Abstracts

A robust algorithm for automatic development of neural-network models for microwave applications (Dec. 2001 [T-MTT])

V.K. Devabhaktuni, M.C.E. Yagoub and Qi-Jun Zhang. "A robust algorithm for automatic development of neural-network models for microwave applications (Dec. 2001 [T-MTT])." 2001 Transactions on Microwave Theory and Techniques 49.12 (Dec. 2001 [T-MTT] (Special Issue on 2001 International Microwave Symposium)): 2282-2291.

For the first time, we propose a robust algorithm for automating the neural-network-based RF/microwave model development process. Starting with zero amount of training data and then proceeding with neural-network training in a stage-wise manner, the algorithm can automatically produce a neural model that meets the user-desired accuracy. In each stage, the algorithm utilizes neural-network error criteria to determine additional training/validation samples required and their location in model input space. The algorithm dynamically generates these new data samples during training, by automatic driving of simulation tools (e.g., OSA90, Ansoft-HFSS, Agilent-ADS). Initially, fewer hidden neurons are used, and the algorithm adjusts the neural-network size whenever it detects under-learning. Our technique integrates all the subtasks involved in neural modeling, thereby facilitating a more efficient and automated model development framework. It significantly reduces the intensive human effort demanded by the conventional step-by-step neural modeling approach. The algorithm inherently distinguishes nonlinear and smooth regions of model behavior and uses relatively fewer samples in smooth subregions. It automatically deals with large data errors that can occur during dynamic sampling by using a Huber quasi-Newton technique. The algorithm is demonstrated through practical microwave device and circuit examples.

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