Centre d'Etudes Doctorales : Sciences et Techniques et Sciences Médicales

Avis de Soutenance

THESE DE DOCTORAT

Présentée par

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Sujet de la thèse

Amélioration des méthodes d'estimation des hyperparamètres pour les techniques d'apprentissage machine

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Résumé de la thèse

Deep neural networks (DNNs) have emerged as powerful tools across various domains, revolutionizing industries with breakthroughs in tasks like image classification, medical diagnosis, and language translation. However, realizing their full potential requires careful tuning of hyperparameters, which significantly impacts model performance. Hyperparameter tuning is crucial yet challenging, involving the exploration of vast configuration spaces. Despite these challenges, advancements in optimization techniques and computational resources enable efficient tuning of DNNs. Techniques like grid search, random search, Bayesian optimization, and evolutionary algorithms facilitate superior results with reduced manual effort. Effectively harnessing DNNs and hyperparameter tuning promises immense rewards. Continued research and innovation in DNN architectures and optimization methods will drive further progress in artificial intelligence and machine learning, enhancing our ability to tackle real-world problems.

Additionally, this thesis presents innovative contributions in hyperparameter optimization for deep neural networks, with a specific focus on Multilayer Perceptrons (MLPs) and Convolutional Neural Networks (CNNs). Firstly, the MLP-GA/BP approach addresses challenges in predicting hypothyroid disease by merging the evolutionary genetic algorithm (GA) and backpropagation (BP) technique to fine-tune the initial weights of MLP neural networks. Leveraging the combined strengths of GA and BP, this model aims to improve both generalization capability and accuracy in hypothyroidism classification. Secondly, the thesis introduces MLPRGA+5, a novel and efficient method for optimizing hyperparameters of MLP neural networks using the real-coded genetic algorithm (RCGA). By combining RCGA with operators such as SBX and polynomial mutation, the approach successfully navigates the complex landscape of hyperparameters, balancing precision and complexity. This expands optimization possibilities for MLPs, providing an effective method for classification tasks and contributing to advances in deep learning. Thirdly, an innovative method for early detection of diabetes mellitus is presented, utilizing deep convolutional neural networks, with a focus on the architecture of 1D convolutional neural networks (1D-CNNs). This approach integrates the evolutionary genetic algorithm (GA) with deep learning (DL) techniques to finely adjust the hyperparameters of the CNN model. This innovative combination aims to enhance overall model performance, providing a refined and optimized solution for the crucial task of early

detection of breast carcinoma. These contributions contribute to the ongoing progress in artificial intelligence and offer efficient solutions for real-world problems.

Keywords: deep neural networks, convolutional neural networks, Hyperparameter Tuning, Initial Weights optimization, Architecture Optimization, Real Coded Genetic Algorithm, Medical Diagnosis.