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AdaPipe: A Recommender System for Adaptive Computation Pipelines in Cyber-Manufacturing Computation Services

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The industrial cyber-physical systems (ICPS) will accelerate the transformation of offline data-driven modeling to fast computation services, such as computation pipelines for prediction, monitoring, prognosis, diagnosis, and control in factories. However, it is computationally intensive to adapt computation pipelines to hetero-geneous contexts in ICPS in manufacturing.

In this paper, we propose to rank and select the best computation pipelines to match contexts and formulate the problem as a recommendation problem. The proposed method Adaptive computation Pipelines (AdaPipe) considers similarities of computation pipelines from word embedding, and features of contexts. Thus, without exploring all computation pipelines extensively in a trial-and-error manner, AdaPipe efficiently identifies top-ranked computation pipelines. We validated the proposed method with 60 bootstrapped data sets from three real manufacturing processes: thermal spray coating, printed electronics, and additive manufacturing. The results indicate that the proposed recommendation method outperforms traditional matrix completion, tensor regression methods, and a state-of-the-art personalized recommendation model.

Keywords

Computation pipeline, computing in cyber-physical systems, recommender system, smart factories

Special/invited session

QSR/INFORMS invited session

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