



EdgeAI: A Vision for Distributed, Edge-Native Artificial Intelligence in Future 6G Networks

Lauri Lovén, Teemu Leppänen, Ella Peltonen, Juha Partala, Erkki Harjula,
Pawani Porambage, Mika Ylianttila, and Jukka Riekk
University of Oulu, 6G Flagship
P.O.Box 4500, 90014-Oulu, Finland
E-mail: first.last@oulu.fi

INTRODUCTION

Edge computing distributes cloud applications to the network infrastructure while providing more bandwidth, reducing latencies and improving controls on privacy. In contrast, current artificial intelligence (AI) methods assume computations are conducted in a homogeneous cloud with ample computational and data storage resources available.

AI DISTRIBUTION

Currently, AI's **cloud-centric** architectural model requires transmitting raw data from the end-user devices to the cloud, consuming significant data transmission resources, introducing latencies and endangering privacy. **Distributed** or federated AI builds and maintains a central model in the cloud or on the edge but allows devices to update the model and use it locally for predictions. **Decentralized** AI flattens the distributed hierarchy, with the joint model built and maintained by devices, edge nodes and cloud nodes with equal responsibility.

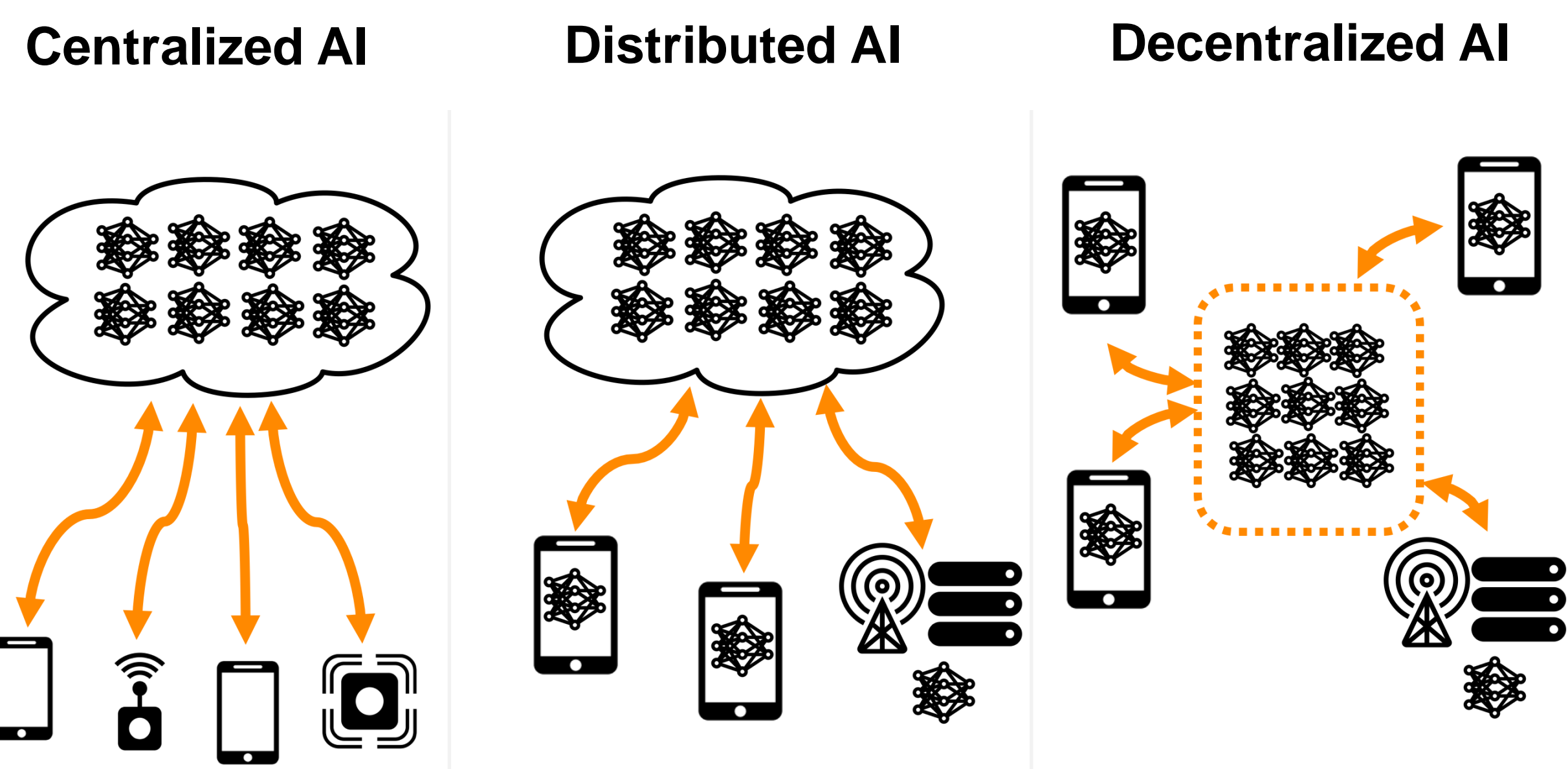


Diagram adapted from Mehdi Bennis, <https://sites.google.com/view/dr-mehdi-bennis/research/ai-on-edge>

VISION

EdgeAI combines edge computing with AI methods to improve both fields in a variety of aspects. Our research aims to **identify the challenges and detail the potential benefits** of EdgeAI, **building a coherent and overarching vision** of what distributed artificial intelligence means in the context of edge computing. Further, we aim **to find the methods of realizing those benefits, testing our hypotheses in a real-world setting** on the edge-based computational platform we're building upon the 5G test network (<http://5gtn.fi>). The vision will be realized during the 8-year time span of the 6G Flagship research program.

Edge Computing

distributed
opportunistic
heterogeneous platform

Artificial Intelligence

centralized
resource-intensive
homogeneous platform

BENEFITS

Clear **benefits** can be identified from combining AI with edge computing. We divide the interplay into *edge computing for AI* and *AI for edge computing*.

Edge Computing for AI

new data and modalities, new model parameters
privacy-preserving regularizations and models
model integrity
massive data, timeliness, locality
faster model convergence, lower generalisation error

AI for Edge Computing

personalisation, intelligence, autonomy	Applications
fine-grained control and management of personal data	Privacy
personalisation, effectiveness, efficiency	Security
predictive and decentralized control, efficient resource usage	Control
better KPI's, QoE	Communication