Supplementary File for "Deep Fuzzy C-means Clustering in a Federated Heterogeneous Scenario"

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I. Experimental Results of FedFCD on Public Datasets: MNIST, Fashion MNIST, Secondary Mushroom, and Rot-iot2022

This part is relevant to Part 2 of Subsection IV-B in the paper. Tab.S-I, Tab.S-II, Tab.S-III and Tab.S-IV reports the experimental results in the public datasets MNIST, Fashion MNIST, Secondary Mushroom, and Rot-iot2022 respectively.

Table S- I. Comparison of Clustering ACC (%) on Different Methods Using Public Dataset **MNIST**

Methods	$D_r = 0\%$									$D_r = 20\%$									$D_r = 50\%$								
	P=10			P=20			P=50			P=10			P=20			P=50			P=10			P=20			P=50		
	0.01	0.1	1.0	0.01	0.1	1.0	0.01	0.1	1.0	0.01	0.1	1.0	0.01	0.1	1.0	0.01	0.1	1.0	0.01	0.1	1.0	0.01	0.1	1.0	0.01	0.1	1.0
f-DEC	42.1	42.9	45.9	41.3	42.9	43.4	40.8	41.7	43.5	42.2	42.7	44.7	41.9	41.6	43.0	39.2	41.2	42.6	42.4	42.3	44.3	40.7	42.1	44.3	40.4	41.5	42.6
f-IDEC	51.4	53.7	55.3	50.8	52.3	53.3	46.9	50.1	53.2	51.8	53.9	54.2	51.9	52.8	54.7	47.2	49.8	52.9	50.7	54.2	53.9	50.5	52.3	53.9	46.6	50	52.1
f-DCEC	45.4	45.5	47.6	43.9	44.6	46.2	41.9	38.8	36.2	44.9	46.2	47.8	44.2	44.8	47.2	42.1	39.4	36.3	45.0	46.2	47.1	44.6	45.1	46.7	41.5	38.7	35.5
f-CADEC	41.9	44.3	45.2	40.3	41.0	42.7	36.7	38.6	40.1	39.2	41.7	43.5	39.6	40.6	41.5	35.4	37.8	39.6	40.8	43.2	44.6	39.4	40	42.3	35.8	36.4	38.7
f-SACC	53.4	51.4	49.7	50.8	48.7	46.5	47.6	45.2	43.4	52.7	51.6	50.3	49.6	47.1	45.8	47.3	44.5	42.9	53.1	50.9	48.7	50.2	49.1	45.4	47.5	45.0	42.6
f-FastDGC	61.2	64.3	65.4	58.7	56.4	60.6	56.9	57.2	58.4	59.7	60.8	63.9	60.2	57.1	58.5	54.8	56.2	57.7	60.0	62.3	64.2	57.6	56.7	59.4	56.0	55.4	58.1
FedFCM	28.4	32.1	35.3	26.7	30.6	34.2	21.7	24.5	26.3	25.3	27.5	31.2	24.9	26.1	29.4	20.4	21.9	23.1	22.8	25.1	27.6	21.3	23.5	26.1	18.6	19.7	21.2
F-FCM	29.7	33.8	36.6	28.6	30.4	35.7	25.7	20.6	18.4	27.1	30.3	34.0	25.8	28.7	31.9	24.1	18.2	16.1	24.5	26.6	28.3	23.2	25.4	27.5	20.4	15.3	13.2
FFCM	38.0	37.4	35.4	36.1	33.2	30.8	35.7	38.6	36.6	35.8	34.7	31.8	34.2	30.6	28.4	30.8	29.5	27.2	33.5	30.5	26.4	29.7	26.4	26.2	26.7	25.4	23.5
LLF-FCM	28.6	21.6	15.3	32.4	21.3	20.1	12.3	15.4	16.7	23.2	18.9	17.6	15.0	18.4	21.0	15.0	15.2	15.0	15.8	15.0	15.0	15.0	16.3	16.4	15.0	15.2	16.6
SDA-FC	48.4	46.1	48.3	36.1	43.7	42.6	32.3	32.1	30.3	46.6	45.8	48.2	36.2	43.1	40.7	30.6	31.3	30.5	40.6	41.2	46.5	30.2	31.2	35.4	26.7	30.1	26.5
FednadamN	27.7	23.9	24.3	23.2	24.9	22.0	21.8	23.4	24.3	25.0	22.3	21.6	21.7	25.7	21.6	21.9	22.4	20.8	21.2	20.6	20.9	21.6	22.0	19.9	22.7	20.5	22.5
UIFCA	62.1	68.8	71.8	40.5	54.2	55.9	48.8	38.0	22.1	61.7	61.8	**75.6**	50.6	56.2	50.7	44.7	38.8	24.3	49.3	50.6	63.4	43.6	42.9	60.2	35.6	22.5	18.3
FedFCD	**71.8**	**73.2**	**74.5**	**68.7**	**70.9**	**71.6**	**68.5**	**69.6**	**70.4**	**70.9**	**72.5**	74.3	**69.2**	**71.1**	**72.4**	**69**	**70.2**	**70.8**	**71.0**	**72.7**	**73.8**	**69.4**	**70.5**	**71.2**	**67.8**	**68.6**	**70**

Table S- II. Comparison of Clustering ACC (%) on Different Methods Using Public Dataset **Fashion MNIST**

Methods	D_r = 0%									D_r = 20%									D_r = 50%								
	P=10			P=20			P=50			P=10			P=20			P=50			P=10			P=20			P=50		
	0.01	0.1	1.0	0.01	0.1	1.0	0.01	0.1	1.0	0.01	0.1	1.0	0.01	0.1	1.0	0.01	0.1	1.0	0.01	0.1	1.0	0.01	0.1	1.0	0.01	0.1	1.0
f-DEC	31.1	35.2	38.6	37.3	38.2	40.9	34.7	37.0	41.5	31.2	32.7	37.5	36.5	37.4	39.6	34.3	36.4	38.7	31.2	34.1	37.8	36.2	36.8	38.7	33.8	36.7	40.2
f-IDEC	53.1	53.8	54.6	53.9	54.5	55.4	52.7	53.6	54.7	52.7	53.0	53.9	53.2	54	54.9	51.9	52.8	53.6	51.6	53.1	53.8	52.6	53.8	54.6	51.7	52.3	53.8
f-DCEC	36.3	40.4	45.2	35.7	39	44.7	35.4	38.7	44.2	36.0	38.7	44.9	35.8	38.2	43.4	34.3	37.2	41.6	35.9	38.7	44.5	35.1	38	43.1	33.7	36.8	43.1
f-CADEC	46.5	48.2	50.7	45.4	46.8	48.6	45	47	48.4	45.8	47.9	50.6	45	45.6	47.8	44.6	46.4	47.1	44.9	47.2	50	44.8	46.1	48	47.9	46.3	47.5
f-SACC	56.7	58.2	60.9	55.6	56.8	59.7	54.3	55.2	58.7	57.6	58.7	61.2	54.9	56.1	59.6	53.9	54.6	58.6	55.3	57.4	58.7	54.8	56.2	60.1	53.4	54.7	57.5
f-FastDGC	63.2	62.7	66.4	59.7	61.2	58.4	60.1	57.9	58.1	64.1	63.2	66.6	60.1	57.9	58.6	59.9	58.6	57.4	62.7	62.4	67.1	59.4	56.7	57.6	58.4	56.7	55.8
FedFCM	12.5	11.5	10.3	11.8	10.7	10	10	-	-	10	-	-	-	-	-	-	-	-	10	-	-	-	-	-	-	-	-
F-FCM	23.7	25.6	28.4	25.1	28.6	29.3	21.3	22.6	26.8	22.4	23.5	26.7	24.2	27.3	28.6	20.7	20.9	24.2	20	21.7	24.9	23.1	25.7	26.8	18.7	19.1	22.3
FFCM	27.4	28.5	31.5	26.6	28.2	32.7	25.6	27.4	29.5	25.3	26.7	28.6	26	27.1	30.4	23.2	25.6	28.1	24.6	25.3	26.9	24.7	25.8	27.4	20.6	21.8	27.2
LLF-FCM	19.9	19.9	20.0	20.2	19.9	19.7	19.6	19.7	19.9	19.7	19.7	19.6	20.1	20.0	19.8	19.6	19.8	19.6	19.4	19.5	19.3	20.1	20.0	20.4	20.0	20.4	20.3
SDA-FC	27.3	31.4	32.0	23.5	29.4	33.1	26.0	28.3	30.2	30.7	34.0	31.5	35.7	29.8	28.2	28.7	30.6	30.4	30.5	33.3	31.1	43.1	27.1	31.3	28.6	29.5	28.2
FednadamN	20.8	19.1	20.6	19.0	18.6	19.9	18.2	18.8	19.9	19.4	20.2	20.1	18.6	18.6	18.7	17.8	18.2	19.3	17.8	17.6	19.8	18.9	17.8	17.6	17.6	18.2	18.9
UIFCA	**63.9**	**79.8**	**71.5**	51.3	**59.3**	59.9	46.5	50.7	**59.6**	**62.8**	**74.4**	**72.1**	**60.2**	**58.9**	61.3	45.7	51.2	**60.4**	**63**	**75.4**	**70.6**	52.3	56.7	57.8	50.7	48.6	57.8
FedFCD	61.2	62.8	64.3	**56.7**	58.4	**60.1**	**57.2**	**57.9**	59.5	60.6	61.7	64.0	55.8	57.6	**61.4**	**56.8**	**57.1**	58.7	59.3	61.8	63.9	**56.8**	**58.6**	**59.7**	**56.9**	**58**	**59.2**

Table S- III. Comparison of Clustering ACC (%) on Different Methods Using Public Dataset **Secondary Mushroom**

Methods	$D_r = 0\%$									$D_r = 20\%$									$D_r = 50\%$								
	P=10			P=20			P=50			P=10			P=20			P=50			P=10			P=20			P=50		
	0.01	0.1	1.0	0.01	0.1	1.0	0.01	0.1	1.0	0.01	0.1	1.0	0.01	0.1	1.0	0.01	0.1	1.0	0.01	0.1	1.0	0.01	0.1	1.0	0.01	0.1	1.0
f-DEC	51.5	53.1	53.4	50.8	52.3	54.8	50.7	51.6	55.3	52.1	53.2	55.6	51.0	52.7	54.6	51.2	52.4	55.6	51.7	52.6	54.7	49.9	52.6	54.3	48.8	52.1	54.6
f-IDEC	66.7	69.6	72.8	67.3	71.4	73.7	66.6	70.1	71.2	66.2	70.0	73.1	67.6	71.0	73.4	67.1	69.6	70.9	65.8	69.2	72.2	66.8	71.5	73.3	66.2	69.8	71.0
f-DCEC	50.5	51.6	53.1	50.2	52.1	53.8	47.6	49.2	50.5	50.7	52.4	53.5	49.7	51.8	53.5	48.5	49.6	50.4	50.1	51.0	52.7	50.2	52.4	54.0	47.6	48.8	50.2
f-CADEC	71.2	73.5	76.4	70.6	73.4	76.2	68.7	70.8	72.6	70.9	72.8	76.1	70	73.6	75.8	69.3	71.0	72.2	71.4	72.8	75.6	71.0	73.5	76.0	68.0	70.5	71.3
f-SACC	74.6	76.3	80.1	73.5	75.6	78.4	70.6	72.3	75.8	75	76.4	80.3	73.6	75.4	78.2	71.0	72.8	76.1	74.6	75.8	79.2	73.1	75.5	77.6	70.4	71.6	74.8
FedFCM	48.6	51.3	53.4	47.5	49.6	51.7	46.9	47.2	50.1	47.2	48.6	52.3	47.2	48.1	49.7	45.8	46.7	48.5	47.2	47.4	51.7	45.5	47.2	48.6	45.3	46.5	47.7
F-FCM	48.5	50.7	52.4	48.6	51.1	52.7	48.1	50.2	52.6	48.0	49.4	51.6	47.3	49.5	50.6	47.4	48.6	50.7	47.6	49.3	51.5	48.1	50.6	51.2	50.7	48.4	52.7
FFCM	56.7	63.2	65.2	58.4	60.7	63.3	58.7	61.2	64.0	57.2	61.3	63.4	57.2	58.4	62.1	57.2	59.3	62.7	55.6	59.8	60.7	56.1	57.8	61.2	57.6	58.4	63.0
LLF-FCM	56.5	56.5	56.5	56.5	56.5	56.5	54.5	55.5	55.5	55.5	55.5	55.5	55.5	55.5	55.5	55.5	55.5	55.5	55.5	55.5	55.5	55.5	55.5	55.5	54.5	55.5	55.5
SDA-FC	50.2	51.8	53.9	52.1	56.2	57.2	49.4	50.7	52.6	51.2	53.4	57.4	50.6	53.20	54.0	48.8	50.3	53.2	49.6	55.4	58.0	48.6	53.5	50	46.2	48.7	54.4
FednadamN	50.3	54.8	57.3	51.2	53.2	57.8	50.5	51.8	53.6	51.3	53.4	56.4	50.7	52.3	53.7	50.3	50.7	52.2	50.7	53.1	54.8	50.3	50.9	53.2	50.4	50.7	51.8
UIFCA	**90.6**	**92.4**	**97.8**	**90.4**	**92.7**	**98.5**	**90**	**91.6**	**95.7**	**90.0**	**92.5**	**96.8**	**91.0**	**93.2**	**96.8**	89.9	**90.5**	**93.7**	**89.5**	**91.0**	**94.7**	**89.7**	**91.5**	**94.6**	**89.7**	**90.5**	**91.7**
FedFCD	88.5	89.7	92.1	89.5	90.2	92.7	87.1	88.8	90.1	88.8	90.2	92.3	87.9	91.4	92.5	**90.7**	89.6	90.4	88.0	90.1	91.7	89.2	90.6	91.6	87.4	89.8	90.2

Table S- IV. Comparison of Clustering ACC (%) on Different Methods Using Public Dataset **RT-ioT2022**

Methods	$D_r = 0\%$									$D_r = 20\%$									$D_r = 50\%$								
	P=10			P=20			P=50			P=10			P=20			P=50			P=10			P=20			P=50		
	0.01	0.1	1.0	0.01	0.1	1.0	0.01	0.1	1.0	0.01	0.1	1.0	0.01	0.1	1.0	0.01	0.1	1.0	0.01	0.1	1.0	0.01	0.1	1.0	0.01	0.1	1.0
f-DEC	53.3	57.6	60.9	53.0	56.3	60.3	52.7	56.4	59.3	53.0	57.8	61.7	52.7	55.5	58.7	53.2	56.6	59.1	50.0	52.6	58.6	50.2	53.1	55.6	52.1	55.7	58.1
f-IDEC	66.5	70.5	72.8	67.7	71.3	73.6	65.1	67.5	70.3	65.1	68.3	71.8	66.2	70.4	73.1	65.7	68.4	71.1	64.6	67.7	71.1	65.7	70	72.5	65.3	68.0	69.7
f-DCEC	60.1	62.4	65.9	59.2	62.2	63.1	56.2	59.0	62.4	59.5	61.9	65.5	59.0	61.4	63.7	57.6	59.5	60.4	59.5	61.9	64.4	58.8	62.0	63.0	56.7	59.2	61.7
f-CADEC	74.3	76.5	78.6	72.2	74.3	75.6	70.4	73.6	75.2	73.8	75.7	78.4	72.5	74.3	76.2	71.3	73.5	74.6	73.5	76.2	78.0	71.6	73.8	75.8	70.2	72.7	74.5
f-SACC	77.6	79.4	82.5	76.5	78.7	83.6	75.6	78.2	82.0	77.4	78.6	81.7	75.8	78.6	84.0	75.3	77.6	81.5	77.2	78.2	81.6	75.6	78.6	82.8	76.1	78.0	81.3
FedFCM	70.2	74.3	76.8	71.4	72.6	75.7	74.1	75.3	76.8	70.4	73.6	75.4	70.6	71.3	74.9	73.6	74.5	75.8	68.4	71.2	74.1	68.6	70.6	73.4	70.3	73.5	74.0
F-FCM	60.7	62.6	64.7	59.2	60.8	63.2	58.1	59.3	61.4	59.2	61.9	64.2	60.1	61.3	62.5	57.8	58.1	59.4	58.3	59.7	60.5	58.7	59.6	61.4	59.5	57.4	60.1
FFCM	58.8	60.5	63.7	54.7	59.3	62.4	56.6	58.5	60.3	57.2	58.4	60.8	56.2	58.7	60.5	56.0	57.4	59.3	56.7	57.5	58.2	56.4	55.7	57.1	55.3	56.4	58.4
LLF-FCM	37.8	41.7	39.4	41.6	38.4	40.6	37.8	44.5	39.5	35.6	39.1	38.4	39.7	42.6	39.4	36.1	39.0	38.7	33.2	36.8	35.9	37.7	40.2	37.5	34.3	37.4	36.2
SDA-FC	43.3	46.9	61.0	39.7	48.1	53.3	38.5	42.8	49.4	44.8	62.9	33.9	38.4	40.3	42.8	35.6	38.5	42.3	40.6	49.2	36.3	48.7	57.4	52.5	31.7	36.2	40.8
FednadamN	76.6	77.0	81.2	56.4	66.4	76.0	62.8	67.1	73.3	59.6	81.1	76.5	48.9	58.9	71.5	59.6	66.8	63.4	72.6	67.9	78.3	41.3	56.7	76.8	57.7	68.4	61.4
UIFCA	**86.7**	**90.2**	**92.1**	85.6	**88.7**	90.4	**86.2**	**89.5**	**91.7**	85.7	**88.4**	90.1	85.2	87.6	89.9	**86.**1	**87.9**	88.6	**87.6**	**87.8**	**90.6**	**86.3**	87.9	88.5	86.0	86.3	88.7
FedFCD	86.2	88.5	90.4	**86**	88.6	**90.7**	85.4	88.7	90.3	**85.8**	88.0	**90.2**	**85.6**	**87.8**	**90.2**	85.6	88.2	**89.7**	85.2	87.6	89.7	86.0	**87.9**	**90**	**86.2**	**87.8**	**90.0**