

Federated Learning with the Concepts and Algorithms of Granular Computing

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Abstract

With the rapid progress encountered in system modeling and simulation, especially in complex and human-centric systems, we have been witnessing important challenges. The visible requirements are inherently associated with the data and a way they are addressed in system modeling. We identify ongoing challenges with far-reaching methodological implications, in particular (i) modeling in the presence of strict constraints of privacy and security, (ii) efficient model building with limited data of varying quality.

We advocate that to conveniently address these challenges, it becomes beneficial to engage the fundamental framework of Granular Computing to enhance the existing approaches. It is demonstrated that various ways of conceptualization of information granules as fuzzy sets, sets, rough sets, and others may lead to efficient solutions.

To establish a sound conceptual modeling framework, we include a brief discussion of concepts of information granules and Granular Computing. In the sequel, a concise information granules-oriented design of rule-based architectures is discussed. A way of forming the rules through unsupervised federated learning is investigated along with algorithmic developments. A granular characterization of the model formed by the server vis-a-vis data located at individual clients is presented. It is demonstrated that the quality of the rules at the client's end is described in terms of granular parameters and subsequently the global model becomes represented as a granular model with parameters in the form of information granules of type-2.

The talk is self-contained; all required prerequisites are covered in a succinct manner.