

River Publishers Series in Communications and Networking

The Autonomous Edge - Intelligence Embedded in Industrial Applications

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ISBN: 9788743815259
e-ISBN: 9788743815266
Available From: June 2026
Price: € 0.00

Description:

The Autonomous Edge – Intelligence Embedded in Industrial Applications explores the technological transformation taking place at the intersection of artificial intelligence, edge computing, autonomous systems, and industrial applications. Bringing together contributions from researchers and practitioners across multiple disciplines, the book presents a comprehensive perspective on how intelligence is increasingly moving from centralised cloud infrastructures directly into vehicles, robots, manufacturing systems, smart cities, critical infrastructures, and embedded devices.

The chapters examine how next-generation edge AI systems are being designed to operate under strict constraints involving latency, energy consumption, privacy, safety, reliability, and real-time responsiveness. The book covers a wide spectrum of technologies, including AI-defined vehicles, continual learning, lightweight neural networks, vision transformers, graph neural networks, digital twins, semantic mapping, multimodal perception, and distributed AI pipelines optimised for deployment on edge hardware.

A central theme throughout the book is the transition from isolated edge AI models toward integrated, adaptive, and autonomous edge intelligence architectures. The presented solutions combine advances in hardware acceleration, embedded edge AI optimisation, communication infrastructures, explainable edge AI, and real-time processing to enable practical deployment in demanding industrial environments. Applications range from autonomous systems, mobility and smart manufacturing to cybersecurity, environmental monitoring, urban safety, and hydrogen infrastructure management.

The book addresses broader challenges associated with autonomous systems, including transparency, liability, ethical decision-making, robustness, and trustworthiness. By combining theoretical foundations with implementation experiences and experimental validations, the chapters provide both scientific insight and practical guidance for researchers, engineers, architects, and decision-makers working on the next generation of intelligent industrial systems at the edge.

Positioned at the convergence of edge AI, autonomous systems, and industrial digitalisation, the book offers a forward-looking view of how distributed intelligence is reshaping the physical world and enabling a new generation of adaptive, efficient, and edge autonomous industrial applications.

Keywords: Autonomous edge AI systems, edge AI technologies, software-defined vehicles, AI-defined-vehicles, edge AI technology stack, micro-edge, deep-edge, and meta-edge, artificial intelligence (AI), edge AI accelerators, deep learning (DL), machine learning (ML), federated learning (FL), edge AI trustworthiness, AI explainability (XAI), AI interpretability (IAI), edge AI applications.