Intelligence Through Physical Computing

IBM Zurich, Switzerland
GHS@zurich.ibm.com

We have entered an exciting era of technology in which we can converse with machines with remarkable fluency. Yet true machine intelligence is not defined solely by the accuracy of responses; it must also be achieved in a manner that is sustainable in both energy and physical space. Meeting this challenge is fundamentally a hardware problem.

In this talk, I will introduce the concept of physical computing as pursued in my research, where computation emerges directly from the intrinsic physics of materials, devices, and circuits, rather than from the abstract digital operations that dominate conventional computing. The talk is divided into three parts. The first part establishes the foundations for scalable physical computing through manufacturable materials and rigorous device engineering at the nanoscale. The second part focuses on circuits and architectures designed to achieve high compute density and efficiency. The final part presents real-world examples demonstrating the merits of physical computing across sensor and inference applications, charting a path toward more efficient and scalable intelligent systems.