Table 1: Accuracy comparisons under different α on CIFAR10.

α		LOCAL	FEDAVG	FEDPROX	SCAFFOLD	PFEDME	PFEDHN	FEDDISCO	PFEDGRAPH	FEDORA	FEDEGOISTS
0.05	PAT	80.47±2.06	36.86±3.00	36.62±6.17	36.61±6.18	48.66±6.38	66.53±2.00	36.61±6.18	52.04±8.66	69.73±1.62	**81.35±0.30**
0.05	Dir	61.59±0.53	44.98±1.91	46.94±2.12	46.76±2.92	44.64±2.61	55.61±0.45	46.74±2.99	46.56±2.55	55.28±0.75	**63.06±0.64**
0.1	PAT	80.47±2.06	49.40±5.50	48.19±5.17	48.18±5.16	56.56±1.66	66.61±1.62	48.19±5.17	55.35±4.51	68.65±2.02	**80.73±1.35**
0.1	Dir	61.59±0.53	46.77±1.96	48.71±1.97	48.61±2.02	46.65±2.74	54.21±0.83	48.56±1.99	49.10±3.19	55.97±0.22	**62.74±1.09**
0.2	PAT	80.47±2.06	63.67±2.10	57.26±1.48	57.24±2.34	79.27±1.35	76.08±2.20	57.25±2.15	60.27±2.33	72.74±1.91	**81.30±1.46**
0.2	Dir	61.59±0.53	55.69±1.90	53.79±1.07	54.16±0.79	53.64±0.79	61.31±0.56	54.08±1.43	53.85±1.07	55.67±0.96	**66.62±1.23**
0.3	PAT	80.47±2.06	57.95±2.37	59.82±4.88	59.83±4.87	63.09±3.26	65.11±2.4	59.82±4.88	62.12±4.51	71.51±2.40	**81.37±1.41**
0.3	Dir	61.59±0.53	50.48±0.87	49.99±1.15	50.09±1.29	49.33±1.94	53.21±0.49	50.17±1.29	50.66±1.59	55.9±1.01	**63.39±0.89**
0.4	PAT	80.47±2.06	58.47±5.87	63.28±4.54	63.27±4.54	66.36±3.88	67.51±3.04	63.28±4.55	63.30±4.61	72.89±1.67	**82.54±0.30**
0.4	Dir	61.59±0.53	50.14±2.2	51.20±2.16	51.23±2.09	51.00±0.94	53.04±0.80	51.14±2.09	51.14±2.16	57.26±0.32	**62.81±0.88**

Table 2: Accuracy comparisons under different α on CIFAR100.

α		LOCAL	FEDAVG	FEDPROX	SCAFFOLD	PFEDME	PFEDHN	FEDDISCO	PFEDGRAPH	FEDORA	FEDEGOISTS
0.05	PAT	46.24±1.38	34.52±8.65	35.42±1.36	35.47±1.36	35.78±1.72	29.98±1.07	35.42±3.58	36.60±1.15	41.91±0.49	**47.00±1.81**
0.05	Dir	**30.31±0.48**	15.33±5.35	19.81±6.54	19.73±6.50	18.71±1.41	18.12±0.92	19.76±6.56	19.76±6.50	27.06±0.26	27.59±1.52
0.1	PAT	46.24±1.38	40.01±0.89	42.57±0.44	42.73±0.44	34.40±4.67	30.17±0.47	42.56±0.45	42.78±0.46	42.63±1.04	**46.28±1.05**
0.1	Dir	30.31±0.48	20.25±4.93	18.86±5.07	18.80±5.03	20.51±0.98	17.45±0.55	18.87±5.05	18.88±4.95	27.50±0.21	**32.01±1.66**
0.2	PAT	46.24±1.38	29.68±4.12	28.60±4.56	28.55±4.34	29.90±1.85	28.38±0.71	29.05±4.11	30.51±4.03	41.63±1.65	**50.21±2.24**
0.2	Dir	30.31±0.48	19.24±1.13	20.10±0.35	20.00±0.48	19.89±0.36	23.11±0.79	19.93±0.38	20.17±0.35	27.24±0.36	**32.86±1.53**
0.3	PAT	46.24±1.38	40.24±0.55	42.42±0.42	42.57±0.30	44.34±2.16	29.63±0.23	42.42±0.41	42.48±0.48	41.72±1.98	**46.38±1.83**
0.3	Dir	30.31±0.48	25.56±0.32	27.37±0.17	27.27±0.24	25.28±2.55	17.21±0.17	27.37±0.17	26.18±1.69	27.43±0.20	**34.30±0.44**
0.4	PAT	46.24±1.38	40.52±0.27	41.63±1.03	41.71±1.05	44.38±1.94	30.18±0.28	41.73±1.03	41.66±1.10	42.94±0.25	**48.16±1.61**
0.4	Dir	30.31±0.48	24.73±0.97	27.37±0.40	27.31±0.26	26.72±1.89	17.08±0.35	27.37±0.40	27.17±0.42	27.24±0.23	**34.15±0.96**

Table 3: The worst-case performance of the proposed approach compared with the baseline approaches.

	0.05		0.1		—0.2		0.3		0.4	
	PAT	Dir	PAT	Dir	PAT	Dir	PAT	Dir	PAT	Dir
CIFAR10	0.011000	-0.002903	0.022900	-0.000624	0.025800	-0.0006030	0.028800	-0.005725	-0.002399	-0.000100
CIFAR100	-0.000999	0.076002	0.011400	-0.000008	-0.000636	-0.0009356	-0.000020	-0.032153	-0.000699	-0.027078

Table 4: Accuracy comparisons under different β of Dirichlet distribution

	CIFAR-10			CIFAR-100		
β	0.01	0.1	0.5	0.01	0.1	0.5
LOCAL	86.75 ± 0.10	$\mathbf{78.58 \pm 0.80}$	58.14 ± 1.73	$\mathbf{58.89 \pm 1.30}$	47.23 ± 0.48	30.92 ± 0.25
FEDAVE	85.22 ± 0.74	69.68 ± 3.24	52.25 ± 1.10	50.13 ± 1.74	40.05 ± 2.11	19.85 ± 1.33
FEDPROX	85.85 ± 0.97	70.17 ± 1.50	50.35 ± 1.29	55.25 ± 1.69	42.38 ± 2.04	20.71 ± 0.57
SCAFFOLD	85.48 ± 0.79	70.11 ± 1.50	50.72 ± 0.99	55.37 ± 1.89	42.40 ± 2.12	20.61 ± 0.60
PFEDME	86.07 ± 7.34	70.90 ± 1.69	50.20 ± 0.99	53.67 ± 4.07	45.72 ± 0.89	20.50 ± 0.58
PFEDHN	85.57 ± 1.65	76.95 ± 0.56	57.87 ± 0.78	47.60 ± 0.48	33.73 ± 0.31	23.72 ± 0.91
FEDDISCO	85.52 ± 0.82	70.21 ± 1.60	50.64 ± 1.65	55.25 ± 1.68	42.38 ± 2.02	20.54 ± 0.50
PFEDGRAPH	85.86 ± 0.97	70.60 ± 1.82	50.41 ± 1.29	55.24 ± 1.86	42.56 ± 2.00	20.78 ± 0.57
FEDORA	86.66 ± 0.07	75.22 ± 2.07	55.67 ± 0.96	55.70 ± 0.61	43.72 ± 0.79	26.78 ± 1.06
FEDEGOISTS	$\mathbf{86.91 \pm 0.07}$	78.03 ± 1.54	$\mathbf{63.18 \pm 1.45}$	58.06 ± 1.19	$\mathbf{47.72 \pm 3.90}$	$\mathbf{33.47 \pm 1.75}$

Table 5: Experiments with synthetic data(Weakly Non-IID,MSE) under fixed competing graphs

	v_1	v_2	v_3	v_4	v_5	v_6	v_7	v_8
LOCAL	0.32 ± 0.05	0.28 ± 0.00	1.00 ± 0.07	0.69 ± 0.08	0.28 ± 0.02	0.28 ± 0.01	0.72 ± 0.06	0.90 ± 0.11
FEDAVE	0.25 ± 0.01	0.25 ± 0.01	0.79 ± 0.05	0.55 ± 0.05	0.23 ± 0.01	$\mathbf{0.23 \pm 0.00}$	0.61 ± 0.04	0.74 ± 0.07
FEDPROX	0.26 ± 0.01	0.27 ± 0.01	0.90 ± 0.10	0.67 ± 0.06	0.26 ± 0.01	0.26 ± 0.01	0.76 ± 0.11	1.02 ± 0.17
SCAFFOLD	0.27 ± 0.01	0.28 ± 0.00	0.90 ± 0.03	0.67 ± 0.06	0.25 ± 0.01	0.26 ± 0.01	0.72 ± 0.09	0.92 ± 0.10
PFEDME	0.28 ± 0.02	0.29 ± 0.03	1.13 ± 0.55	0.86 ± 0.58	0.33 ± 0.13	0.33 ± 0.12	0.74 ± 0.02	0.82 ± 0.04
PFEDHN	0.35 ± 0.07	0.31 ± 0.05	0.91 ± 0.07	0.61 ± 0.06	0.33 ± 0.04	0.31 ± 0.05	0.70 ± 0.09	0.90 ± 0.18
PFEDGRAPH	0.26 ± 0.01	0.27 ± 0.01	0.90 ± 0.04	0.67 ± 0.08	0.26 ± 0.01	0.26 ± 0.00	0.74 ± 0.08	0.99 ± 0.05
FEDEGOISTS	$\mathbf{0.23 \pm 0.01}$	$\mathbf{0.24 \pm 0.00}$	$\mathbf{0.24 \pm 0.01}$	$\mathbf{0.22 \pm 0.02}$	$\mathbf{0.22 \pm 0.00}$	0.23 ± 0.01	$\mathbf{0.25 \pm 0.01}$	$\mathbf{0.25 \pm 0.02}$

Table 6: Experiments with synthetic data(Strongly Non-IID, MSE) under fixed competing graphs

	v1	v2	v3	v4	v5	v6	v7	v8
LOCAL	0.29 ± 0.03	0.29 ± 0.02	0.26 ± 0.00	0.29 ± 0.04	0.27 ± 0.01	0.27 ± 0.04	0.27 ± 0.02	0.27 ± 0.01
FEDAVE	0.25 ± 0.00	$\mathbf{0.25 \pm 0.01}$	$\mathbf{0.23 \pm 0.01}$	0.23 ± 0.01	0.23 ± 0.01	$\mathbf{0.22 \pm 0.00}$	0.23 ± 0.02	0.24 ± 0.02
FEDPROX	0.27 ± 0.02	0.26 ± 0.01	0.26 ± 0.01	0.26 ± 0.01	0.24 ± 0.01	0.24 ± 0.01	0.25 ± 0.01	0.25 ± 0.01
SCAFFOLD	0.26 ± 0.01	0.26 ± 0.01	0.26 ± 0.01	0.26 ± 0.01	0.24 ± 0.01	0.24 ± 0.01	0.25 ± 0.01	0.25 ± 0.01
PFEDME	0.36 ± 0.12	0.37 ± 0.12	0.25 ± 0.00	0.25 ± 0.01	0.28 ± 0.02	0.27 ± 0.01	0.27 ± 0.01	0.28 ± 0.01
PFEDHN	0.33 ± 0.05	0.34 ± 0.03	0.32 ± 0.05	0.28 ± 0.03	0.34 ± 0.03	0.29 ± 0.03	0.29 ± 0.05	0.29 ± 0.06
PFEDGRAPH	0.26 ± 0.01	0.27 ± 0.01	0.26 ± 0.02	0.26 ± 0.02	0.24 ± 0.01	0.24 ± 0.01	0.25 ± 0.01	0.25 ± 0.01
FEDEGOISTS	$\mathbf{0.24 \pm 0.00}$	0.27 ± 0.05	0.24 ± 0.03	$\mathbf{0.22 \pm 0.01}$	$\mathbf{0.22 \pm 0.00}$	$\mathbf{0.22 \pm 0.00}$	$\mathbf{0.22 \pm 0.01}$	$\mathbf{0.22 \pm 0.01}$