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Review for Paper Titled:

"QuPeD: Quantized Personalization via Distillation with Applications to Federated Learning"

1- Summary

This paper proposes important solutions that addresses the problem of Data Heterogeneity across clients and Collaboration of clients with different resources faced by Federated Learning (FL) algorithms. These problems occur because single local model may not provide good performance to all clients in settings where data is distributed heterogeneously. In addition to this, the participating Edge Devices may vary widely in terms of the resources that they possess.

This paper proposes a model compression framework for personalized FL via Knowledge distillation (KD) that addresses both data and resource heterogeneity in a unified manner. Particularly, this paper's framework supports collaboration among different clients with different resource requirements both in terms of precision as well as model/dimension/structure for learning Personalized Quantized Models (PQM).

2- Novelty/Contribution

This paper seems to be the first work to mathematically formulate a Personalized FL Optimization Problem where clients may have different model dimensions and prediction requirements for their personalized models by a solution which combines alternating proximal updates with knowledge distillation. In addition to this, despite optimizing over quantization values (centers), it recovers the standard convergence rate of $O(1/T)$ in the centralized setting, and it recovers the convergence rate of $O(1/\sqrt{T})$ despite learning PQMs with different precisions/dimensions in the Federated setting.

3- Evaluation

The paper evaluates its contributions by considering an image classification task on FEMNIST (50 clients) and CIFAR10 (66 clients) datasets both in a Centralized as well as Personalized Quantized FL setting. In a Centralized setting, updating quantization centers algorithm significantly improved the test accuracy when compared with other similar cases. Similarly, in a Personalized Federated Learning setting, the QuPeD Full Precision model outperforms on all the datasets consideration. Also, the Quantized QuPeD model with different model dimensions/precisions outperforms other methods in full precision on multiple settings and datasets, demonstrating the effectiveness of the QuPeD scheme for FL settings.

4- Unique Strength/Weakness

Modelling the KD augmented Personalized FL by the mathematical formulation and thorough evaluation of this mathematical formulation and the proposed solution over multiple settings is what I consider the strength of this paper.