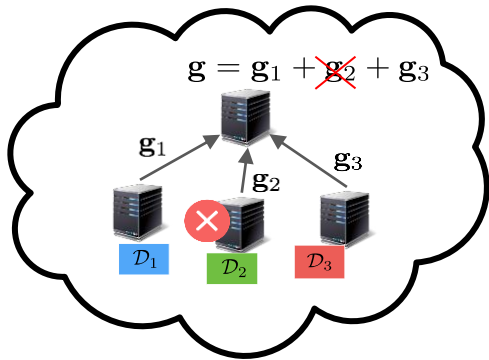


Large-Scale Distributed Learning

1. Distributed Learning in Cloud



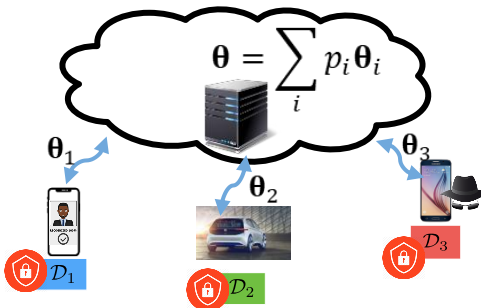
Challenges

- Communication bottleneck
- Straggling worker nodes

Proposal: CodedReduce [1]

- Novel **tree topology** for inter-cluster parallelization
- Smart algebraic **coding over gradients** for straggler resiliency
- Gains of up to **30x** over prior benchmarks over AWS

2. Federated Learning



Challenges

- Data privacy
- Data heterogeneity
- Model inversion attacks
- Byzantine attacks

Proposal: DiverseFL [2]

- Provides robustness against Byzantine attacks, particularly with **non-IID** client data
- Novel **per client criteria** for finding Byzantines
- **TEE-assisted** secure aggregation at server
- Outperforms prior SOTA for Byzantine mitigation, such as FLTrust (NDSS'21)

(More details in next 2 slides)

3. Decentralized Serverless Learning



Challenges

- Lack of central coordinator
- Topology design for decentralized training
- Security against Byzantine attacks

Proposal: Basil [3]

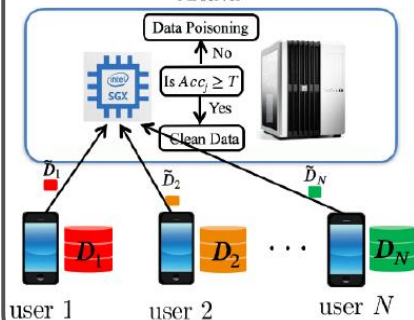
- **Fast and computationally efficient** Byzantine-resilient decentralized training
- **Logical ring** topology for sequential training for low power edge devices
- Novel **performance-based approach** for Byzantine mitigation
- Superior performance with **non-IID data**, where prior SOTA fails completely

DiverseFL Overview:

Step 0, 1 - Sample Evaluation

Sample Sharing with TEE
TEE Detects Poisoned Samples

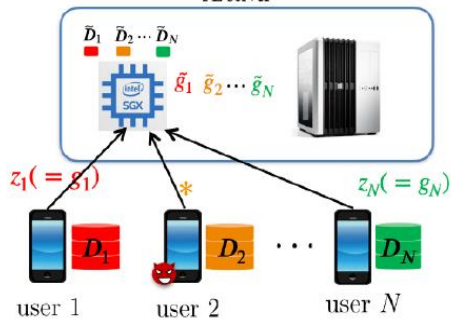
FL server



Step 2, 3 - Training

Local Training on the Client
Guiding Model Update Computation on TEE

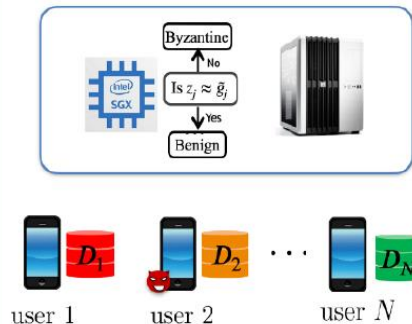
FL server



Step 4 - Similarity Checks

Byzantine Identification by FL Server

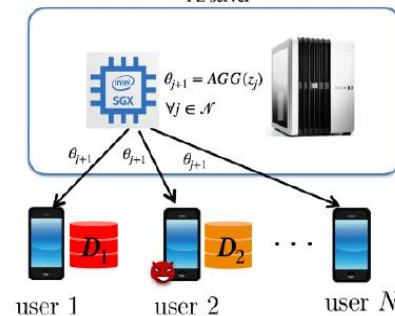
FL server



Step 5 - Aggregation

Global Model Update in FL Server

FL server



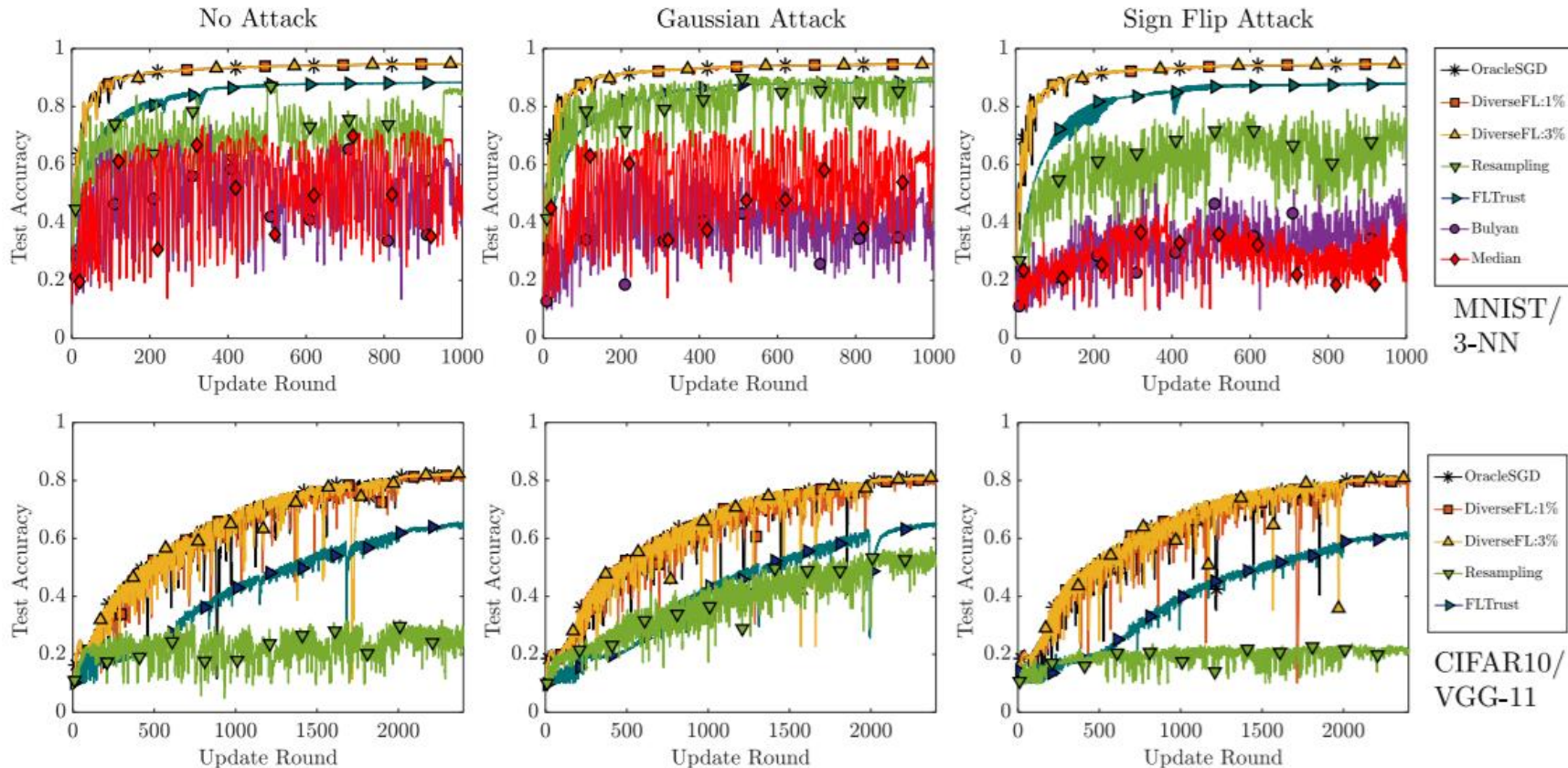
DiverseFL Convergence: For communication round i , and optimal global model θ^* , current model θ^i satisfies the following with high probability:

$$\|\theta^i - \theta^*\| \leq (1 - \rho)^i \|\theta^0 - \theta^*\| + \frac{\alpha(2 + \epsilon_2)(4\Gamma_1 + \beta)}{\rho}$$

DiverseFL Performance in Practice

Setting:

Total 23 clients; 5 Byzantine nodes; non-IID data distribution



DiverseFL achieves **stable, near optimal** performance across multiple attacks and **datasets**