Mining Traces of Embedded Software Systems for Insights

Sebastian Fischmeister
Department of Electrical and Computer Engineering
University of Waterloo
sfischme@uwaterloo.ca

ABSTRACT

Embedded safety-critical systems are essential for today's society as we rely on them in all aspects of our life. Should safety-critical systems fail to meet their specified function, then they have the potential to cause harm to people, cause loss of capital infrastructure, or cause significant damage to the environment. Safety-critical systems are becoming increasingly complex; the more complex, the higher the risk of safety hazards for the public. With the increase of automation in driving and other areas, the complexity and criticality of the software will continue to increase drastically. Computer assistance will become essential for humans to get a deep understanding of programs underlying modern systems.

Mining specifications and properties from program traces is a promising approach to help humans understand modern complex programs. Understanding temporal dependencies in relation to performance is one aspect of such an endeavour. A specification mined from a system trace can allow the developer to understand, among others, task dependencies, activation patterns, and response triggers. The artefacts produced by mining are useful for system designers, developers, safety managers, and can even provide input for other tools. This talk introduces the concepts behind mining traces of embedded software programs and discusses the challenges of building practical tools.

CCS Concepts/ACM Classifiers

Software reverse engineering, embedded systems, data mining.

Author Keywords

Specification mining, instance mining, embedded software

BIOGRAPHY

Sebastian Fischmeister is an Associate Professor in the Department of Electrical and Computer Engineering at the University of Waterloo, NSERC/Magna Industrial Research Chair in Automotive Software for Connected and Automated Vehicles, and Executive Director of the Waterloo Centre for Automotive Research (WatCAR). Sebastian has 20 years of experience in R&D of safety-critical real-time embedded systems and delivered innovation to real-time communication, embedded software, timing analysis, instrumentation and debugging technology, as well as safety and security monitoring.

Sebastian performs systems research at the intersection of software technology, distributed systems, and formal methods. He has published more than 90 peer-reviewed conference presentations and 30 journal articles, and has built demonstrators with his team and colleagues, including the reference demo for the ASTM F29.21 standard, an SFOC-licensed UAV, the APMA Connected Vehicle Technology Demonstrator, the Renesas Autonomous Vehicle Demonstrator (showcased at CES in Las Vegas in 2017 and 2018), and the DENSO Driving AI Demonstrator (CES 2018). His work has received several research and industry awards.

Sebastian is a licensed Canadian Professional Engineer, a member of the Standards Council of Canada, and an ACM Distinguished Speaker.

ICPE '20, April 20–24, 2020, Edmonton, AB, Canada

ACM ISBN 978-1-4503-6991-6/20/04.
https://doi.org/10.1145/3358960.3383580