

Enhancing Cyber-Physical Systems with Machine Learning -- Drilling Holes into the Walls Between Disciplines

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In the talk, we will introduce the notion of cyber-physical systems (CPS). For CPS, there is a complex interaction between the physical environment, hardware platforms, and the software running on them. We will briefly introduce CPS characteristics as well as challenges for their design. Mechanical, energy, thermal and dependability issues have to be considered, leading to the requirement of multidisciplinary design. Sensors may be providing huge amounts of data requiring sophisticated data analysis in order to generate reliable information.

The collaborative research center CRC 876 at TU Dortmund (see <http://sfb876.tu-dortmund.de>) addresses the need for data analysis and multidisciplinary. Its focus is on resource constrained machine learning and its applications. With this focus, it merges fundamentals of embedded systems and machine learning with applications in many scientific areas such as physics, medicine, logistics, and factory automation. In the second part of the talk, we will present exemplary results from cooperative work at the collaborative research center. These results will demonstrate the potential of interdisciplinary research using concrete examples.

Final remarks will concern approaches for CPS education.



Dr. Peter Marwedel studied physics at the University of Kiel, Germany. He received a Dr. rer. nat. degree in physics in 1974 and a Dr. habil. degree in computer science in 1987. He held a chair for computer engineering and embedded systems at the computer science department of TU Dortmund from 1989 until 2014, where he currently serves as a senior professor. He is chairing ICD, a local spin-off. His research interests include design automation for embedded systems, in particular the generation of efficient embedded and cyber-physical system software. Focus is on energy efficiency, timing predictability, reliability and tradeoffs between design objectives. Dr. Marwedel has published a text book on embedded systems foundations of cyber-physical systems. The book is complemented by videos available on youtube and by publicly available slides. He served as the vice-chair of the collaborative research center SFB 876, aiming at resource-efficient analysis of large data sets. He is an IEEE Fellow, recipient of the Teaching Award at TU Dortmund in 2003, DATE fellowship in 2008, the EDAA Lifetime Achievement Award in 2013, the 2014 ACM SIGDA Distinguished Service Award and the ESWEEK Lifetime Achievement Award in 2014.