Report 1: UGA & FedMeta reproducing

In order to study and reproduce the results of the article, Unbiased Gradient Aggregation and Federated Meta Learning algorithms were first developed. I compared the results of training with and without these techniques to understand their effects on model accuracy.

UGA addresses the problem of gradient biases that can occur when multiple steps of local updates are performed in federated learning. It uses a novel gradient evaluation strategy, including the keep-trace gradient descent, to compute gradients in an unbiased and computation-efficient manner. FedMeta, on the other hand, introduces a meta update procedure after model aggregation to provide a clear and consistent optimization objective, allowing for better control and fine-tuning of federated models.

My experimental results clearly demonstrate that both UGA and FedMeta lead to better model performance compared to training without these techniques. We observed an increase in accuracy and faster convergence when using UGA and FedMeta, suggesting that these techniques are beneficial for improving the training of federated models.

Here are the key findings:

1. UGA improves model performance: UGA helps to mitigate the issue of gradient biases and enhances the convergence speed of federated models. The code implementation showed higher accuracy and faster convergence when UGA was applied.
2. FedMeta enhances control and optimization: FedMeta provides a clear and consistent optimization objective. It allows for the fine-tuning of federated models, leading to improved accuracy and better control over model behavior.
3. Combined use of UGA and FedMeta: When both UGA and FedMeta are applied together, the model benefits from unbiased gradient aggregation and fine-tuning. This results in the best performance, demonstrating the compatibility and synergy between the two techniques.
4. Distributed learning upgrades perform better on computationally complex tasks such as convolutional learning.

In summary, experiments highlight the effectiveness of UGA and FedMeta in federated learning settings. These techniques provide practical solutions to the challenges of gradient biases and optimization objectives in federated learning, ultimately leading to better model accuracy and faster convergence.