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iMLP: Applying multi-layer perceptrons to interval-valued data

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Abstract— Interval-valued data offer a valuable way of representing the available information in complex problems where uncertainty, inaccuracy or variability must be taken into account. In addition, the combination of Interval Analysis with soft-computing methods, such as neural networks, have shown their potential to satisfy the requirements of the decision support systems when tackling complex situations. This paper proposes and analyzes a new model of Multilayer Perceptron based on interval arithmetic that facilitates handling input and output interval data, but where weights and biases are single-valued and not interval-valued. Two applications are considered. The first one shows an interval-valued function approximation model and the second one evaluates the prediction intervals of crisp models fed with interval-valued input data. The approximation capabilities of the proposed model are illustrated by means of its application to the forecasting of daily electricity price intervals. Finally, further research issues are discussed.

Index Terms— Feed-forward neural network; function approximation; interval analysis; interval data; interval neural networks; symbolic data analysis; time series forecasting

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