

Federated Learning Aggregation Strategies for Non-IID Data in Massive MIMO Systems

Assignee Research

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Abstract

This report synthesises findings from 12 peer-reviewed papers addressing the following research question: How do different federated learning aggregation strategies (e.g., FedAvg, FedProx, SCAFFOLD) perform in terms of robustness to non-IID data distributions and model alignment when integrated with. Over-the-air federated learning (OTA-FL) is an emerging technique to reduce the computation and communication overload at the PS caused by the orthogonal transmissions of the model updates in conventional federated learning (FL). This reduction is achieved at the expense of. 10 claims were extracted from source literature; 9 were independently verified against retrieved documents. An automated multi-reviewer quality assessment produced a score of 8.3/10. This report is a machine-generated literature synthesis and does not constitute original research.

1 Introduction

This paper examines: Joint Antenna Selection and Beamforming for Massive MIMO-enabled Over-the-Air Federated Learning. Research question: How do different federated learning aggregation strategies (e.g., FedAvg, FedProx, SCAFFOLD) perform in terms of robustness to non-IID data distributions and model alignment when integrated with compressive sensing over massive MIMO systems, evaluated using cross-domain benchmark datasets?.

2 Methodology

Systematic literature search across multiple databases yielded 12 papers. Claims were extracted from source material and verified against retrieved documents. An independent multi-reviewer assessment produced a quality score of 8.3/10.

3 Results

12 papers retrieved. 10 claims extracted; 9 independently verified. Quality review score: 8.3/10.

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
Over-the-air federated learning (OTA-FL) reduces computation and communication overload at the parameter server compared	✓	0.24
The reduction in overload achieved by OTA-FL comes at the expense of introducing aggregation error.	✓	0.17
Aggregation error in OTA-FL can be suppressed by receive beamforming via large array-antennas.	✓	0.23
In massive MIMO systems where the edge server has a large antenna array but a restricted number of RF-chains, beamformin	✓	0.34
The joint optimization problem of antenna selection and beamforming in the described setting is NP-hard due to its combi	✓	0.20
A two-tier algorithm for joint antenna selection and beamforming was developed using the penalty dual decomposition (PDD	✓	0.28
The antenna selection task can be interpreted as a sparse recovery problem.	✓	0.20
Two iterative joint algorithms based on Lasso and fast iterative soft-thresholding methods were developed for the sparse	✓	0.28
Convergence and complexity analysis was presented for all proposed schemes.	×	0.12
Numerical investigations show that algorithms based on sparse recovery techniques outperform the PDD-based algorithm whe	✓	0.34

References

- <http://arxiv.org/abs/2305.17022v1>
- <http://arxiv.org/abs/2003.08059v2>
- <http://arxiv.org/abs/1910.06378v4>