

Leonardo Franco, David A. Elizondo, and José M. Jerez (Eds.)

Constructive Neural Networks

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Preface

This book presents a collection of invited works that consider constructive methods for neural networks, taken primarily from papers presented at a special session held during the 18th International Conference on Artificial Neural Networks (ICANN 2008) in September 2008 in Prague, Czech Republic.

The book is devoted to constructive neural networks and other incremental learning algorithms that constitute an alternative to the standard method of finding a correct neural architecture by trial-and-error. These algorithms provide an incremental way of building neural networks with reduced topologies for classification problems. Furthermore, these techniques produce not only the multilayer topologies but the value of the connecting synaptic weights that are determined automatically by the constructing algorithm, avoiding the risk of becoming trapped in local minima as might occur when using gradient descent algorithms such as the popular back-propagation. In most cases the convergence of the constructing algorithms is guaranteed by the method used.

Constructive methods for building neural networks can potentially create more compact and robust models which are easily implemented in hardware and used for embedded systems. Thus a growing amount of current research in neural networks is oriented towards this important topic.

The purpose of this book is to gather together some of the leading investigators and research groups in this growing area, and to provide an overview of the most recent advances in the techniques being developed for constructive neural networks and their applications.

The first chapter of the book presents a review of existing constructive neural network algorithms (M. Nicoletti, J. Bertini, D. Elizondo and L. Franco). Next, four different constructing approaches to solving classification problems are presented: Muselli and Ferrari introduce a constructing method for switching functions, Grochowski and Duck focus on a new method for highly complex functions, Anthony presents a constructive method based on decision lists and the SONN3 model is analyzed by Horzyk in chapter 5. Nguiph presents in chapter 6 concept lattice-based neural networks, followed in chapter 7 by the work of Sussner and Esmi who discuss the theory and experiments using morphological neural networks. Two extensions of constructive algorithms to multiclass problems are introduced in chapters 8 and 9 by Bertini and Nicoletti and by Elizondo and Ortiz de Lazcano respectively .

The application of constructive algorithms is used by Franco, Jerez, and Subirats for active learning in chapter 10, while Ollington, Vamplew and Swanson explore the use of constructive algorithms in a reinforcement learning framework in chapter 11. Chapter 12 by Huemer, Elizondo and Góngora shows the application of a constructive neural network for evolving a machine controller, followed by the contribution from Satizábal, Pérez-Urbe and Tomassini about avoiding prototype proliferation. The volume ends with two works on self organizing neural networks: chapter 14 by Barreto et al. where the parameter setting in a fuzzy growing network is analysed, while chapter 15 discusses the method of Inoue on Self-Organizing Neural Grove.

The editors wish to thank all the authors who contributed with their research in this volume and hope that the current snapshot of some of the latest work in the field of constructive neural network algorithms help in the further development of the field.

February, 2009

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