

# Federated Learning: A comparison of methods

How do different machine learning algorithms compare against each other?

## Introduction

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- Federated learning (FL)<sup>[1]</sup> is a **distributed machine learning approach** that enables model training using geographically distributed data, without centralizing it.
- FL utilizes an **iterative** process of local training and model weight **aggregation** to continually improve model performance over time<sup>[2]</sup>.

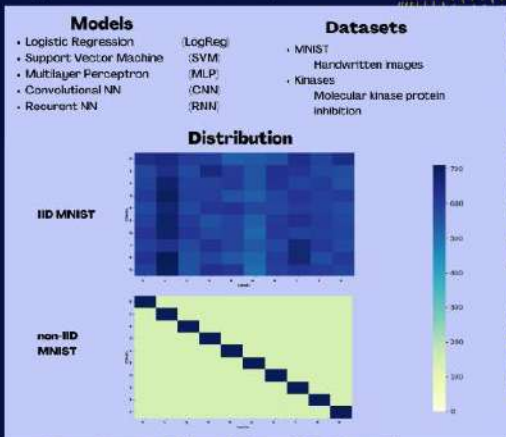
## Motivation

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- Advancing the comprehensive understanding of **applicability** and **inherent limitations** of different models in the context of federated learning.
- Contributing to the growing body of research in federated learning by providing **implementation examples**.

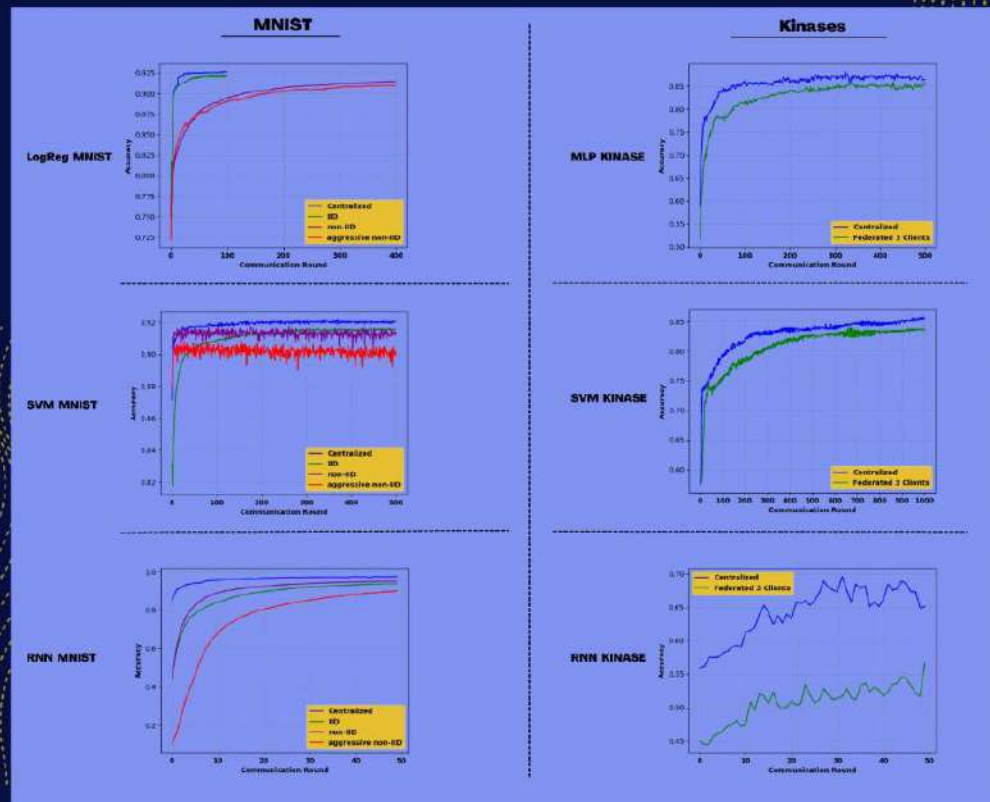
## Experimental Setup

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## Results

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## Conclusion

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- The results demonstrated that **centralized** machine learning approaches generally performed better in terms of accuracy and convergence compared to **federated learning**.
- Linear models** performed well on both datasets, particularly in the case of **IID data**, but faced challenges with **non-IID data distributions** and class imbalances.
- Non-linear models** outperformed linear models on the **MINIST** dataset, capturing complex patterns in the image data.
- MLP** and **CNN** showed promise in handling **non-IID** data distributions, while **RNN** struggled with the **Kinase dataset**.
- The impact of **underlying implementation details** should be considered when interpreting the results of machine learning models, emphasizing the significance of understanding how implementation choices can influence outcomes.
- Limitations** include **restricted time** allocated for exploration of models and datasets, **computational resource** constraints preventing experiments on separate machines, and the influence of specific implementation details on observed performance.
- Future research** should involve experiments on **separate machines**, expand the current implementation with new models and datasets, **explore new implementations**, and keep the codebase up to date with evolving standards.

## REFERENCES

- [1] Qiang Yang, Yang Liu, Tianyi Chen, and Yu Tong, Federated machine learning: Concept and applications, ACM Transactions on Intelligent Systems and Technology (TIST), 10(2):12, 2018.
- [2] Brendan McMahan, Eider Moore, and Daniel Ramage, Communication-efficient learning of deep networks from decentralized data, In Proceedings of the 20th International Conference on Artificial Intelligence and Statistics, volume 54, pages 1273–1282, 2017.