What are the limitations of derivative-based models for optimization in machine learning?

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Abstract

Most machine learning models can be transposed into optimization problems with the goal being finding the global minima or maxima. This paper covers how the main learning methodologies (supervised, unsupervised and reinforcement) are essentially optimization and the mathematical models commonly used in the optimization along with the limitations of these methods.

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Chapter 1

Introduction to Machine Learning and Optimization

1.1 What is Machine Learning?

Machine learning (ML) is a subfield of artificial intelligence (AI) which, broadly speaking, is the use of computational methods and models to improve performance and predictions through experience [1]. Unlike humans, this learning is based entirely on data and statistics and experience is gained through interaction with a training set of data or an environment of some kind. As a result of this,

1.2 Defining Factors of Optimization

1.3 Notation in Optimization

Chapter 2

Supervised Learning

Chapter 3

Unsupervised Learning

Chapter 4

Reinforcement Learning

Chapter 5

Mathematical Models for Optimization

References

[1] Mehryar Mohri, Afshin Rostamizadeh, and Ameet Talwalkar. *Foundations of machine learning*. MIT press, 2018.