

## MNIST

```
python3 main.py --dataset 'MNIST' --pu_lr 0.01 --clientSelect_Rate 1 --num_clients 3
--classes_per_client 4 --num_classes 10 --device cuda:1 --pu_batchsize 100 --use_PULoss
--local_epochs 2
```

```
data_per_client [20000, 20000, 20000]
data_per_client_per_class: [5000, 5000, 5000]
Data split:
- Client 0: [5000 5000 5000 5000 0 0 0 0 0 0]
- Client 1: [ 0 0 0 0 5000 5000 5000 5000 0 0]
- Client 2: [ 923 1742 958 1131 842 421 918 1265 5851 5949]

index list: tensor([[1., 1., 1., 1., 0., 0., 0., 0., 0., 0.],
                    [0., 0., 0., 0., 1., 1., 1., 1., 0., 0.],
                    [1., 0., 0., 0., 0., 0., 0., 0., 1., 1.]], device='cuda:1')
##### Semi-supervised setting #####
```

```
data_per_client_per_class: [5000, 5000, 5000]
Data split:
- Client 0: [5000 5000 5000 5000 0 0 0 0 0 0]
- Client 1: [ 0 0 0 0 5000 5000 5000 5000 0 0]
- Client 2: [ 923 1742 958 1131 842 421 918 1265 5851 5949]

index list: tensor([[1., 1., 1., 1., 0., 0., 0., 0., 0., 0.],
                    [0., 0., 0., 0., 1., 1., 1., 1., 0., 0.],
                    [1., 0., 0., 0., 0., 0., 0., 0., 1., 1.]], device='cuda:1')
##### Semi-supervised setting #####
use puloss
mean loss of 2 epochs: -1.1423
Accuracy of the 3 on the testing sets: 25.3800 %%
use puloss
mean loss of 2 epochs: -0.7320
Accuracy of the 1 on the testing sets: 39.7800 %%
use puloss
```

PU

```

Accuracy of the 1 on the testing sets: 45.0000 %%
use puloss
mean loss of 2 epochs: -3.0586
Accuracy of the 2 on the testing sets: 38.4000 %%
Round:198, Accuracy: 87.8600 %
##### Semi-supervised setting #####
use puloss
mean loss of 2 epochs: -3.1161
Accuracy of the 1 on the testing sets: 42.6600 %%
use puloss
mean loss of 2 epochs: -3.1164
Accuracy of the 2 on the testing sets: 38.5100 %%
use puloss
mean loss of 2 epochs: -3.2189
Accuracy of the 3 on the testing sets: 29.3300 %%
Round:199, Accuracy: 87.8700 %
finishing...
max cloud accuracy: 91.12
max accuracy of client 0 : 45.18
max accuracy of client 1 : 40.11
max accuracy of client 2 : 30.75
Traceback (most recent call last):
  File "/home/jmw7289/fedpu/fake/main.py", line 51, in <module>
    main()
  File "/home/jmw7289/fedpu/fake/main.py", line 45, in main
    trainer.begin_train()
  File "/home/jmw7289/fedpu/fake/roles/FmpuTrainer.py", line 83, in begin_train
    fp.write(max(self.clients[c].accuracy_trace))
TypeError: write() argument must be str, not float
(fedpu) jmw7289@i4-l-ffm5105-02:~/fedpu/fake$ python3 main.py --dataset 'MNIST' --pu_lr 0.01 --clientSelect_Rate 1 --num_clients 3 --cl
asses_per_client 4 --num_classes 10 --device cuda:1 --pu_batchsize 100 --use PULoss --local_epochs 2 --communication_rounds 200

```

## PU\_teacher

### With ensemble teacher

```

Round:198, Accuracy_c: 91.0900 %
##### Semi-supervised setting #####
use teacher_student
mean loss of 2 epochs: -3.2177
mean loss of 2 epochs: -2.1112
Accuracy of the 3 on the testing sets: 33.4000 %%
use teacher_student
mean loss of 2 epochs: -2.9573
mean loss of 2 epochs: -1.9290
Accuracy of the 1 on the testing sets: 41.1400 %%
use teacher_student
mean loss of 2 epochs: -3.0930
mean loss of 2 epochs: -1.9468
Accuracy of the 2 on the testing sets: 40.2900 %%
odict_keys(['conv1.weight', 'conv1.bias', 'conv2.weight', 'conv2.bias', 'fc1.weight', 'fc1.bias', 'fc2.w
Round:199, Accuracy: 91.5600 %
Round:199, Accuracy_c: 91.0400 %
finishing...
max cloud accuracy: 91.84
max cloud accuracy_c: 91.33
max accuracy of client 0 : 42.03
max accuracy of client 1 : 40.61
max accuracy of client 2 : 41.73
(fedpu) jmw7289@i4-l-ffm5105-02:~/fedpu/fake$

```

```

odict_keys(['conv1.weight', 'conv1.bias', 'conv2.weight', 'conv2.bias', 'fc1.weight', 'fc1.bias', 'fc2.weight', 'fc2.bias'])
Round:398, Accuracy: 91.4700 %
Round:398, Accuracy_c: 90.6200 %
##### Semi-supervised setting #####
use teacher_student
mean loss of 2 epochs: -2.7999
mean loss of 2 epochs: -1.8246
Accuracy of the 2 on the testing sets: 39.0400 %%
use teacher_student
mean loss of 2 epochs: -2.8184
mean loss of 2 epochs: -1.8458
Accuracy of the 1 on the testing sets: 52.5800 %%
use teacher_student
mean loss of 2 epochs: -3.0660
mean loss of 2 epochs: -2.0012
Accuracy of the 3 on the testing sets: 42.3000 %%
odict_keys(['conv1.weight', 'conv1.bias', 'conv2.weight', 'conv2.bias', 'fc1.weight', 'fc1.bias', 'fc2.weight', 'fc2.bias'])
Round:399, Accuracy: 91.3600 %
Round:399, Accuracy_c: 90.4700 %
finishing...
max cloud accuracy: 91.96
max cloud accuracy_c: 91.04
max accuracy of client 0 : 52.85
max accuracy of client 1 : 41.74
max accuracy of client 2 : 45.08
(fedpu) jmw7289@i4-l-ffm5105-02:~/fedpu/fake$ python3 main.py --dataset 'MNIST' --pu_lr 0.01 --clientSelect_Rate 1 --num_client
asses per client 4 --num_classes 10 --device cuda:1 --pu_batchsize 100 --use pu_teacher --local_epochs 2 --communication_rounds

```

## With avg teacher

```

##### Semi-supervised setting #####
use teacher_student
mean loss of 2 epochs: -3.0193
mean loss of 2 epochs: -3.1715
Accuracy of the 1 on the testing sets: 45.8100 %%
use teacher_student
mean loss of 2 epochs: -2.9410
mean loss of 2 epochs: -3.0468
Accuracy of the 2 on the testing sets: 38.9200 %%
use teacher_student
mean loss of 2 epochs: -3.1597
mean loss of 2 epochs: -2.9963
Accuracy of the 3 on the testing sets: 69.2200 %%
Round:199, Accuracy: 90.8500 %
finishing...
max cloud accuracy: 91.42
max accuracy of client 0 : 46.04
max accuracy of client 1 : 39.18
max accuracy of client 2 : 71.5
Traceback (most recent call last):
  File "/home/jmw7289/fedpu/fake/main.py", line 51, in <module>
    main()
  File "/home/jmw7289/fedpu/fake/main.py", line 45, in main
    trainer.begin_train()
  File "/home/jmw7289/fedpu/fake/roles/FmpuTrainer.py", line 83, in begin_train
    fp.write(max(self.clients[c].accuracy_trace))
TypeError: write() argument must be str, not float
(fedpu) jmw7289@i4-l-ffm5105-02:~/fedpu/fake$ python3 main.py --dataset 'MNIST' --pu_lr 0.01 --clientSelect_Rate 1 --num_clients 3
--classes_per_client 4 --num_classes 10 --device cuda:1 --pu_batchsize 100 --use pu_teacher --local_epochs 2 --communication_rounds
200

```

## Chest-x-ray

```

(295,)
checking for nan...
1
2
3
4
calculating weights...
weights: [1.89624183 0.67905208]
classes_per_client: 2
couter in split image data: Counter({1: 3418, 0: 1224})
data_per_client [1547, 1547, 1547]
data_per_client_per_class: [773, 773, 773]
Data split:
- Client 0: [774 773]
- Client 1: [ 450 1097]
- Client 2: [   0 1547]

index list: tensor([[1., 1.],
                    [1., 1.],
                    [0., 1.]], device='cuda:1')
#### Semi-supervised setting ####
use puloss

```

PU

```

use puloss
mean loss of 2 epochs: -2.5871
Accuracy of the 1 on the testing sets: 84.8749 %%
Round:48, Accuracy: 79.2165 %
#### Semi-supervised setting ####
use puloss
mean loss of 2 epochs: -2.7635
Accuracy of the 1 on the testing sets: 86.5071 %%
use puloss
mean loss of 2 epochs: -3.5979
Accuracy of the 2 on the testing sets: 86.2894 %%
use puloss
mean loss of 2 epochs: -6.7600
Accuracy of the 3 on the testing sets: 69.7497 %%
Round:49, Accuracy: 69.9674 %
finishing...
max cloud accuracy: 79.21653971708379
max accuracy of client 0 : 89.11860718171926
max accuracy of client 1 : 89.11860718171926
max accuracy of client 2 : 69.74972796517955
Traceback (most recent call last):
  File "/home/jmw7289/fedpu/fake/main.py", line 51, in <module>
    main()
  File "/home/jmw7289/fedpu/fake/main.py", line 45, in main
    trainer.begin_train()
  File "/home/jmw7289/fedpu/fake/roles/FmpuTrainer.py", line 83, in begin_train
    fp.write(max(self.clients[c].accuracy_trace))
TypeError: write() argument must be str, not float
(fedpu) jmw7289@i4-l-ffm5105-02:~/fedpu/fake$ python3 main.py --dataset 'chest' --method 'FedAvg' --local_epochs 2 --communication_ro
und 50 --pu_lr 0.001 --clientSelect_Rate 1 --num_clients 3 --classes_per_client 2 --num_classes 2 --pu_batchsize 32 --use_PULoss --pu_w
eight 0.5 --device cuda:1

```

## PU\_teacher

```
mean loss of 2 epochs: -3.1043
Accuracy of the 1 on the testing sets: 87.4864 %%
use teacher_student
mean loss of 2 epochs: -3.1843
mean loss of 2 epochs: -3.6828
Accuracy of the 2 on the testing sets: 84.2220 %%
Round:48, Accuracy: 78.5637 %
##### Semi-supervised setting #####
use teacher_student
mean loss of 2 epochs: -2.7621
mean loss of 2 epochs: -2.9551
Accuracy of the 1 on the testing sets: 88.9010 %%
use teacher_student
mean loss of 2 epochs: -6.7770
mean loss of 2 epochs: -6.8941
Accuracy of the 3 on the testing sets: 69.7497 %%
use teacher_student
mean loss of 2 epochs: -3.5279
mean loss of 2 epochs: -3.7180
Accuracy of the 2 on the testing sets: 83.0250 %%
Round:49, Accuracy: 75.5169 %
finishing...
max cloud accuracy: 85.310119695321
max accuracy of client 0 : 90.20674646354733
max accuracy of client 1 : 86.8335146898803
max accuracy of client 2 : 69.74972796517955
Traceback (most recent call last):
  File "/home/jmw7289/fedpu/fake/main.py", line 51, in <module>
    main()
  File "/home/jmw7289/fedpu/fake/main.py", line 45, in main
    trainer.begin_train()
  File "/home/jmw7289/fedpu/fake/roles/FmpuTrainer.py", line 83, in begin_train
    fp.write(max(self.clients[c].accuracy_trace))
TypeError: write() argument must be str, not float
(fedpu) jmw7289@i4-l-ffm5105-02:~/fedpu/fake$ python3 main.py --dataset 'chest' --method 'FedAvg' --local_epochs 2 --communication_rounds 50 --pu_lr 0.001 --clientSelect_Rate 1 --num_clients 3 --classes_per_client 2 --num_classes 2 --pu_batchsize 24 --use_pu_teacher --pu_weight 0.5 --device cuda:0
```

## Cifar10

### PU

```
Accuracy of the 1 on the testing sets: 43.1400 %%
use puloss
mean loss of 2 epochs: -2.8291
Accuracy of the 3 on the testing sets: 49.2100 %%
use puloss
mean loss of 2 epochs: -3.4504
Accuracy of the 2 on the testing sets: 44.4700 %%
Round:199, Accuracy: 63.8000 %
finishing...
max cloud accuracy: 67.17
max accuracy of client 0 : 44.23
max accuracy of client 1 : 50.86
max accuracy of client 2 : 52.12
Traceback (most recent call last):
  File "/home/jmw7289/fedpu/fake/main.py", line 51, in <module>
    main()
  File "/home/jmw7289/fedpu/fake/main.py", line 45, in main
    trainer.begin_train()
  File "/home/jmw7289/fedpu/fake/roles/FmpuTrainer.py", line 83, in begin_train
    fp.write(max(self.clients[c].accuracy_trace))
TypeError: write() argument must be str, not float
(fedpu) jmw7289@i4-l-ffm5105-02:~/fedpu/fake$ python3 main.py --dataset 'CIFAR10' --pu_lr 0.01 --clientSelect_Rate 1 --num_clients 3 --classes_per_client 4 --num_classes 10 --device cuda:1 --pu_batchsize 100 --use_PULoss --local_epochs 2 --communication_rounds 200
```

```
python3 main.py --dataset 'CIFAR10' --pu_lr 0.01 --clientSelect_Rate 1 --num_clients 3
--classes_per_client 4 --num_classes 10 --device cuda:1 --pu_batchsize 100 --local_epochs 2
```

--communication\_rounds 200 --use\_pu\_teacher

```
mean loss of 2 epochs: -2.9380
Accuracy of the 3 on the testing sets: 42.9600 %%
use teacher_student
mean loss of 2 epochs: -3.4391
mean loss of 2 epochs: -3.0432
Accuracy of the 2 on the testing sets: 50.5700 %%
Round:199, Accuracy: 41.3400 %
finishing...
max cloud accuracy: 68.94
max accuracy of client 0 : 62.61
max accuracy of client 1 : 66.26
max accuracy of client 2 : 65.28
Traceback (most recent call last):
  File "/home/jmw7289/fedpu/fake/main.py", line 51, in <module>
    main()
  File "/home/jmw7289/fedpu/fake/main.py", line 45, in main
    trainer.begin_train()
  File "/home/jmw7289/fedpu/fake/roles/FmpuTrainer.py", line 83, in begin_train
    fp.write(max(self.clients[c].accuracy_trace))
TypeError: write() argument must be str, not float
(fedpu) jmw7289@i4-l-ffm5105-02:~/fedpu/fake$ python3 main.py --dataset 'CIFAR10' --pu_lr 0.01 --clientSelect_Rate 1 --num_clients
3 --classes_per_client 4 --num_classes 10 --device cuda:1 --pu_batchsize 100 --local_epochs 2 --communication_rounds 200 --use_pu_t
eacher
```

### ISIC2018 task 3

```
getting ISIC...
coverting training data...
converting test data...
checking for nan values...
- in x train
- in y train
- in x test
- in y test
weights: [ 1.28545758  0.21338021  2.78349083  4.37527304  1.30183284 12.44099379
 10.07545272]
classes_per_client: 3
counter in split image data: Counter({1: 6705, 0: 1113, 4: 1099, 2: 514, 3: 327, 6: 142, 5: 115})
data_per_client [3338, 3338, 3338]
data_per_client_per_class: [1112, 1112, 1112]
Data split:
- Client 0: [1112 1112 514 327 273 0 0]
- Client 1: [ 1 2254 0 0 826 115 142]
- Client 2: [ 0 3338 0 0 0 0 0]

index list: tensor([[1., 1., 1., 1., 0., 0., 0.],
 [0., 1., 0., 0., 1., 1., 1.],
 [0., 1., 0., 0., 0., 0., 0.]], device='cuda:1')
##### Semi-supervised setting #####
use teacher_student
mean loss of 2 epochs: 1.2519
Accuracy of the 2 on the testing sets: 53.9021 %%
use teacher_student
mean loss of 2 epochs: 1.1266
Accuracy of the 1 on the testing sets: 15.9392 %%
use teacher_student
mean loss of 2 epochs: 0.0531
Accuracy of the 3 on the testing sets: 60.1190 %%
Round:0, Accuracy: 60.1190 %
##### Semi-supervised setting #####
use teacher student
```

PU

```

Accuracy of the 2 on the testing sets: 60.4497 %
use puloss
mean loss of 2 epochs: -5.8456
Accuracy of the 3 on the testing sets: 61.3095 %
use puloss
mean loss of 2 epochs: -0.9294
Accuracy of the 1 on the testing sets: 51.5212 %
Round:297, Accuracy: 64.0212 %
##### Semi-supervised setting #####
use puloss
mean loss of 2 epochs: -2.6137
Accuracy of the 2 on the testing sets: 60.5159 %
use puloss
mean loss of 2 epochs: -0.9471
Accuracy of the 1 on the testing sets: 49.2063 %
use puloss
mean loss of 2 epochs: -5.8337
Accuracy of the 3 on the testing sets: 60.6481 %
Round:298, Accuracy: 64.0873 %
##### Semi-supervised setting #####
use puloss
mean loss of 2 epochs: -0.9834
Accuracy of the 1 on the testing sets: 50.9921 %
use puloss
mean loss of 2 epochs: -2.5399
Accuracy of the 2 on the testing sets: 60.4497 %
use puloss
mean loss of 2 epochs: -5.9057
Accuracy of the 3 on the testing sets: 61.1772 %
Round:299, Accuracy: 64.7487 %
finishing...
max cloud accuracy: 67.65873015873017
max accuracy of client 0 : 55.48941798941799
max accuracy of client 1 : 63.955026455026456
max accuracy of client 2 : 61.507936507936506
(fedpu) jmw7289@i4-l-ffm5105-02:~/fedpu/fake$ python3 main.py --dataset 'isic' --method 'FedAvg' --pu_weight 0.5 --local_epoch
s 2 --communication_round 300 --pu_lr 0.00001 --clientSelect_Rate 1 --num_clients 3 --classes_per_client 3 --num_classes 7 --dev
ice cuda:0 --pu_batchsize 32 --use PULoss

```

## PU\_teacher

```

Round:298, Accuracy: 60.3544 %
##### Semi-supervised setting #####
use teacher_student
mean loss of 2 epochs: -5.8285
mean loss of 2 epochs: 0.1664
Accuracy of the 3 on the testing sets: 65.4762 %
use teacher_student
mean loss of 2 epochs: -0.9696
mean loss of 2 epochs: 0.1211
Accuracy of the 1 on the testing sets: 64.6825 %
use teacher_student
mean loss of 2 epochs: -2.5234
mean loss of 2 epochs: 0.1599
Accuracy of the 2 on the testing sets: 65.8730 %
Round:299, Accuracy: 66.9974 %
finishing...
max cloud accuracy: 70.17195767195767
max accuracy of client 0 : 66.4021164021164
max accuracy of client 1 : 67.46031746031746
max accuracy of client 2 : 66.7989417989418
Traceback (most recent call last):
  File "/home/jmw7289/fedpu/fake/main.py", line 51, in <module>
    main()
  File "/home/jmw7289/fedpu/fake/main.py", line 45, in main
    trainer.begin_train()
  File "/home/jmw7289/fedpu/fake/roles/FmpuTrainer.py", line 83, in begin_train
    fp.write('\n'.join(max(self.clients[c].accuracy_trace)))
TypeError: can only join an iterable
(fedpu) jmw7289@i4-l-ffm5105-02:~/fedpu/fake$ python3 main.py --dataset 'isic' --method 'FedAvg' --local_epochs 2 --communication_rou
nd 300 --pu_lr 0.00001 --clientSelect_Rate 1 --num_clients 3 --classes_per_client 3 --num_classes 7 --device cuda:1 --pu_batchsize 30 -
--use_pu_teacher --pu_weight 0.5

```