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Benedetta Picano · Romano Fantacci

Edge Intelligent Computing Systems in Different Domains

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Dedicated to Annamaria.

Preface

Nowadays, there is a remarkable interest in Edge Intelligent Computing systems as key technology for next-generation intelligent applications. The emerging paradigms of distributed machine learning, digital twin, and semantic communications are considered in this book as enablers of Edge Intelligent Computing systems in novel domains. Being the Federated Learning recognized as one of the most promising and efficient distributed learning algorithms, we investigate its behavior under actual application conditions. In particular, despite Federated Learning enables end-devices to train a shared machine learning model while keeping data locally, communications between end-devices and edge servers over wireless links are required. This makes the Federated Learning process dependent on the propagation conditions of the wireless channels. Hence, in investigating the behavior of the Federated Learning process in a six generation (6G) environment, this book discusses efficient solutions both to improve the resulting converge time. Furthermore, even if Federated Learning is considered a promising approach, it struggles to adapt to the diversity of components within a same system. To overcome these limitations, the novel Democratized Learning paradigm is discussed in the book. Finally, the book discuss the Digital Twins technology as a manageable bridge between the applications and physical assets and the emerging semantic communication approach to enable the deployment of an Edge Intelligent Computing ecosystem in novel scenarios.

The book consists of five chapters. The first one deals with a brief discussion on the fundamentals of the Edge Computing, Federated Learning, and Semantic Communications features. In the remaining chapters, we comprehensively discuss the design and analysis of Edge Intelligent Computing systems in different domains. Specifically, resource optimization, incentive mechanism, and quality of service preservation are considered. Furthermore, we present several solutions based on the matching theory and provide numerical results concerning the performance of the considered systems in different application scenarios.

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