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Scalable machine learning methods based on random-weight neural networks

Title of the dissertation	Advances in Extreme Learning Machines
Contents of the dissertation	Nowadays, due to advances in technology, the size and dimensionality of data sets used in machine learning have grown very large and continue to grow by the day. Therefore, it is important to have efficient computational methods that can be applied to large data sets, such that it is still possible to complete the machine learning task in reasonable time. This dissertation focuses on developing machine learning methods, based on random-weight neural networks, meant to deal with these challenges. The contributions take three main directions: Combinations of multiple random-weight neural networks, which improve accuracy and allow for adaptation to a possibly changing context. Computational time is reduced through parallelization and GPU-acceleration strategies. Secondly, several variable selection approaches based on random-weight neural networks are introduced, which result in more accurate and efficient models by eliminating the irrelevant parts of a data set. Finally, a training algorithm for random-weight neural networks which allows for a flexible trade-off between accuracy and computational time is investigated. Overall, the resulting collection of proposed methods provides an efficient, accurate and flexible framework for solving large-scale supervised learning problems. The proposed methods are not limited to the particular types of random-weight neural networks and contexts in which they have been tested, and can easily be incorporated in new contexts and models.
Field of the dissertation	Information and Computer Science, Machine Learning
Doctoral candidate	Mark van Heeswijk, M.Sc. Born in 1981, Waalwijk, The Netherlands
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Doctoral candidate's contact information	Mark van Heeswijk, Department of Computer Science, Aalto University, mark.van.heeswijk@aalto.fi

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