

Optimisation in Scilab Using the Gradient Descent Algorithm

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Abstract

Gradient descent is an optimization technique designed to minimize a function by iteratively moving in the direction of the steepest descent. The algorithm's simplicity and computational efficiency make it a popular choice for a wide range of models, from linear regression to deep learning networks. This project presents a comprehensive analysis of three gradient descent optimization algorithms—Batch Gradient Descent (BGD), Stochastic Gradient Descent (SGD), and Mini-Batch Gradient Descent (Mini-BGD)—applied to logistic regression for binary classification. The study highlights the importance of carefully selecting hyperparameters such as learning rate and batch size, as these can significantly impact the convergence rate and the accuracy of the solution.

Moreover, the study investigates the convergence behaviour and stability of each optimization method. Data standardization is used to enhance convergence speed and stability. The significance of these findings extends to a variety of domains. In deep learning, it is fundamental for optimizing neural network weights and biases. In fields such as economics, game theory, and market equilibrium modelling, it supports the analysis and resolution of complex systems. The findings provide practical insights and recommendations for selecting appropriate gradient descent strategies in logistic regression tasks, emphasizing the importance of algorithm choice, learning rate tuning, and data preprocessing in achieving efficient and robust model training.