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Reasoning about ensemble learning algorithms with Justification Logic.
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An ensemble learning algorithm is a predictive method that uses multiple learning algorithms to obtain better results than it could obtain by using only one of those algorithms[1]. An algorithm, or an ensemble of them, is said to be opaque when its internal workings are not transparent, making it challenging to understand how it makes decisions or to identify the factors that influence those decisions[2].

Justification Logic (specifically LP, the Logic of Proofs) was introduced by Artemov[3]. It allows one to introduce the notion of proofs or justifications in the object language. Instead of writing $\Box X$ to mean that “ X is knowable” or that “ X is provable”, one writes $t : X$ to mean that “ t is a justification of X ” or that “ t is a proof of X ”[4].

In this work, we present a first appraisal at reasoning on the opacity of ensemble learning algorithms through Justification Logic, so that a logical explanation of such algorithms can be given.

[1] SAGI, O. AND ROKACH, L., *Ensemble learning: A survey.*, ***WIREs Data Mining and Knowledge Discovery***, 8:e1249, (2018).

[2] BURRELL, J., *How the machine ‘thinks’: Understanding opacity in machine learning algorithms.*, ***Big Data & Society***, 3(1), (2016).

[3] ARTEMOV, S., *Operational modal logic.*, ***Technical Report MSI 95–29***, (1995) Cornell University.

[4] ARTEMOV, S. AND M. FITTING, ***Justification Logic: Reasoning with Reasons.***, Cambridge Tracts in Mathematics, Cambridge University Press, (2019).