Ashfaq Farooqui

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EDUCATION

CHALMERS UNIVERSITY OF TECHNOLOGY | PhD
October 2015 – June 2021 | Gothenburg, Sweden
Thesis: On Supervisor Synthesis via Active Automata Learning

CHALMERS UNIVERSITY OF TECHNOLOGY MS in Systems, Controls & Mechatronics
2013 - 2015 | Gothenburg, Sweden

BMS INSTITUTE OF TECHNOLOGY BE in Electronics & Communication
2008 - 2012 | Bangalore, India

RESEARCH INTERESTS

- Supervisory Control Theory
- Safe and Intelligent Control
- Formal Methods
- Automation
- Artificial Intelligence

LINKS

Github:// ashfaqfarooqui
LinkedIn:// ashfaqfarooqui

COURSEWORK

FORMAL METHODS

- Logic in Computer Science
- Algorithms
- Formal Verification of Hardware: Why, When, How?
- Formal methods in software development
- Supervisory Control Theory

AUTONOMOUS SYSTEMS

- Autonomous and Cooperative Vehicular Systems
- Humanoid Robotics
- Chalmers Formula Student
- Embedded Control Systems

MANAGEMENT

- Applied Project Management
- Reflecting on Leadership Perspectives and Contexts

EXPERIENCE

RESEARCH INSTITUTE OF SWEDEN
| Researcher
October 2021 – Present | Borås, Sweden

- Prototyping for various research projects.
- Validation and verification approaches for safety and cybersecurity.

NOKIA NETWORKS | Software engineer
July 2012 – August 2013 | Bangalore, India

- Development and maintenance of a Telecommunication Management Network software.
- Automated testing using Robot Framework.
- JUnit (Unit testing framework for Java) test case code reviewer.

PROJECTS

MASTER THESIS: INTERFACING A COLLABORATIVE ROBOT AND TRUCK

January 2015 – August 2015 | Gothenburg Sweden

- Automation platform interfacing a collaborative robot, a truck, and the workshop.
- Built using Robot operating system (ROS) as the middleware component.

CHALMERS FORMULA STUDENT

September 2013 – August 2014 | Gothenburg, Sweden

- Design, implementation and testing of hardware and software systems for a formula style weekend race car to compete in FSUK, and FSG.
- Responsible for data acquisition and control algorithm for automated gear-shifting

TEACHING AND SUPERVISION

- Master thesis - Learning EFA models for self-driving cars, Supervisor
- Master Thesis - 3D simulations to validate an algorithm which generates supervisors automatically, Supervisor
- Automatically Learning Formal Models of Systems with Large Alphabets by Reducing the Alphabet Size, (SSY226), Supervisor, Autumn, 2020
- Industrial Automation (SSY066), TA, 2015-2020
- Selecting Active Automata Learning Algorithm Based on Model Characteristics (SSY226), Supervisor, Autumn 2019
- Autonomous Twizy - Simulation using Apollo Auto (EENX15 2018) , Supervisor, 2018
- Handling Unlabelled Event-logs to Discover Process Models in an Automotive Production Line (SSY226), Supervisor, 2017
- Applied Mechatronic Design (SSY261), TA, 2016-2018

SKILLS

PROGRAMMING

Over 5000 lines:
• Scala • Python • Embedded C
Over 1000 lines:
• Java • C++

TOOLS & FRAMEWORKS

• ROS/ROS2 • OpenDaVINCI
• STM32 • AVR-Arduino
• Kicad • Altium
• GNU/Linux • Git

SELECTED TALKS

PhD Seminar

Title: On Supervisor Synthesis via Active Automata Learning
Supervisor: Martin Fabian
Description: Ensuring the correctness of automated systems is crucial. The supervisory control theory proposes techniques to help build control solutions that provide certain correctness guarantees. These techniques rely on a model describing the behavior of the system. Unfortunately, such models are hard to create, thus limiting the industrial adoption of SCT. This thesis aims to improve the situation by providing an approach to automatically learn a model that captures the system's behavior.
This talk introduces two approaches to integrate active learning and the supervisory control theory. Active learning is a promising technique to learn models by interacting with the system to be learned. Using active learning helps avoid the manual step of creating models, thus allowing the use of supervisory control techniques in the absence of models.

Licentiate Seminar

Title: Towards Automatic Generation of Formal Models for Highly Automated Manufacturing Systems
Supervisor: Martin Fabian
Description: The manufacturing industry is undergoing a digital revolution, often referred to as Industry 4.0. The aim of this revolution is to transform the factories into, so called, smart factories. The need for having digitalized tools that support operators and engineers was identified in a survey that was conducted to understand the problems faced during maintenance of manufacturing systems. This talk presents an architecture that can be applied on old legacy systems as well as new state-of-the-art systems to collect data from the factory floor. The data obtained can be visualized in the form of Gantt charts to help operators keep track of the execution of the station. Furthermore, the talk describes a method to learn a behaviour model of the system by actively interacting with its simulation.

PUBLICATIONS

[1] Ashfaq Farooqui and Behrooz Sangchoolie. Towards formal fault injection for safety assessment of automated systems. *arXiv preprint arXiv:2311.09810*, 2023.

[2] Mehdi Maleki, Ashfaq Farooqui, and Behrooz Sangchoolie. Carfase: A carla-based tool for evaluating the effects of faults and attacks on autonomous driving stacks. In *2023 53rd Annual IEEE/IFIP International Conference on Dependable Systems and Networks Workshops (DSN-W)*, pages 92–99. IEEE, 2023.

[3] Fredrik Hagebring, Ashfaq Farooqui, Martin Fabian, and Bengt Lennartson. On optimization of automation systems: Integrating modular learning and optimization. *IEEE Transactions on Automation Science and Engineering*, pages 1–13, 2022.

[4] Ashfaq Farooqui. *On Supervisor Synthesis via Active Automata Learning*. PhD thesis, Chalmers Univeristy of Technology, 2021.

[5] Ashfaq Farooqui, Ramon Tijsse Claase, and Martin Fabian. On Plant-Free Active Learning of Supervisors. 2021. Submitted to Transactions on Automation Science and Engineering.

[6] Yuvaraj Selvaraj, Ashfaq Farooqui, Ghazaleh Panahandeh, Wolfgang Ahrendt, and Martin Fabian. Automatically learning formal models from autonomous driving software. *Electronics*, 11(4), 2022.

[7] Ashfaq Farooqui, Fredrik Hagebring, and Martin Fabian. Mides: A tool for supervisor synthesis via active learning. In *2021 IEEE 17th International Conference on Automation Science and Engineering (CASE)*, pages 792–797, 2021.

[8] Yuvaraj Selveraj, Ashfaq Farooqui, Ghazaleh Panahandeh, and Martin Fabian. Automatically learning formal models: An industrial case from autonomous driving development. In *ACM/IEEE 23rd International Conference on Model Driven Engineering Languages and Systems (MODELS '20 Companion)*, 2020.

[9] Ashfaq Farooqui, Fredik Hagebring, and Martin Fabian. Active learning of modular plant models. In *In Proceedings of Workshop on Discrete Event Systems, 2020, Rio, Brazil*, 2020.

[10] Fredik Hagebring, Ashfaq Farooqui, and Martin Fabian. Modular supervisory synthesis for unknown plant models using active learning. In *In Proceedings of Workshop on Discrete Event Systems, 2020, Rio, Brazil*, 2020.

[11] Ashfaq Farooqui, Kristofer Bengtsson, Petter Falkman, and Martin Fabian. Towards data-driven approaches in manufacturing; an architecture to collect sequences of operations. *International Journal of Production Research*, 2019.

[12] Ashfaq Farooqui and Martin Fabian. Synthesis of supervisors for unknown plant models using active learning. In *2019 IEEE 15th International Conference on Automation Science and Engineering (CASE)*. IEEE, 2019.

[13] Ashfaq Farooqui. Towards automatic generation of formal models for highly automated manufacturing systems. 2018. Licentiate Thesis.

[14] Ashfaq Farooqui, Kristofer Bengtsson, Petter Falkman, and Martin Fabian. From factory floor to process models: A data gathering approach to generate, transform, and visualize manufacturing processes. *CIRP Journal of Manufacturing Science and Technology*, 2018.

[15] Ashfaq Farooqui, Petter Falkman, and Martin Fabian. Towards automatic learning of discrete-event models from simulations. In *2018 IEEE 14th International Conference on Automation Science and Engineering (CASE)*, 2018.

[16] Ashfaq Farooqui, Kristofer Bengtsson, Petter Falkman, and Martin Fabian. Real-time visualization of robot operation sequences. In *16th IFAC Symposium on Information Control Problems in Manufacturing*, volume 51, pages 576–581, 2018.