Artificial Intelligence for Industrie 4.0

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Abstract. The transformative power of Artificial Intelligence (AI) for the fourth industrial revolution based on cyber-physical production systems is now recognized globally by highly industrialized nations. When we coined the term Industrie 4.0 in 2010, it was already clear to me that machine learning, semantic technologies, real-time action planning as well as plan recognition, collaborative robotics, and intelligent user interfaces are the scientific foundation for smart factories, smart products and smart services. AI is a key enabler for the next generation of smart manufacturing in Industrie 4.0, since it leads to a disruption in traditional workflows, supply chains, value creation, and business models in manufacturing and works towards empowering and expanding workforce expertise. The use of AI in manufacturing is paving the way to the synergistic collaboration between humans and robots in urban smart factories for mass customization [2]. In particular, we present recent results from our Industrie 4.0 projects at DFKI, including hybrid teams of human workers and collaborative robots, deep learning for predictive maintenance of networked production machines and for understanding human behaviors of shop floor workers, semantic technologies for worldwide interoperability of machine-to-machine communication in smart factories and logistics, human-aware and real-time production planning and scheduling for multiagent systems, intelligent industrial assistance systems for human workers, and proactive and situation-aware on-line help and training on the shop floor. The concept of active semantic product memories [3] that serve as digital twins invert the traditional production logic, since in Industrie 4.0 the emerging product is controlling its own production process in a service-oriented multiagent architecture. We discuss use cases from legacy factories which we have upgraded to Industrie 4.0 and show the comparative gains [1] in productivity, stock reduction, resource efficiency, retooling or changeover times, and job satisfaction.

References