Matthew Danish

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Current position

Research Associate, Cambridge University

Areas of specialization

Computer Science; Sensor Networks, Programming Languages, Operating Systems.

Research summary

Matthew Danish's interest is in the design and deployment of real-time urban and in-building sensor networks and data processing. Those applications include networks of simple sensors measuring gases, temperature and humidity as well as camera-based intelligent sensors driven by computer vision machine-learning models capable of distilling complex scenes down to simple readings. He is developing frameworks for real-time data processing while preventing the leakage of potentially private information collected by these sensors. He is currently working on the Adaptive City project to outfit the West Cambridge site with a Digital Twin real-time model of the buildings and outdoor environment on the site. This effort is part of the Centre for Digital Built Britain collaborative programme and the Construction Innovation Hub. His past work has focused on applications of programming language theory and software evolution to helping ensure the correctness of scientific programs written in Fortran, as well as in applying advanced type-theory concepts at the lowest level of operating system development to formalise resource management and reasoning about properties of such critical software.

Education

May 2004 B.S. in Logic and Computation, Carnegie-Mellon University

May 2015 Ph.D. in Computer Science, Boston University. Dissertation: *Terrier: An embedded operating system using advanced types for safety.*

Other positions

2004–2008 Research Programmer at Intelligent Coordination and Logistics Laboratory, Robotics Institute, Carnegie-Mellon University, Pittsburgh, PA, USA.

2011 Summer Internship at VMWare, Palo Alto, CA, USA.

Papers

2010 Matthew Danish and Hongwei Xi. Operating System Development with ATS. In PLPV 2010: Proceedings of the 4th Workshop on Programming Languages meets Program Verification. Madrid, Spain.

2011 Matthew Danish, Ye Li and Richard West. Virtual-CPU Scheduling in the Quest Operating System. In Proceedings of the 17th IEEE Real-Time and Embedded Technology and Applications Symposium. Chicago, IL, USA.

2011 Ye Li, Matthew Danish and Richard West. Quest-V: A Virtualized Multikernel for High-Confidence Systems. Technical Report: arXiv:1112.5136, arXiv.org.

2014 Matthew Danish, Hongwei Xi. Using lightweight theorem proving in an asynchronous systems context. In Proceedings of the Sixth NASA Formal Methods Symposium. Houston, TX, USA.

2016 Richard West, Ye Li, Eric Missimer, and Matthew Danish. A Virtualized Separation Kernel for Mixed-Criticality Systems. ACM Trans. Comput. Syst. 34, 3, Article 8.

2016 Mistral Contrastin, Andrew Rice, Matthew Danish and Dominic Orchard, Units-of-Measure Correctness in Fortran Programs. In Computing in Science & Engineering, 2016 18(1).

2017 Dominic Orchard, Mistral Contrastin, Matthew Danish, and Andrew Rice. Verifying Spatial Properties of Array Computations. In PACM Progr. Lang. 1, OOPSLA, Article 75.

2019 Matthew Danish, Miltiadis Allamanis, Marc Brockschmidt, Andrew Rice and Dominic Orchard. Learning units-of-measure from scientific code. In Software Engineering for Science, May 2019.

2020 Matthew Danish, Justas Brazauskas, Rob Bricheno, Ian Lewis and Richard Mortier. DeepDish: Multi-Object Tracking with an Off-the-Shelf Raspberry Pi. In The 3rd International Workshop on Edge Systems, Analytics and Networking (EdgeSys), April 2020.

2021 Verma, Rohit, Justas Brazauskas, Vadim Safronov, Matthew Danish, Jorge Merino, Xiang Xie, Ian Lewis, and Richard Mortier. SenseRT: A Streaming Architecture for Smart Building Sensors. arXiv preprint arXiv:2103.09169. March 2021.

2021 Brazauskas, Justas, Rohit Verma, Vadim Safronov, Matthew Danish, Jorge Merino, Xiang Xie, Ian Lewis, and Richard Mortier. Data Management for Building Information Modelling in a Real-Time Adaptive City Platform. arXiv preprint arXiv:2103.04924. March 2021.

2021 Verma, Rohit, Justas Brazauskas, Vadim Safronov, Matthew Danish, Ian Lewis, and Richard Mortier. RACER: Real-Time Automated Complex Event Recognition in Smart Environments. In Proceedings of the 29th International Conference on Advances in Geographic Information Systems, pp. 634-637. November 2021.

2021 Safronov, Vadim, Justas Brazauskas, Matthew Danish, Rohit Verma, Ian Lewis, and Richard Mortier. Do we want the New Old Internet? Towards Seamless and Protocol-Independent IoT Application Interoperability. In Proceedings of the Twentieth ACM Workshop on Hot Topics in Networks, pp. 185-191. November 2021.

2022 Matthew Danish, Rohit Verma, Justas Brazauskas, Ian Lewis and Richard Mortier. DeepDish on a diet: low-latency, energy-efficient object-detection and tracking at the edge. In The 5th International Workshop on Edge Systems, Analytics and Networking (EdgeSys), April 2022.

Talks and posters

2012 Matthew Danish, Hongwei Xi and Richard West. Applying Language-based Static Verification in an ARM Operating System. In Work-in-Progress Poster Session of the 33rd IEEE Real-Time Systems Symposium. San Juan, PR, USA.

2013 Matthew Danish. Applying Language-based Static Verification in an ARM Operating System. Presented at the High Confidence Software And Systems Conference. Annapolis, MD, USA.

2013 Matthew Danish. Functional Pearl: Four slot asynchronous communication mechanism. Presented at the ACM SIGPLAN Workshop on Dependently-Typed Programming, informal work-in-progress talk session. Boston, MA, USA.

Teaching

Fall 2009 Assistant for CS131 (Combinatorial Structures)
Spr 2010 Assistant for CS131 (Combinatorial Structures)
Fall 2012 Assistant for CS108 (Application Programming)
Fall 2014 Assistant for CS330 (Algorithms)
Spr 2015 Assistant for CS131 (Combinatorial Structures)
Fall 2015 Supervisor for Types (Part II)
Fall 2016 Supervisor for Concurrent and Distributed Systems (Part IB)
Spr 2017 Supervisor for Concurrent and Distributed Systems (Part IB)
Fall 2017 Supervisor for Concurrent and Distributed Systems (Part IB)
Spr 2018 Supervisor for Concurrent and Distributed Systems (Part IB)

Volunteering and other interests

2001– Debian Developer
2016– Charity Trustee of Cambridge Cycling Campaign

Languages

English (native), Español (C1 – pendiente)