Supplementary Material for Enhancing Federated Learning Performance Fairness via Collaboration Graph-based Reinforcement Learning

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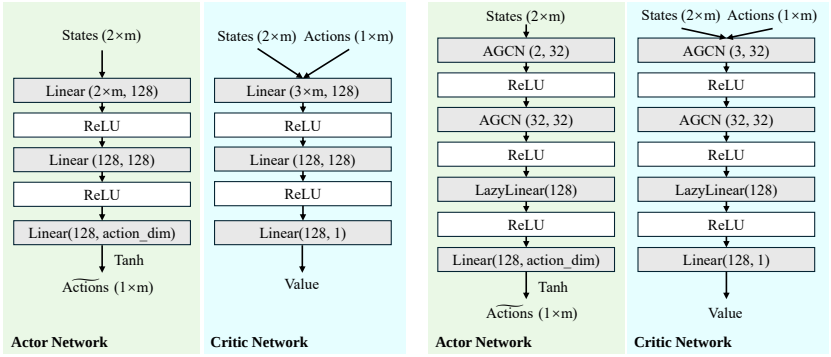
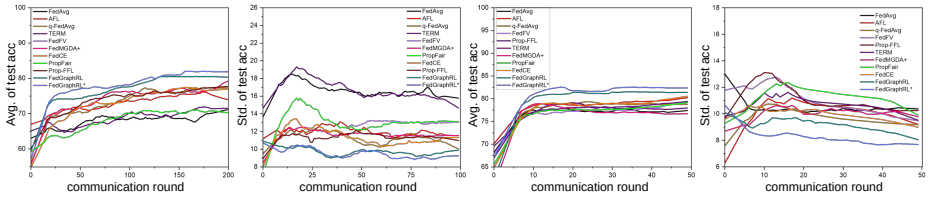


(a) Traditional Reinforcement Learning Agent

(b) Reinforcement Learning Agent with Multi-Layer AGCN

Fig. 1. Detailed architecture of the actor-critic network for (a) a traditional reinforcement learning agent and (b) our FedGraphRL agent equipped with a multi-layer AGCN.

⋆ Yuexuan Xia and Benteng Ma contributed equally to this work.



(a) HAM10k (b) Fed-DRG

Fig. 2. The average (left half) and the variance (right half) of test accuracy on all clients on (a) HAM10k, and (b) Fed-DRG.

Table 1. The Summary of HAM10k and Fed-DRG datasets.

Dataset	Centers	Device System/Source	Train	Validation	Test
HAM10k	vidir_molemax	MoleMax HD	2769	394	791
	vidir_modern	DermLiteTM FOTO	2355	336	672
	rosendahl	DermLite Fluid/DL3	1582	225	452
	vienna_dias	Heine Dermaphot	308	43	88
Fed-DRG	APTOS	Multiple Devices	2551	370	741
	DeepDR	TOPCON, Optomap P200Tx	1401	199	400
	FGADR	Collected by IIAI	1289	185	368
	e-ophtha	OPHDIAT Tele-medical network	310	44	88
	IDRiD	Kowa VX-10	361	52	103
	Messidor	Topcon TRC NW6	1221	174	349

Table 2. Comparison of mainstream FFL objective functions as the aggregate loss in reward function, with q-FedAvg's objective function achieving the highest average accuracy and lowest standard deviation across two federated datasets. For each task, **best** rank is marked.

Task			HAM10k		Fed-DRG	
L_t	Principle	Objective	Avg.	Std.	Avg.	Std.
FedAvg	Utilitarian	$\sum_i p_i l_i$	82.11	10.71	82.40	8.10
AFL	Egalitarian	$\max_i l_i$	82.20	9.64	82.54	8.10
q-FedAvg$\|_{q=0.1}$	α-fairness	$\sum_i \frac{p_i}{q+1} l_i^{q+1}$	**82.59**	**9.51**	**83.67**	**7.88**
TERM$\|_{\alpha=0.5}$	N/A	$\sum_i p_i e^{\alpha l_i}$	82.25	10.20	82.66	8.17
PropFair$\|_{M=5.0}$	Proportional	$-\sum_i p_i \log(M - l_i)$	82.31	10.30	82.21	8.48
Prop-FFL$\|_{q=0.1,\lambda=0.7}$	Proportional	$\sum_i (\frac{1-\lambda}{q+1} l_i^{q+1} + \lambda \log \frac{\sum_j l_j}{l_i})$	81.62	11.12	82.45	8.14