UNIVERSIDAD ADOLFO IBÁÑEZ

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FACULTAD DE INGENIERÍA Y CIENCIAS

NEW DEVELOPMENTS FOR RANDOMIZED NEURAL NETWORKS

PABLO ANDRÉS HENRÍQUEZ VALDEBENITO

Submitted in part fulfilment of the requirements for the degree of Doctor of Complex Systems Engineering of the Universidad Adolfo Ibáñez, April 2019

SANTIAGO-CHILE 2019

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Abstract

Nowadays, due to advances in technology, data is generated at an incredible rate, resulting in large data sets of ever-increasing size and dimensionality. Therefore, it is important to have efficient computational methods and machine learning algorithms that can handle large data sets, such that they may be analyzed in reasonable time. One particular approach that has gained popularity in recent years is Extreme Learning Machine (ELM), which is the name given to neural networks that employ randomization in their hidden layer, and that can be trained efficiently. This Ph.D. thesis introduces several machine learning methods based on neural networks with random weights aimed at dealing with the challenges that modern data sets pose.

This thesis presents new algorithms and applications of randomized neural networks, a kind of artificial neural network that runs very fast on a computer. Five contributions are presented. First, a new parallel architecture is proposed. Second, a real problem with noise data is analyzed with this type of neural networks. Another direction of research was to develop an algorithm for pruning irrelevant neurons in the hidden layer. Fourth, an empirical study of the hidden matrix rank is presented. Finally, a novel non-iterative deep neural network is used for sentiment classification in Twitter.

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