Rebuttal Material

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1 Ablation Study of Warmup

Table 1: Ablation study of warmup round numbers for performance and cost using "FedAvg" as the measuring unit (Other settings: CIFAR-10 dataset, IFCA [1], client-wise non-iid with Dirichlet distribution $\alpha = 0.1$, Cluster number $K = 10$).

Baseline	# Warmup + Training	Performance/%		Cost/"FedAvg"		
		Accuracy	Macro-F1	Storage	Communication	Computation
IFCA	0+100	47.62	23.36	**10x**	10x	10x
IFCA-CAM	0+100	63.75	32.17	11x	11x	11x
	10+90	72.69	41.24	11x	10x	10x
	20+80	**73.83**	**44.72**	11x	9x	9x
	30+70	72.54	42.86	11x	8x	8x
	40+60	72.98	42.20	11x	7x	7x
	50+50	65.74	26.63	11x	**6x**	**6x**

2 More Clustering Analysis

Submitted to 37th Conference on Neural Information Processing Systems (NeurIPS 2023). Do not distribute.

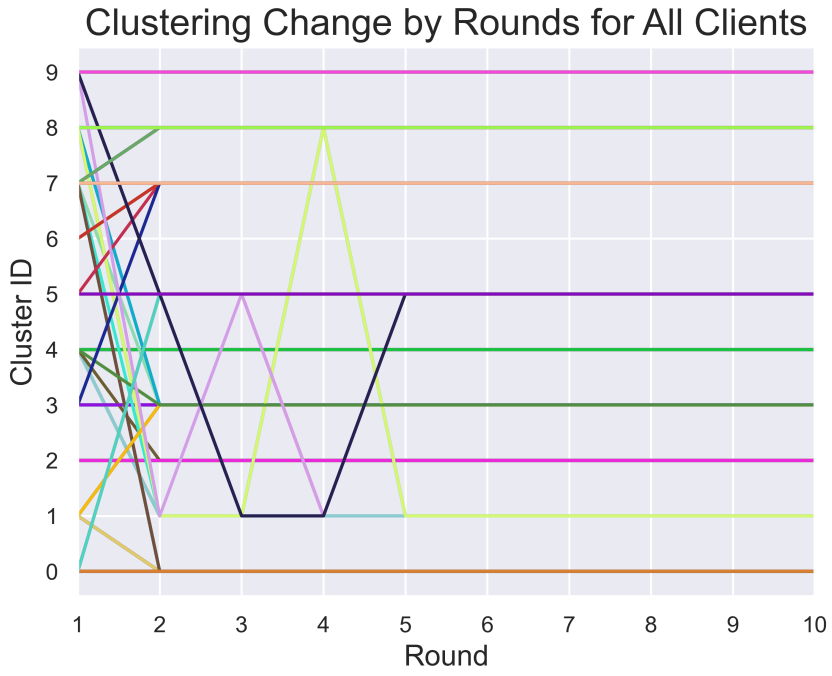

Figure 1: A Clustering change example for IFCA-CAM with client-wise non-IID and $K = 10$ on CIFAR-10. Note that there are 200 lines in this graph, and each represents a client. The bold line in this figure is the combination of lines of clients within one cluster. **After five rounds, the clustering remains stable.**

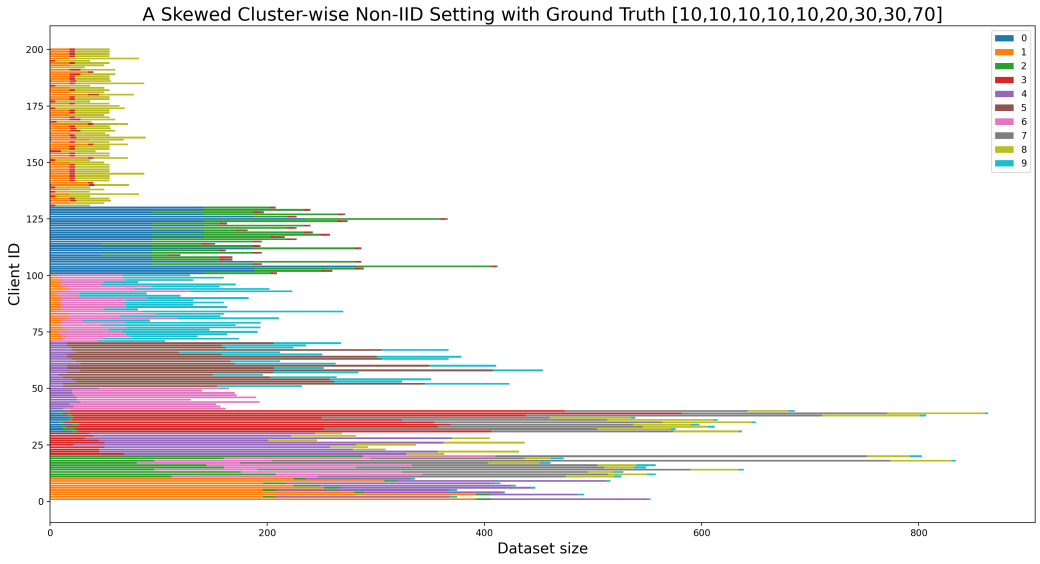

Figure 2: A skewed non-iid setting example on CIFAR-10. Legends represent labels of the dataset.

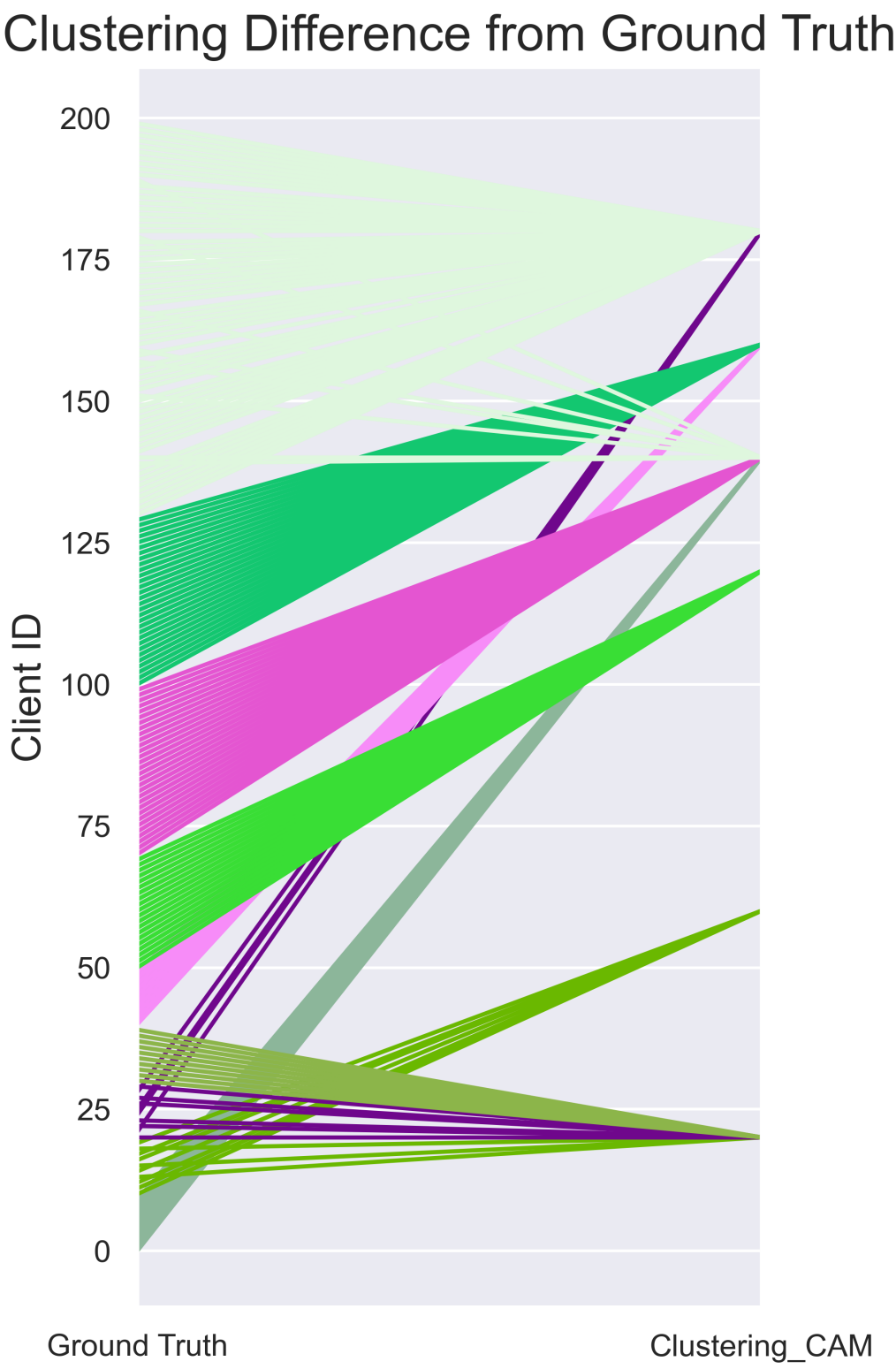

Figure 3: In the context of the highly-skewed clustering scenario depicted in Figure 2, the differences between IFCA-CAM's clustering and the actual ground truth remain minimal. Conversely, the clustering of IFCA easily collapses into a single cluster. The right y-axis indicates the cluster id. The color represents the ground truth, while the lines indicate the transition from the original ground truth to the clustering through CAM. Notably, **CAM also demonstrates its capability to alleviate clustering collapse and imbalance in skewed clustering settings successfully.**

References

[1] Avishek Ghosh, Jichan Chung, Dong Yin, and Kannan Ramchandran. An efficient framework for clustered federated learning. *Advances in Neural Information Processing Systems*, 33:19586–19597, 2020.