# Harnessing Machine Learning and Meta-Learning for Enhanced Medical Diagnosis

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**Abstract**

In the age of data-centric health-care, the critical role of machine learning in medical diagnosis is unmistakable. This study presents an innovative approach aimed at refining and enhancing predictive models for medical diagnoses through a diverse range of optimization techniques. By harnessing machine learning algorithms designed to emulate human learning processes and improve accuracy, our novel approach integrates machine learning with optimization models to enhance the precision of medical diagnoses. We primarily focus on fine-tuning parameters of widely used machine learning algorithms such as logistic regression, support vector machines, and neural networks, aiming to approximate the diagnostic function and explore optimal algorithm configurations. Through meticulous navigation of algorithmic parameter spaces, we uncover optimal setups. Additionally, by representing algorithms as computational graphs and exploiting their relationships with diagnostic outcomes, we envision the ideal characteristics of existing algorithms. This approach holds the potential to guide the development of novel, highly accurate diagnostic tools. The integration of machine learning and optimization models provides a systematic, data-driven framework for refining existing algorithms and discovering innovative solutions, ultimately leading to improved medical outcomes. This efficacy is demonstrated through case studies involving logistic regression, neural networks, SVM, etc., where parameters such as the inverse of regularization strength (C) are precisely tailored. The outcomes of logistic regression are extended with the assistance of graph neural networks, significantly enhancing medical diagnosis.