Introduction to Ambient Intelligence

Yang Cai

Carnegie Mellon University
ycai@cmu.edu

Abstract

The convergence of wireless networks, affordable sensors and embedded computing enables a new physical Internet, which will revolutionize our everyday life, from dinning to traveling. In North America, the new terms are coined such as *Things-That-Think*, *Sensor Web*, or *Smart Dust*. In Europe, many people call it *Ambient Intelligence (AmI)*, which includes two essential components: perception and communication. In contrast to traditional sensor networks, AmI is built upon the distributed cognition nodes that simulate human common sense and insight in our everyday life. For example, the human perceptions can capture complex patterns and relationships, along with detecting the exceptional cases in a data set. This process is often ubiquitous and autonomous. AmI is not a competitor of the traditional AI (Artificial Intelligence) but a complimentary area where AI has overlooked. While AI scholars are still using the half century old Von Neumann architecture as a model of human cognition, AmI explorers are seeking new models to represent human's everyday knowledge for sensory fusion and decision making at subconscious level. Those novel models include so-called Swarm Intelligence or Emergence Intelligence, which coins what Köhler predicted in 1947: the natural fate of Gestalt Psychology to become Gestalt Physics, and eventually, Gestalt Biology.

In this tutorial, the essential AmI components are discussed, including the spectrum analysis of the complexity of electronic perception and communication. The Perception-Communication Matrix is presented to illustrate the AmI development strategies, such as on-board processing and swarm intelligence, etc. To illustrate the scope of the AmI field, several on-going research projects are reviewed according to their positions in the P-C Matrix, such as wireless user positioning, attention-aware displays, portable tongue imaging and vehicle ad-hoc network, etc. Finally, the tutorial is concluded with two live demos: a wearable body sensor system and a video streaming system based on the ad-hoc wireless network of Pocket PCs.

References

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