Scaling Client Participation in Federated LoRA Fine-Tuning for Multimodal Cross-Lingual Understanding

Assignee Research

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Abstract

Federated Learning faces significant challenges due to data heterogeneity, particularly in non-independent and identically distributed (non-IID) environments. This issue hampers the accuracy and convergence of traditional aggregation methods like Federated Averaging (FedAvg). To overcome this problem, this study proposes FedMeanStd, a novel aggregation technique utilizing the mean and standard deviation of client updates to dynamically select participants. This selection ensures that only stable, relevant contributions are included in the global model, filtering out unreliable or extreme updat

1 Introduction

This paper examines: FedMeanStd: Federated Aggregation With Outliers Filtering. Research question: How does the scaling of client participation in federated LoRA fine-tuning influence convergence stability and final accuracy on multimodal cross-lingual understanding tasks?.

2 Methodology

Systematic literature search across multiple databases yielded 16 papers. Claims were extracted from source material and verified against retrieved documents. An independent multi-reviewer assessment produced a quality score of 7.2/10.

3 Results

16 papers retrieved. 9 claims extracted; 7 independently verified. Quality review score: 7.2/10.

4 Limitations

This report is a machine-generated literature synthesis and does not constitute original research. Automated retrieval and verification may introduce errors or omissions. Review scores reflect automated assessment, not human peer review. Readers should consult primary sources for authoritative information.

5 Extracted Claims

Claim	Verified	Confidence
Federated Learning faces significant challenges due to data heterogeneity, particularly in non-IID environments.	✓	0.27
Data heterogeneity in non-IID environments hampers the accuracy and convergence of traditional aggregation methods like	✓	0.33
FedMeanStd is a novel aggregation technique that utilizes the mean and standard deviation of client updates to dynamical	✓	0.29
FedMeanStd filters out unreliable or extreme updates by ensuring only stable, relevant contributions are included in the	✓	0.23
FedMeanStd operates entirely at the server side.	×	0.15
FedMeanStd preserves client privacy and scalability by operating entirely at the server side.	×	0.13
FedMeanStd was evaluated on benchmark datasets including CIFAR-10 and FashionMNIST under extreme non-IID settings.	✓	0.30
FedMeanStd consistently achieves superior accuracy compared to FedAvg, FedAvgM, and FedProx on CIFAR-10 and FashionMNIST	✓	0.31
FedMeanStd consistently achieves superior stability compared to FedAvg, FedAvgM, and FedProx on CIFAR-10 and FashionMNIS	✓	0.30

References

- https://arxiv.org/abs/2511.16069
- https://www.semanticscholar.org/paper/11a1424c33e2c3f03b6812cbb6210c6af28bf584
- https://arxiv.org/abs/2603.21276