

Learning-based methods for fault detection and recovery

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Abstract: A true test for the autonomy and super-intelligence of robots is their ability to handle failures, disturbances, and edge cases. I will present new results emphasizing autonomous Fault Detection, Isolation, and Recovery. Conventional machine learning methods require large amounts of data for training, making real-time retraining of an entire deep neural network nearly infeasible for fast-moving robots. Our methods overcame those limitations by identifying and rapidly adapting the low-dimensional parameters that must be updated in real time. The key innovation is to systematically guarantee stability and safety in a hierarchically separated architecture using contraction stability theory. This talk's main message is the importance of research into failures and faults in robotics and aerospace applications.

Bio: Soon-Jo Chung is a Bren Professor of Control and Dynamical Systems at Caltech. Prof. Chung is also a Senior Research Scientist of the NASA Jet Propulsion Laboratory. Professor Chung's research focuses on autonomous vehicles, aerospace robotics, and space autonomous systems, and in particular, on the theory and application of control, estimation, learning-based control and planning, and navigation of autonomous vehicles. He is the recipient of the UIUC Engineering Dean's Award for Excellence in Research, the Arnold Beckman Faculty Fellowship of the U of Illinois Center for Advanced Study, the AFOSR Young Investigator Program (YIP) award, the NSF CAREER award, the 2024 IEEE Robotics and Automation Letters Best Paper Award, a 2020 Honorable Mention for the IEEE Robotics and Automation Letters Best Paper Award, the Best Paper Award from the 2015 AIAA Guidance, Navigation, and Control Conference, the Best Paper Award from the 2009 AIAA Infotech at Aerospace Conference, and four best student paper awards. Prof. Chung is a Senior Editor of the IEEE Robotics and Automation Letters and an Associate Editor of the AIAA Journal of Guidance, Control, and Dynamics. He was a Senior Editor of the IEEE Transactions on Aerospace and Electronic Systems, an Associate Editor of the IEEE Transactions on Automatic Control, an Associate Editor of the IEEE Transactions on Robotics, and the Guest Editor of a Special Section on Aerial Swarm Robotics published in the IEEE Transactions on Robotics.