Online.

### **Synthesis with Mandatory Stop Actions.**

- In the 18th International Conference on Principles of Knowledge Representation and Reasoning (KR), 11/11/2021, Online + KR local gathering at Sapienza University of Rome, Italy.

### **On the Power of Automata Minimization in Temporal Synthesis.**

- In the 12th International Symposium on Games, Automata, Logics, and Formal Verification (GandALF), 20/09/2021, Online.

### **Program Synthesis of Linear Temporal Logic over Finite Traces.**

- (Invited) In a seminar held at Sapienza University of Rome, 11/06/2020, Online.

### **First-Order vs. Second-Order Encodings for $LTL_f$ -to-Automata Translation.**

- In the 15th Annual Conference of Theory and Applications of Models of Computation (TAMC), 16/04/2019, Kitakyushu, Japan.

### **Temporal Synthesis with Reachability and Safety Goals.**

- (Invited) In a seminar series, Sapienza University of Rome, 01/04/2019, Italy.
- (Invited) In the Formal Methods and Verification group seminar, Université libre de Bruxelles, 28/03/2019, Belgium.

### **First-Order vs. Second-Order Encodings for $LTL_f$ -to-Automata: An Extended Abstract.**

- In the 2nd Women in Logic (WiL) Workshop, 08/07/2018, UK.

### **Symbolic $LTL_f$ Synthesis.**

- In the 26th International Joint Conference on Artificial Intelligence (IJCAI), 22/08/2017, Australia.

### **Symbolic Synthesis from $LTL_f$ Formulas.**

- In the 2017 Expeditions in Computing project “ExCAPE: Expeditions in Computer Augmented Program Engineering” Annual Meeting, 04/05/2017, USA.

### **SAT-based Explicit LTL Reasoning.**

- In the 1st Young Researchers Workshop on Formal Methods (YR-SETTA), 03/11/2015, China.
- In the 2015 annual Sino-Danish Basic Research Center IDEA4CPS Workshop, 30/11/2015, China.

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## **Awards and Honors**

2023 **Future Digileader**, *Digital Futures, Sweden.*

2022 **Rising Star in Electrical Engineering and Computer Science (EECS)**, *UT Austin, USA.*

**Invited to Dagstuhl Seminar on The Futures of Reactive Synthesis.**

**Invited to Lorentz workshop on Contract Languages: Expressiveness, Abstraction, Interoperability, and Applications.**

**Invited to Dagstuhl Seminar on Automated Synthesis: Functional, Reactive and Beyond.**

**Travel Grant.**

KR Diversity & Inclusion Travel Grant 2022, IJCAI 2019, FLoC 2018, Travel Award for WiL 2018 & 2023.

**Academic Scholarship**, *East China Normal University*, 2015, 2016, 2017, 2018, 2019.

**Chinese Government Scholarship**, *Chinese Scholarship Council*, 2016.

**Outstanding Student Scholarship**, *East China Normal University*, 2012, 2013, 2014.

**Notable Freshman Mentor**, *East China Normal University*, 2011.

## Open Source Tools

**Syft**, *Github link: <https://github.com/Shufang-Zhu/SyftMax>*.

- The first symbolic reactive synthesis tool for  $LTL_f$  specifications, which also has been integrated into all state-of-the-art  $LTL_f$  synthesizers and extended to support various synthesis scenarios.
- Extension of synthesizing maximally permissive controller for  $LTL_f$  specifications.
- The latest version LydiaSyft got the **2nd place** in the synthesis competition (SYNTCOMP) 2023.

**GFSynth**, *Github link: <https://github.com/Shufang-Zhu/GFSynth>*.

- Reactive synthesis for  $LTL_f$  specifications under Generalized Reactivity (1) environment specifications.

## Publications

**\* indicates author list has been sorted alphabetically by last name.**

### Conference Proceedings

- [ECAI 23] \* Giuseppe De Giacomo, Gianmarco Parretti, **Shufang Zhu**. "LTL<sub>f</sub> Best-Effort Synthesis in Nondeterministic Planning Domains" To appear at the 26th European Conference on Artificial Intelligence (ECAI), 2023.
- [EUMAS 23] \* Benjamin Aminof, Giuseppe De Giacomo, Antonio Di Stasio, Hugo Francon, Sasha Rubin, **Shufang Zhu**. "LTL<sub>f</sub> Synthesis Under Environment Specifications for Reachability and Safety Properties" To appear at the 20th European Conference on Multi-Agent Systems (EUMAS).
- [EUMAS 23] \* Giuseppe De Giacomo, Gianmarco Parretti, **Shufang Zhu**. "Symbolic LTL<sub>f</sub> Best-Effort Synthesis." To appear at the 20th European Conference on Multi-Agent Systems (EUMAS).
- [VSTTE 22] \* Suguman Bansal, Giuseppe De Giacomo, Antonio Di Stasio, Yong Li, Moshe Y Vardi, **Shufang Zhu**. "Compositional Safety LTL Synthesis." To appear at the 14th International Conference on Verified Software: Theories, Tools, and Experiments (VSTTE).
- [IJCAI 22] \* Giuseppe De Giacomo, Marco Favorito, Jianwen Li, Moshe Y Vardi, Shengping Xiao, **Shufang Zhu**. "LTL<sub>f</sub> Synthesis as AND-OR Graph Search: Knowledge Compilation at Work." In Proc. of International Joint Conference on Artificial Intelligence (IJCAI).
- [IJCAI 22] **Shufang Zhu**, Giuseppe De Giacomo. "Synthesis of Maximally Permissive Strategies for LTL<sub>f</sub> Specifications." In Proc. of International Joint Conference on Artificial Intelligence (IJCAI).
- [KR 22] **Shufang Zhu**, Giuseppe De Giacomo. "Act for Your Duties but Maintain Your Rights." In Proc. of International Conference on Principles of Knowledge Representation and Reasoning (KR).
- [IJCAI 21] \* Giuseppe De Giacomo, Antonio Di Stasio, Lucas M Tabajara, Moshe Y. Vardi, **Shufang Zhu**. "Finite-Trace and Generalized-Reactivity Specifications in Temporal Synthesis." In Proc. of International Joint Conference on Artificial Intelligence (IJCAI).
- [AAAI 21] Shengping Xiao, Jianwen Li, **Shufang Zhu**, Yingying Shi, Geguang Pu, Moshe Y. Vardi. "On-the-fly Synthesis for LTL over Finite Traces." The 35th AAAI Conference on Artificial Intelligence (AAAI).
- [KR 21] \* Giuseppe De Giacomo, Antonio Di Stasio, Giuseppe Perelli, **Shufang Zhu**. "Synthesis with Mandatory Stop Actions." In Proc. of International Conference on Principles of Knowledge Representation and Reasoning (KR).
- [GandALF 21] **Shufang Zhu**, Lucas M Tabajara, Geguang Pu, Moshe Y Vardi. "On the Power of Automata Minimization in Temporal Synthesis." In Proc. of International Symposium on Games, Automata, Logics, and Formal Verification (GandALF).
- [KR 20] \* Giuseppe De Giacomo, Antonio Di Stasio, Moshe Y. Vardi, **Shufang Zhu**. "Two-stage technique for LTL<sub>f</sub> synthesis under LTL assumptions." In Proc. of International Conference on Principles of Knowledge Representation and Reasoning (KR).
- [AAAI 20] **Shufang Zhu**, Giuseppe De Giacomo, Geguang Pu, Moshe Y Vardi. "LTL<sub>f</sub> Synthesis with Fairness and Stability Assumptions." In Proc. of AAAI Conference on Artificial Intelligence (AAAI).

- [TACM 19] **Shufang Zhu**, Geguang Pu, Moshe Y. Vardi “First-Order vs. Second-Order Encodings for  $LTL_f$ -to-Automata Translation.” In Proc. of Annual Conference of Theory and Applications of Models of Computation (TAMC).
- [IJCAI 17] **Shufang Zhu**, Lucas M. Tabajara, Jianwen Li, Geguang Pu, Moshe Y. Vardi “Symbolic  $LTL_f$  Synthesis.” In Proc. of International Joint Conference on Artificial Intelligence (IJCAI).
- [HVC 17] **Shufang Zhu**, Lucas M. Tabajara, Jianwen Li, Geguang Pu, Moshe Y. Vardi “A Symbolic Approach to Safety LTL Synthesis.” In Proc. of International Haifa Verification Conference (HVC).
- [ICCAD 17] Jianwen Li, **Shufang Zhu**, Yueling Zhang, Geguang Pu, Moshe Y. Vardi “Safety model checking with complementary approximations.” In Proc. of IEEE/ACM International Conference on Computer-Aided Design (ICCAD).
- [HVC 15] Jianwen Li, **Shufang Zhu**, Geguang Pu, Moshe Y. Vardi “SAT-Based Explicit LTL Reasoning.” In Proc. of International Haifa Verification Conference (HVC).

#### Journal Articles

- [JAIR 23] \* Giuseppe De Giacomo, Dror Fried, Fabio Patrizi, **Shufang Zhu**. “Mimicking Behaviors in Separated Domains.” Journal of Artificial Intelligence Research. <https://doi.org/10.1613/jair.1.14591>
- [FMSD 23] \* Giuseppe De Giacomo, Antonio Di Stasio, Lucas M. Tabajara, Moshe Y. Vardi, **Shufang Zhu**. “Finite-trace and generalized-reactivity specifications in temporal synthesis.” Formal Methods Syst. Des. <https://doi.org/10.1007/s10703-023-00413-2>
- [FMSD 19] Jianwen Li, **Shufang Zhu**, Geguang Pu, Lijun Zhang, Moshe Y. Vardi. “SAT-based explicit LTL reasoning and its application to satisfiability checking.” Formal Methods Syst. Des. 54(2): 164-190.
- [FAC 18] Jianwen Li, **Shufang Zhu**, Geguang Pu, Moshe Y. Vardi, Jifeng He “An explicit transition system construction approach to LTL satisfiability checking.” Formal Aspects Comput. 30(2): 193-217.