Supplementary Materials of FedAlign: Federated Domain Generalization with Cross-Client Feature Alignment

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001 1. Contents

In this supplementary document, we provide comprehensive details and additional experimental results, including:

- Detailed Ablation Study over two diverse datasets, across
 all domains.
- Detailed results of FedAlign with different upload ratios
 and hyperparameters.

008 1.1. Ablation Study

009 We conduct the ablation study to explore the individual effects of MixCluster, along with the Supervised Contrastive, 010 011 Representation Consistency, and JS Divergence components of the loss function across all domains of the PACS 012 and Caltech-10 datasets. The results show that even with 013 only MixCluster, the model outperforms most other mod-014 els, and each additional component further enhances overall 015 016 performance compared to the baseline. Results presented in Table 1 demonstrate a balanced improvement across all 017 018 domains, with each added component contributing to in-019 crementally better overall performance. The steady performance gains indicate that these components effectively ad-020dress domain shifts by enhancing feature generalization and021reducing intra-class variance. This confirms the effective-022ness of our proposed modifications in improving the adapt-023ability and robustness of FedAlign across diverse datasets.024

1.2. Upload Ratio and Loss Function Hyperparameters 025

We evaluate the performance of FedAlign under different 027 upload ratios and hyperparameters, as shown in Fig. 1. To 028 assess the effect of λ_1 , we kept λ_2 fixed at 1, and conversely, 029 when evaluating λ_2 , we set λ_1 to 1. The results indicate 030 that variations in the upload ratio r and the hyperparameters 031 λ_1 and λ_2 have minimal impact on overall performance in 032 the PACS and Caltech-10 datasets. This demonstrates that 033 FedAlign consistently outperforms other models, even with 034 a minimal upload ratio, highlighting its robustness despite 035 limited statistical information. Moreover, this stability sug-036 gests that FedAlign is well-suited for real-world federated 037 learning scenarios with communication constraints. 038



Figure 1. Effect of hyperparameters r(upload ratio), λ_1 , λ_2 on average accuracy.

MC*	L_{SC}	$L_{\rm RC}$	$L_{\rm JS}$	PACS					Caltech-10				
				P	А	С	S	Avg.	A	С	D	W	Avg.
				93.47	78.81	76.24	74.12	80.66	94.26	89.40	98.09	92.20	93.49
			\checkmark	92.81	78.52	76.24	74.32	80.47	93.84	88.42	97.45	89.83	92.38
		\checkmark		93.41	79.30	76.88	72.56	80.54	94.05	89.40	98.73	92.20	93.60
		\checkmark	\checkmark	92.93	80.27	76.54	77.35	81.77	94.15	89.94	97.45	89.83	92.84
	\checkmark			93.05	77.29	77.90	73.35	80.40	94.47	89.05	98.73	91.86	93.53
	\checkmark		\checkmark	93.23	80.71	76.11	75.44	81.37	93.95	88.87	98.73	92.54	93.52
	\checkmark	\checkmark		92.87	79.10	77.69	78.52	82.04	94.26	90.56	98.73	89.49	93.26
	\checkmark	\checkmark	\checkmark	92.93	79.20	76.24	78.24	81.65	93.36	88.23	97.73	92.22	92.88
\checkmark				93.05	79.79	77.94	74.60	81.34	93.32	89.67	98.09	91.86	93.24
\checkmark			\checkmark	93.23	79.54	76.83	75.67	81.32	93.42	90.03	97.45	90.17	92.77
\checkmark		\checkmark		93.95	79.44	77.77	78.11	82.32	93.84	89.40	98.73	91.19	93.29
\checkmark		\checkmark	\checkmark	94.31	79.83	77.47	77.14	82.19	94.68	88.87	98.09	90.85	93.12
\checkmark	\checkmark			92.63	80.86	77.69	75.36	81.64	93.95	89.23	98.09	91.53	93.20
\checkmark	\checkmark		\checkmark	93.95	80.22	78.16	73.50	81.46	94.05	90.12	97.45	91.19	93.20
\checkmark	\checkmark	\checkmark		93.35	79.88	78.11	76.41	81.94	94.15	89.58	98.09	90.51	93.08
\checkmark	\checkmark	\checkmark	\checkmark	93.11	80.57	77.94	80.20	82.96	94.78	89.85	98.73	91.53	93.72

Table 1. Ablation study results. The total number of clients is set to 6 and the upload ratio is set to 0.1. MC* refers to MixCluster.