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Bachelor's/ Master's Thesis

Machine Unlearning for Online Federated Learning

Abstract

Driven by the advent of the right to be forgotten, machine unlearning has emerged as a significant area of research. Current approaches to machine unlearning in federated settings concentrate on the offline scenario, where all participating clients possess a static dataset prior to the collaborative training of the machine learning model. However, the process of unlearning in an online federated learning (OFL) context, where a server coordinates multiple clients that engage with sequentially arriving streaming data points, remains largely unexplored.

Content

This thesis explores the problem of machine unlearning within the context of Online Federated Learning (OFL). We begin by providing a formal definition of the unlearning problem in OFL, followed by the design of an algorithmic framework based on random perturbation for both learning and unlearning that can remove data samples from a trained OFL model while offering provable guarantees. Through theoretical analysis, we show that our approach can maintain the utility of the model with high efficiency. To demonstrate the efficacy and performance of our framework, we will carry out experiments using real-world datasets.

Requirements

- Interests in machine learning (ML) and online learning.
- A basic understanding of fundamental ML concepts and algorithms, along with knowledge of probability and statistics, is essential.
- Experience in Python for ML experiments.

Literature

- Suriyakumar, Vinith, and Ashia C. Wilson. "Algorithms that approximate data removal: New results and limitations." Advances in Neural Information Processing Systems 35 (2022): 18892-18903.
- Sekhari, Ayush, et al. "Remember what you want to forget: Algorithms for machine unlearning." Advances in Neural Information Processing Systems 34 (2021): 18075-18086.
- Tao, Youming, et al. "Communication Efficient and Provable Federated Unlearning." Proc. VLDB Endow 17.5 (2024): 1119- 1131.

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