MLP × DagsHub Hackthon'23

[Re] Towards Understanding Biased Client Selection in Federated Learning

Peng Ju* | Physics Dept., Purdue University

Gautam Choudhary* | Computer Science Dept., Purdue University

Revealing the Power of Choice

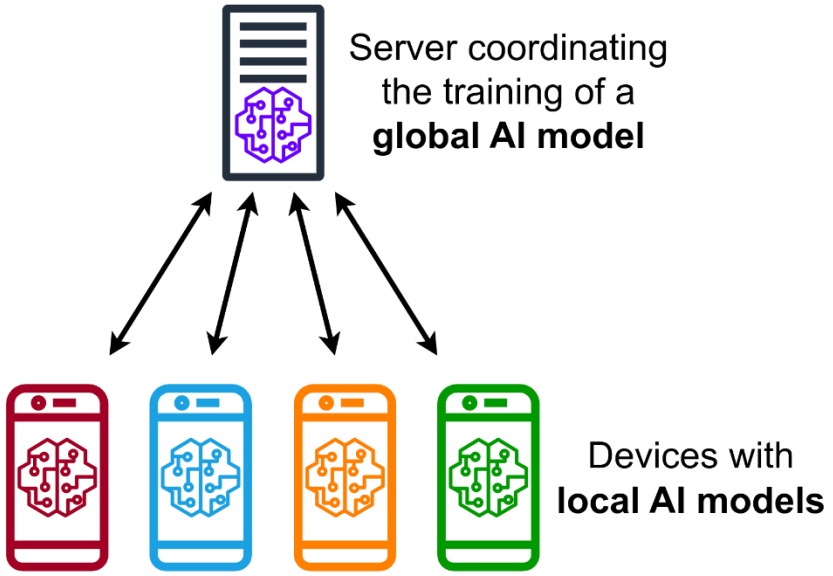
Source: "The matrix" Movie

Team: Silent.ML

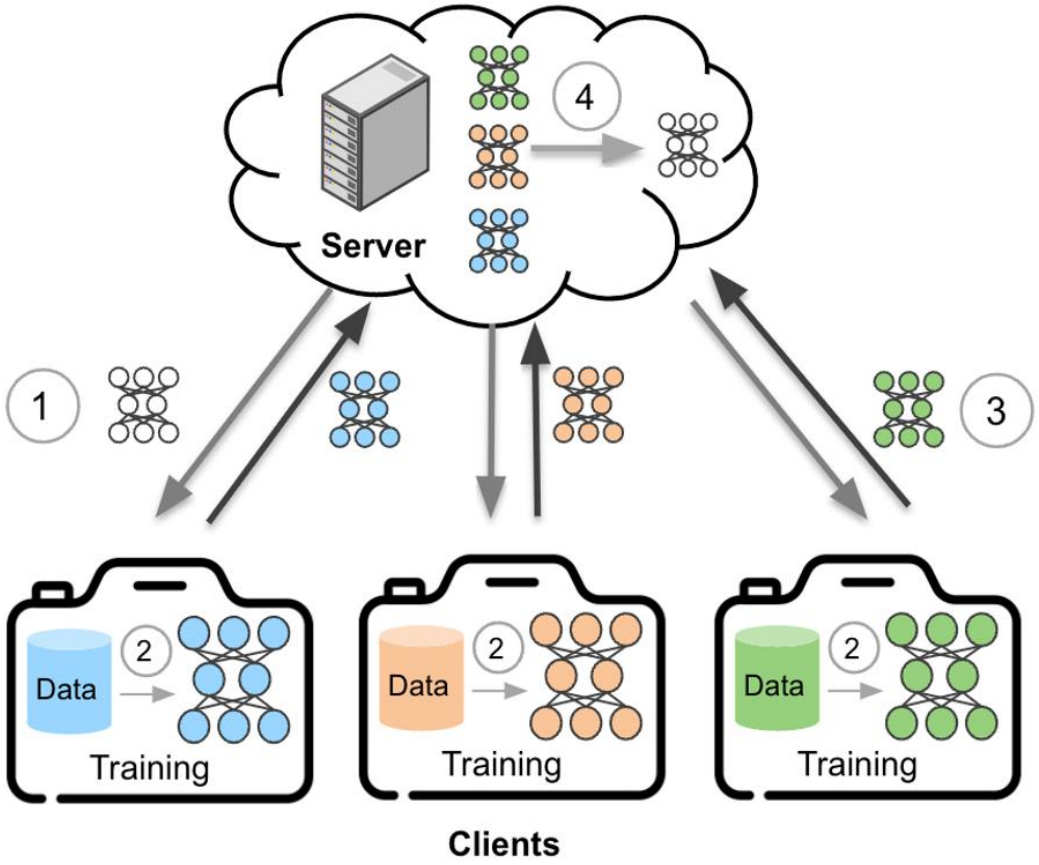
* Equal contribution

Motivation | Federated Learning

Decentralized Learning



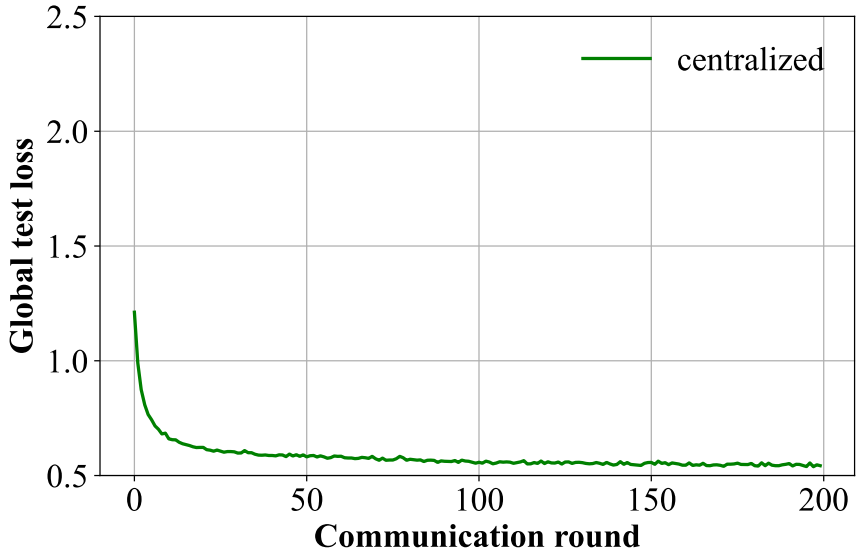
Source: https://en.wikipedia.org/wiki/Federated_learning



Source: https://ai.sony/blog/blog-032/

Client Selection | Power of Choice

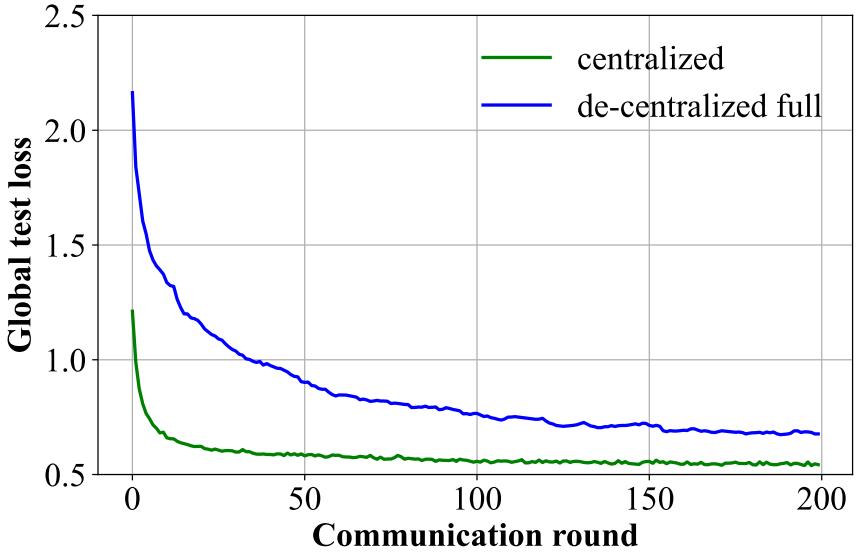
- Centralized Setup – Traditional ML



Client Selection | Power of Choice

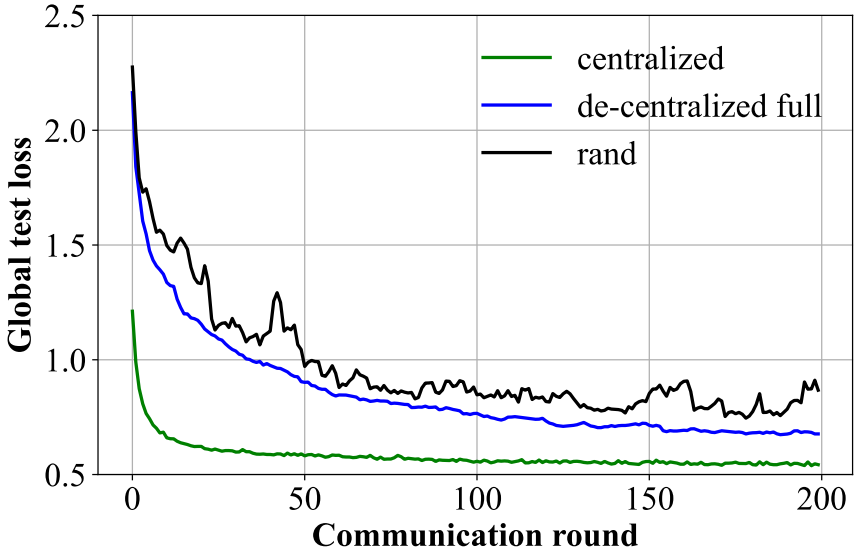
- Centralized Setup – Traditional ML

- Federated Setup – Full Participation



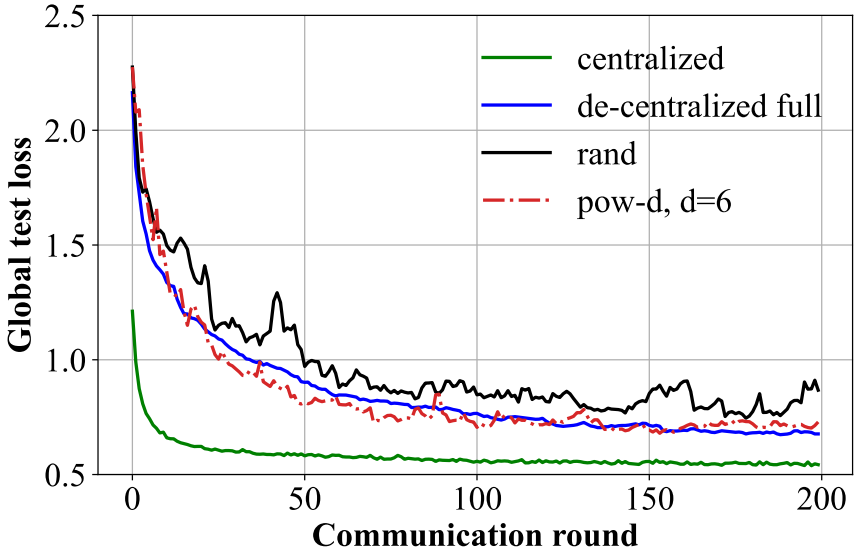
Client Selection | Power of Choice

- Centralized Setup – Traditional ML
- Federated Setup – Full Participation
- Random Client Selection

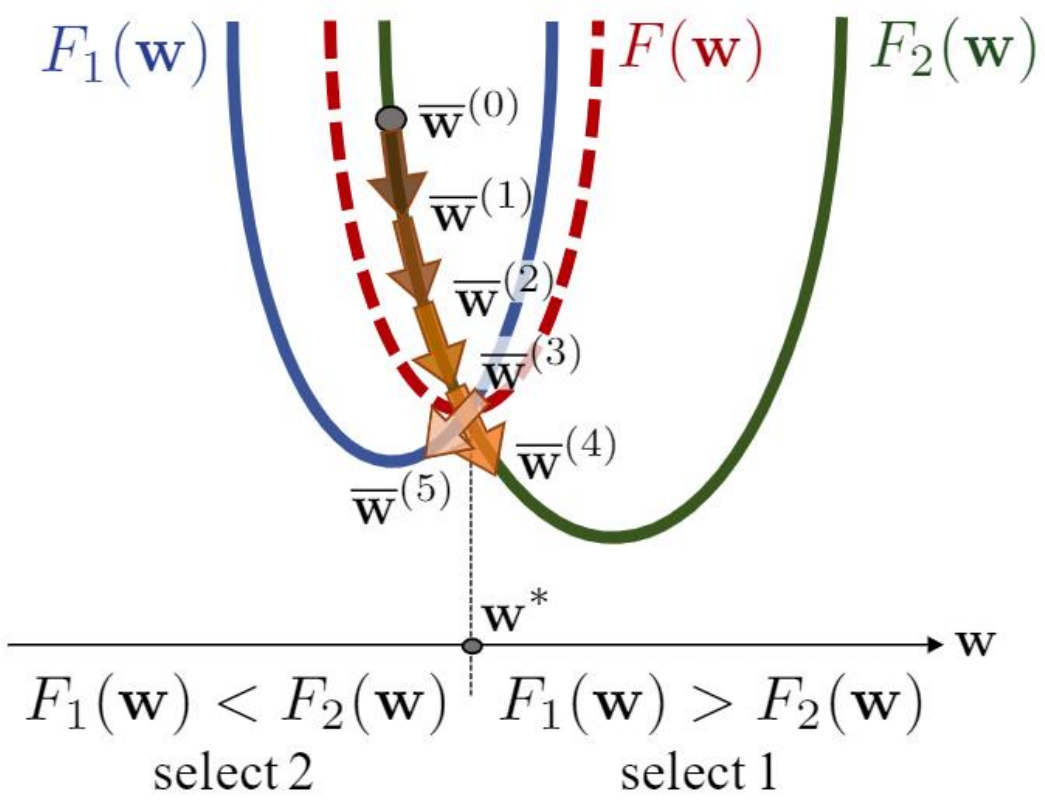


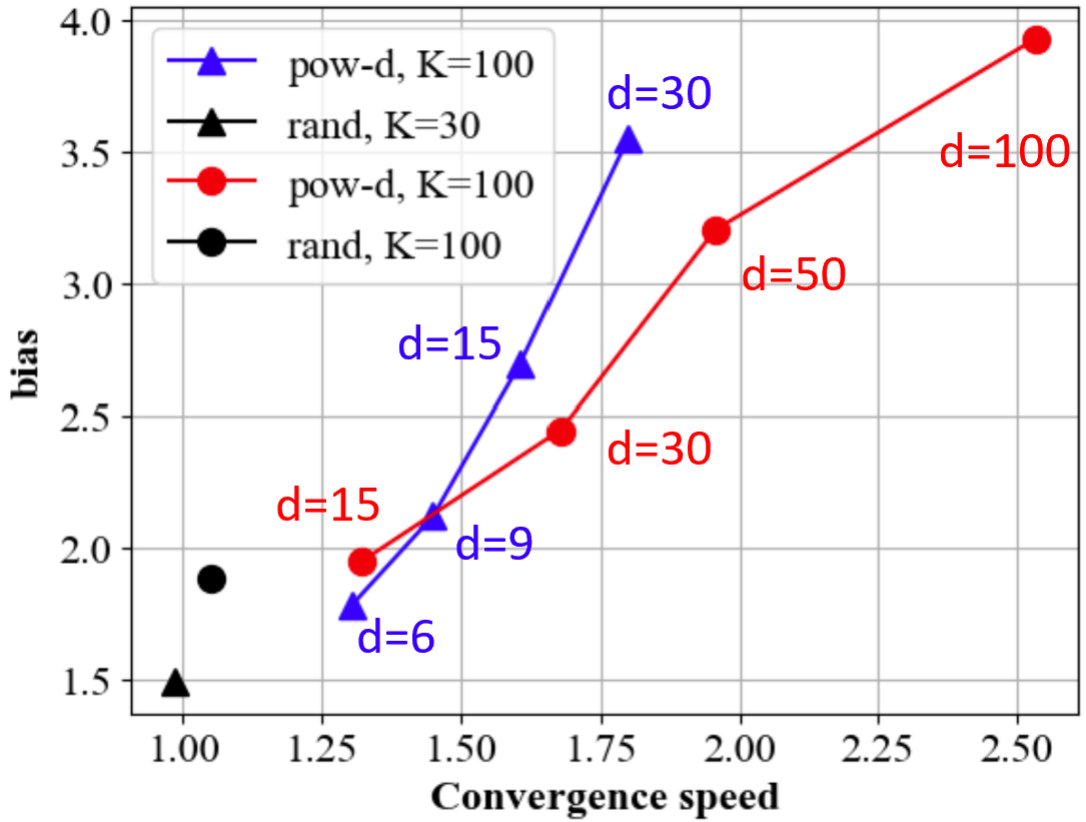
Client Selection | Power of Choice

- Centralized Setup – Traditional ML
- Federated Setup – Full Participation
- Random Client Selection
- Proposed – Power-of-Choice



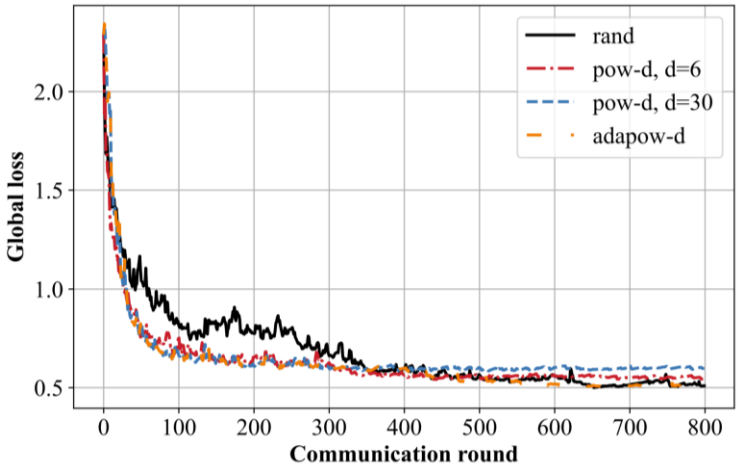
Results | Quadratic Optimization





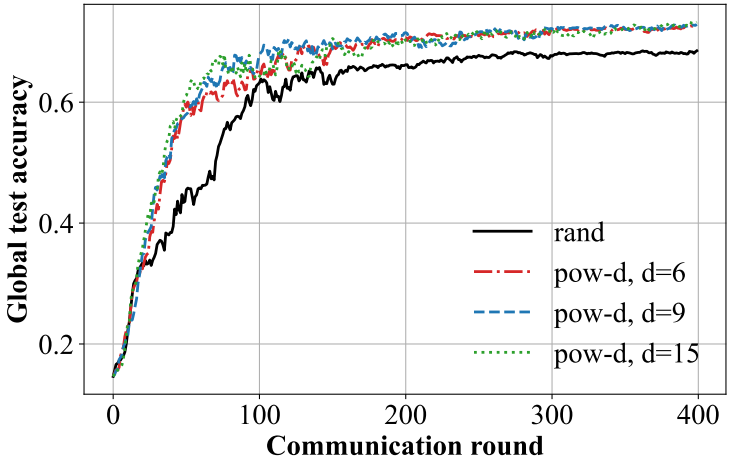
Results | Main Experiments

Logistic Regression



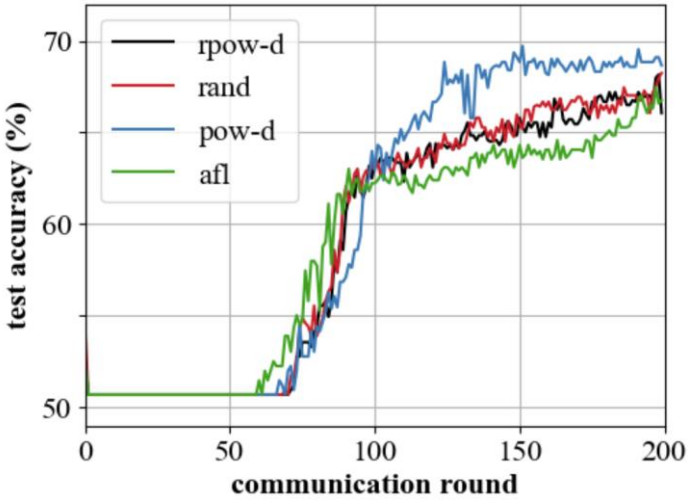
Synthetic Dataset

Image Classification



Fashion MNIST Dataset

Sentiment Analysis



Twitter Dataset

Results | Ablation Study

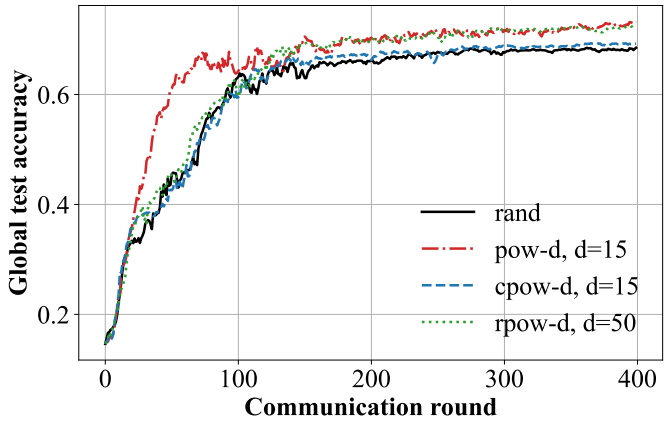


Fig 5a: Variants of Pow-d

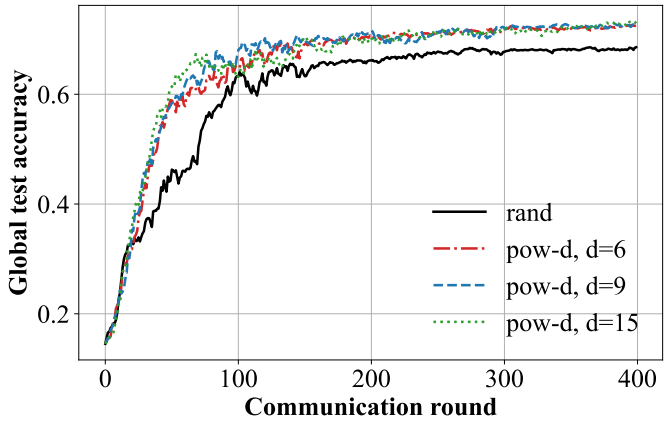


Fig 13a: Effect of batch size

Image Classification

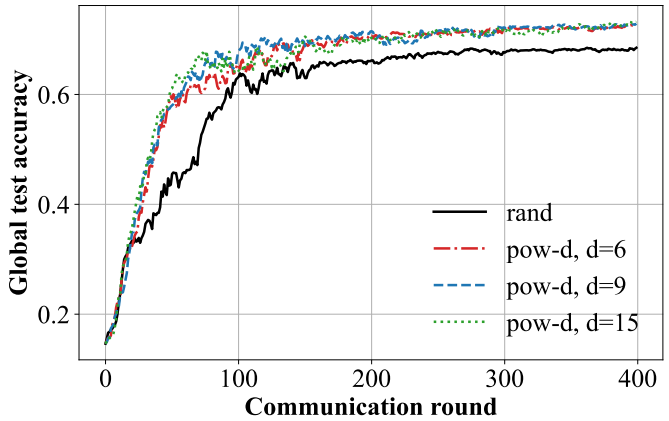


Fig 4a: Default Settings

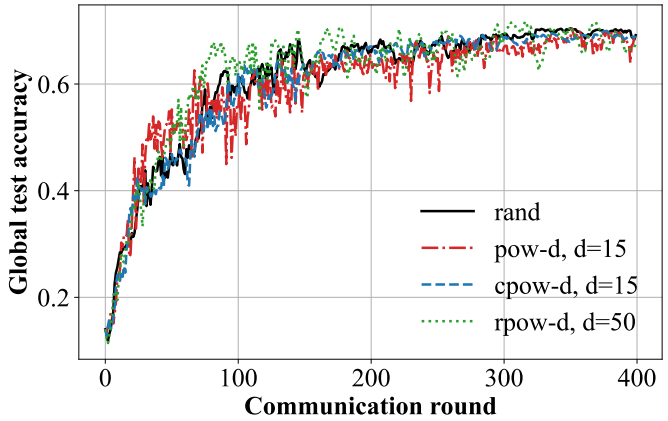


Fig 4b: Effect of data heterogeneity

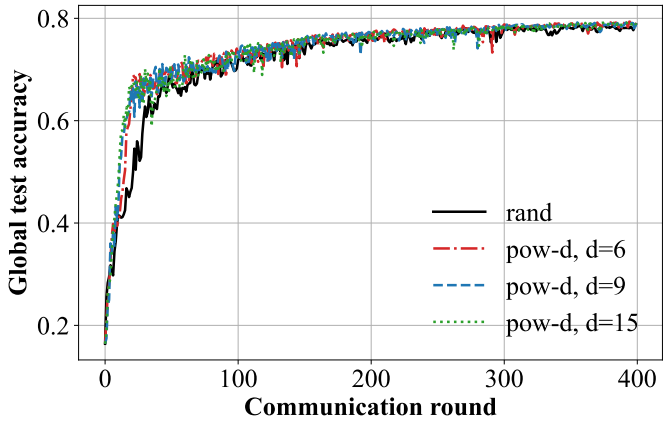
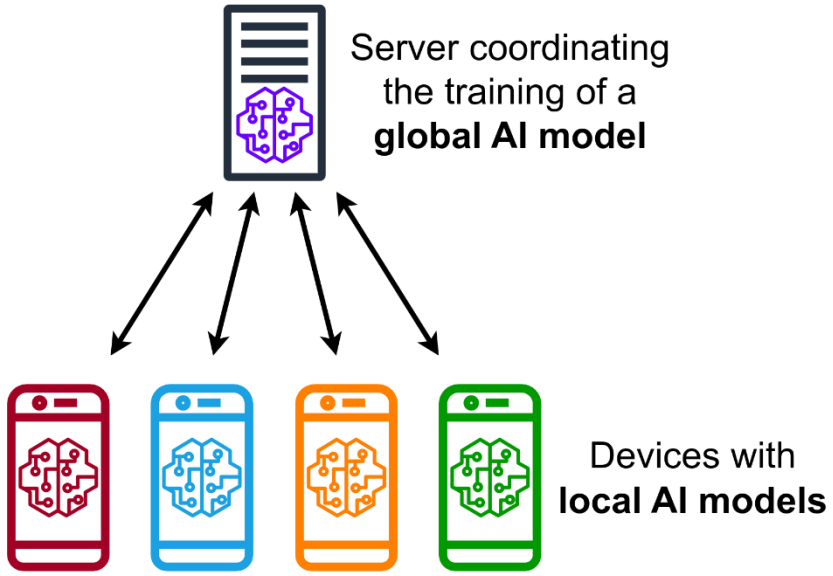


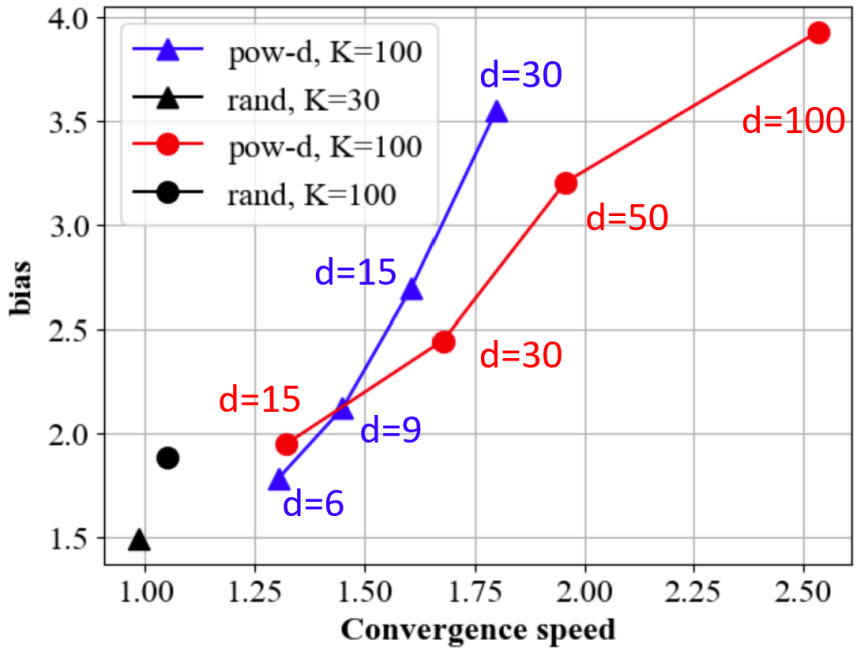
Fig 15a: Effect of local epochs

Conclusion & Summary

- Reproduced most experiments and conducted ablation study.
- Pros: Biased client selection strategy can speed up the training.
- Cons: The advantage is valid for low learning rate, small local iteration number and limited communication rounds.

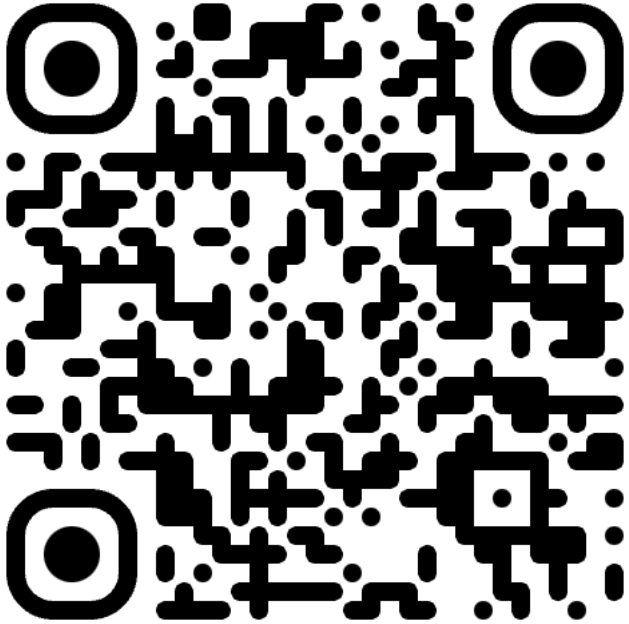


Source: https://en.wikipedia.org/wiki/Federated_learning



Thank you!

↓ Link to the repository↓



Peng: ju26@purdue.edu
Gautam: gchoudha@purdue.edu