SEMINARIO

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Algebraic AI

Atomized semilattices and Algebraic Machine Learning

Abstract:

We will introduce atomizations for semilattices, a novel representation technique for semilattices whose computational flexibility allows their use in machine learning. A finite semilattice is extended with additional elements, called atoms, that serve the purpose of a basis whenever they form an atomization. We will present the main properties of atomizations: the uniqueness of a minimal atomization for a finite semilattice, how an atomization is built iteratively, and its behaviour under semilattice operations such as restrictions and joins. We will show how atomizations are still well posed when considering infinite semilattices. Finally we will discuss how, through atomizations, semilattice models (more precisely, embeddings of problems in semilattices) can be computed and trained efficiently. This is the foundation of Algebraic Machine Learning (AML), a machine-learning method alternative to statistical ones, e.g. neural networks. We wil highlight the link between the properties of atomizations and the main features of AML.

References:

[1] Fernando Martin-Maroto, Gonzalo G. de Polavieja, *Algebraic Machine Learning*, https://arxiv.org/abs/1803.05252, 2018.

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[3] Fernando Martin-Maroto, Gonzalo G. de Polavieja, *Semantic Embeddings in Semilattices*, https://arxiv.org/abs/2205.12618, 2022.

[4] Fernando Martin-Maroto, Antonio Ricciardo, David Mendez, Gonzalo G. de Polavieja, *Infinite Atomized Semilattices*, https://arxiv.org/abs/2311.01389, 2023.

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