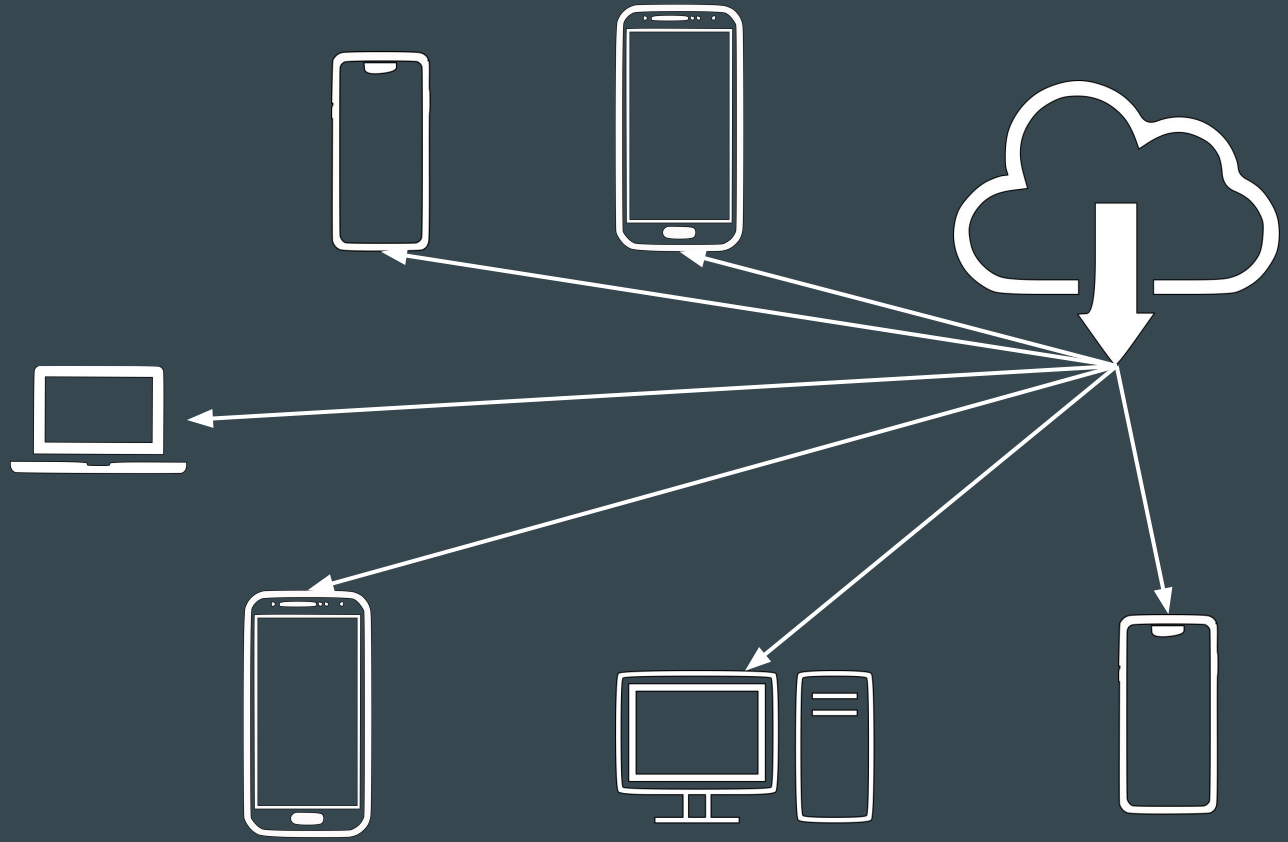
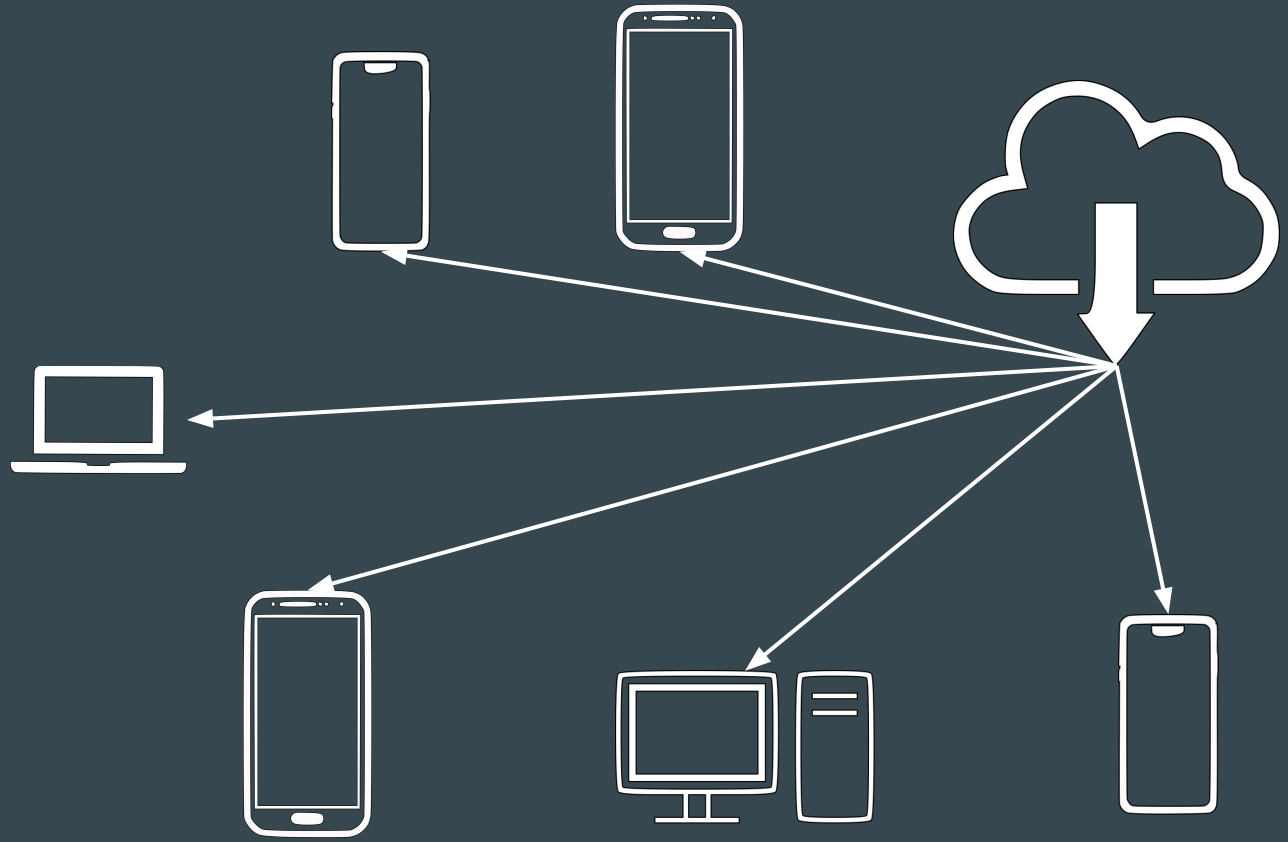
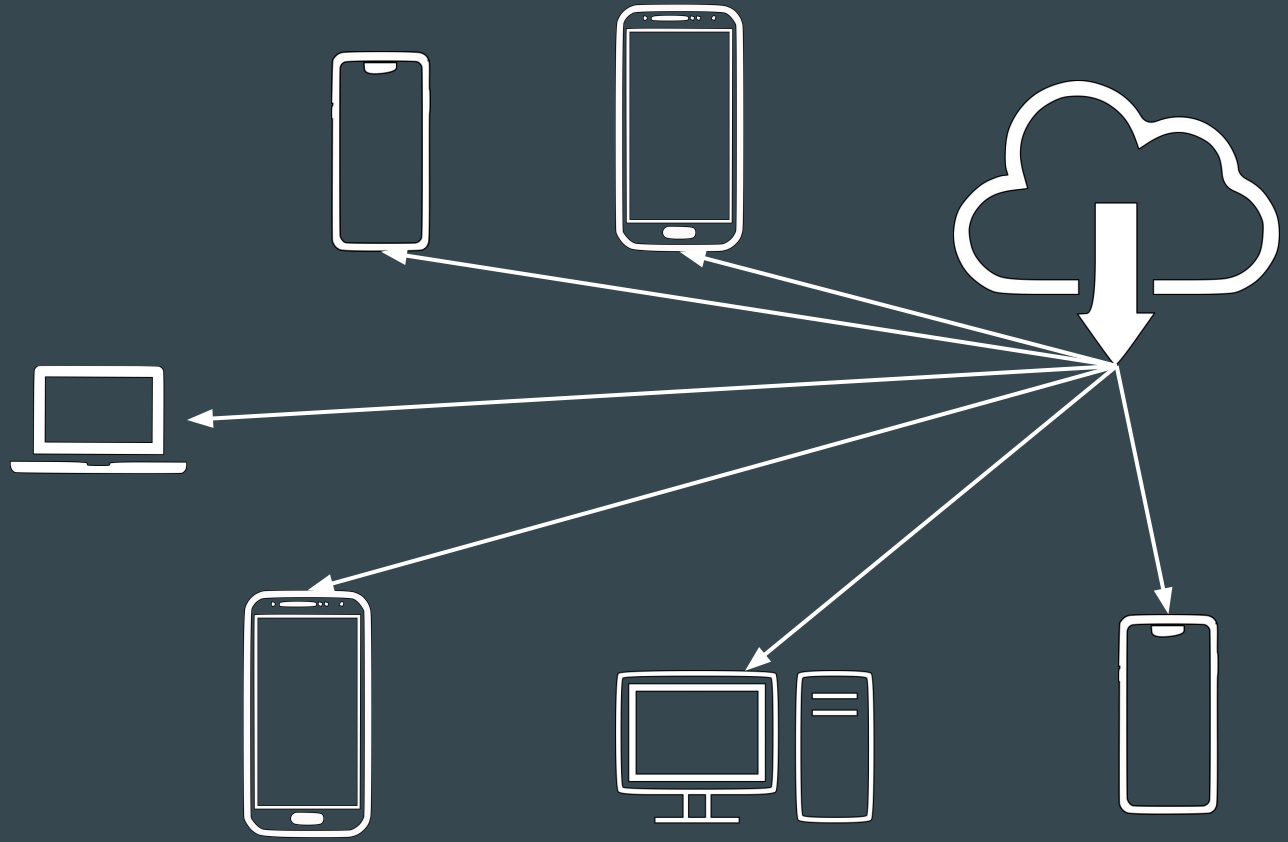
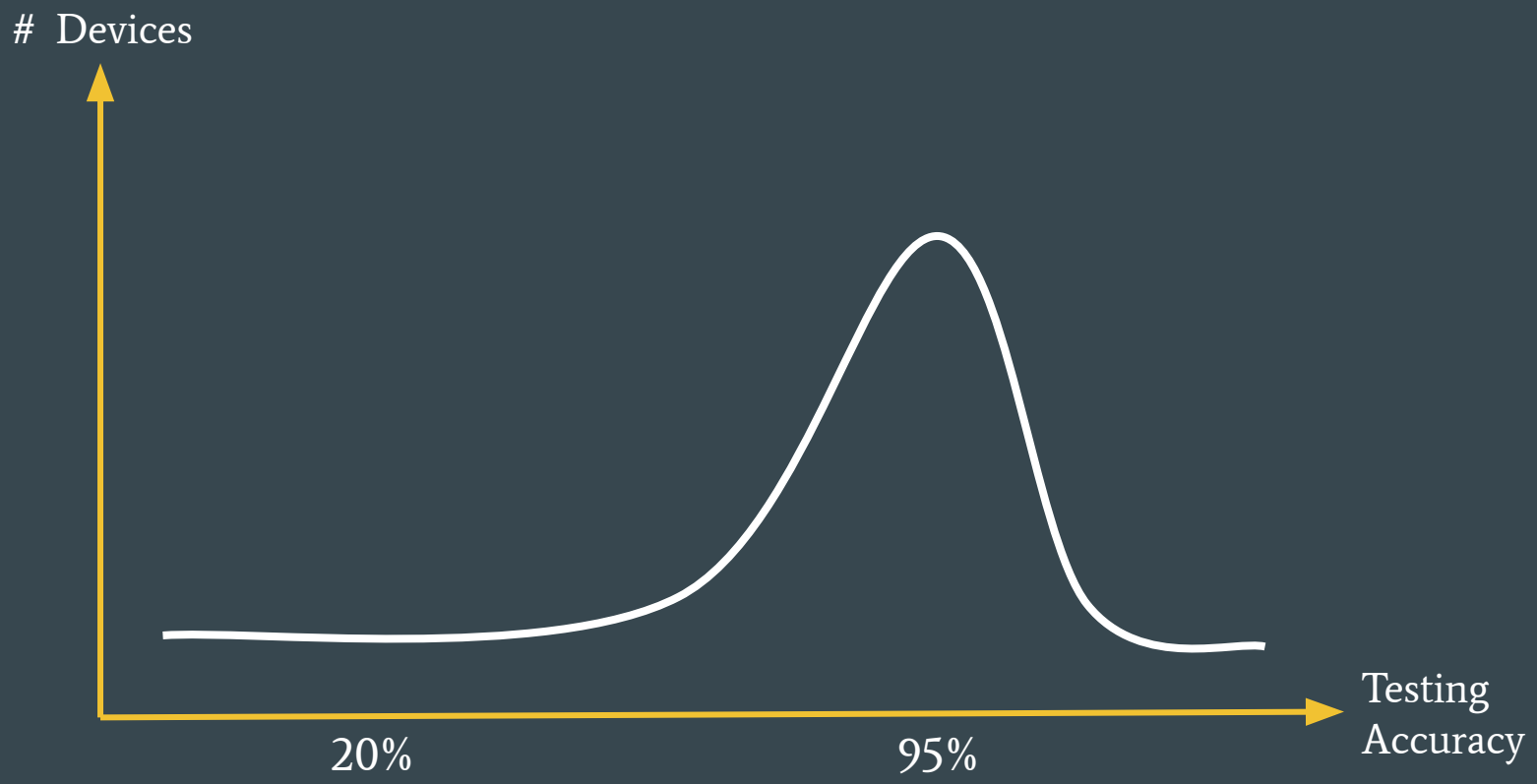
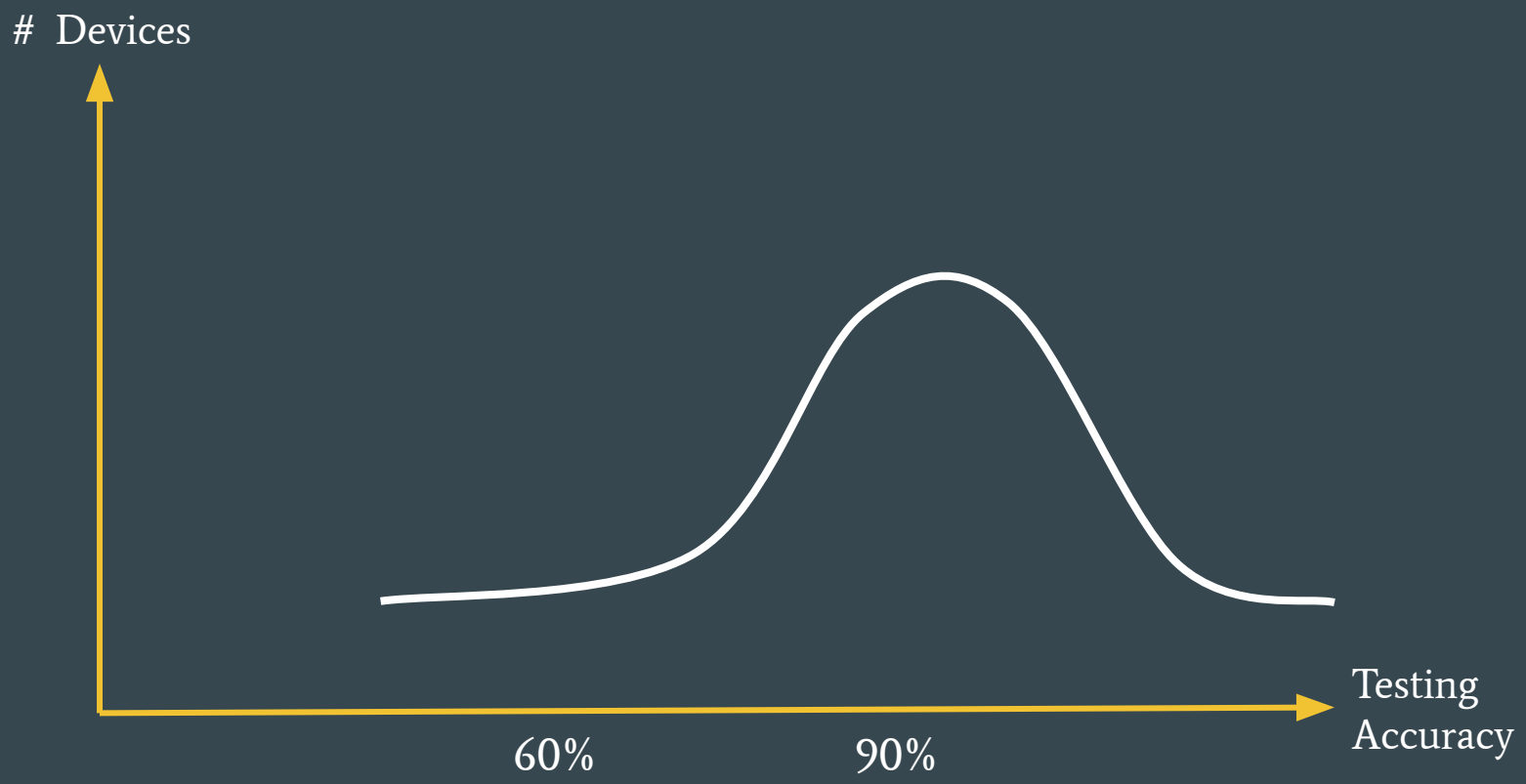







Devices
Testing Accuracy
20%
95%


Devices
Testing Accuracy
60%
90%

FAIRNESS

Fair Resource Allocation In Federated Learning

Tian Li, Maziar Sanjabi, Ahmad Beirami, Virginia Smith

OBJECTIVE

$$\min_{w} f(w) = \sum_{k=1}^{m} p_k F_k(w)$$

reweight

$$\min_{w} \; f_q(w) = \sum_{k-1}^{m} \frac{p_k}{q+1} F_k^{q+1}(w)$$

q-FFL

SOLVER

Lipschitz

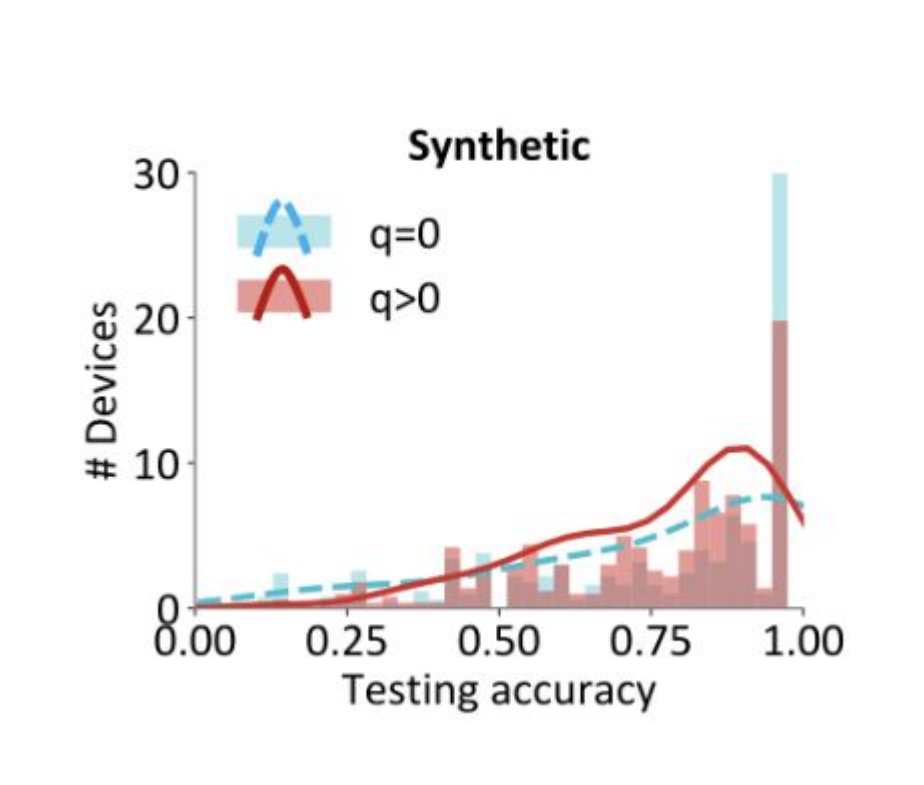
q-FedSGD

q-FedAvg

EVALUATION

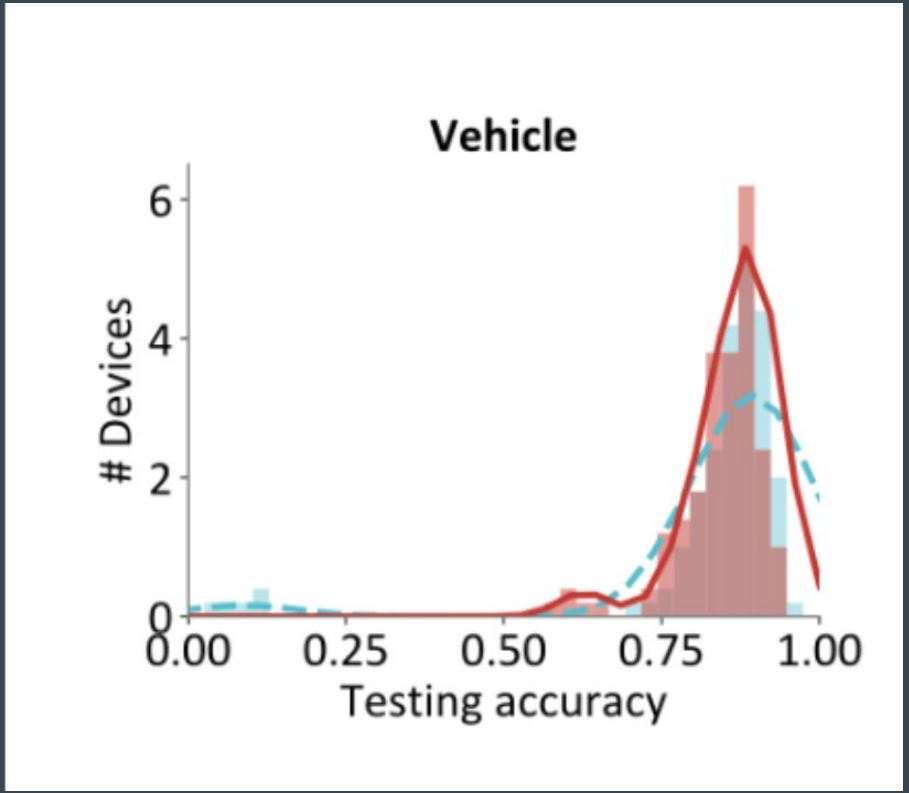
more fair

synthetic


Synthetic
q=0
q>0
Devices
30
20
10
0
0.00
0.25
0.50
0.75
1.00
Testing accuracy

synthetic

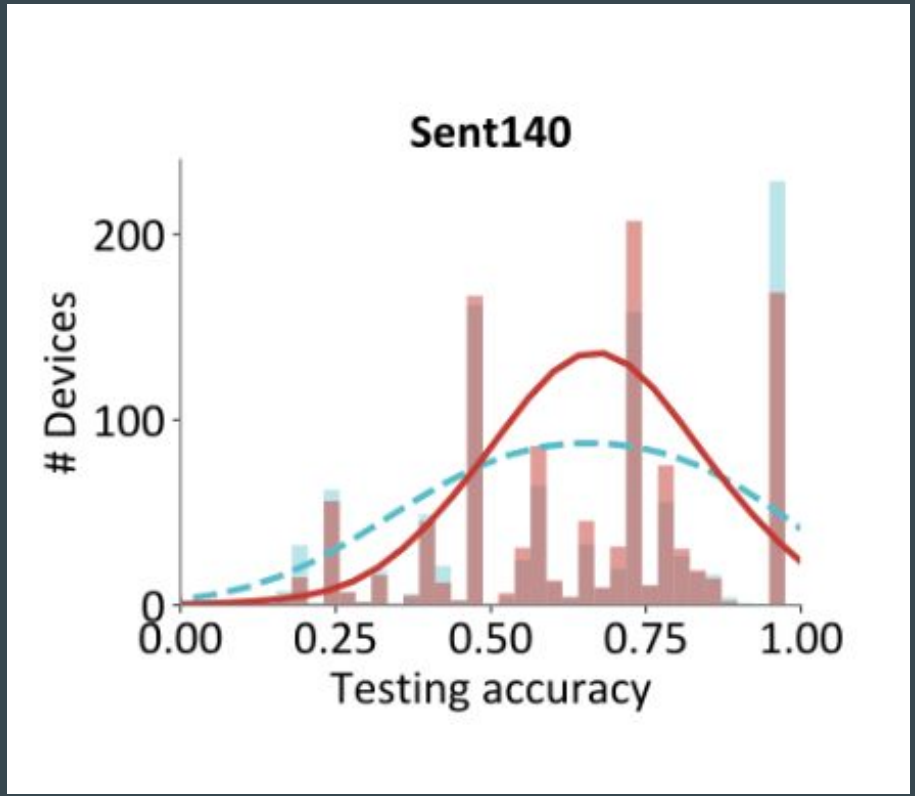
vehicle



synthetic

vehicle

tweet

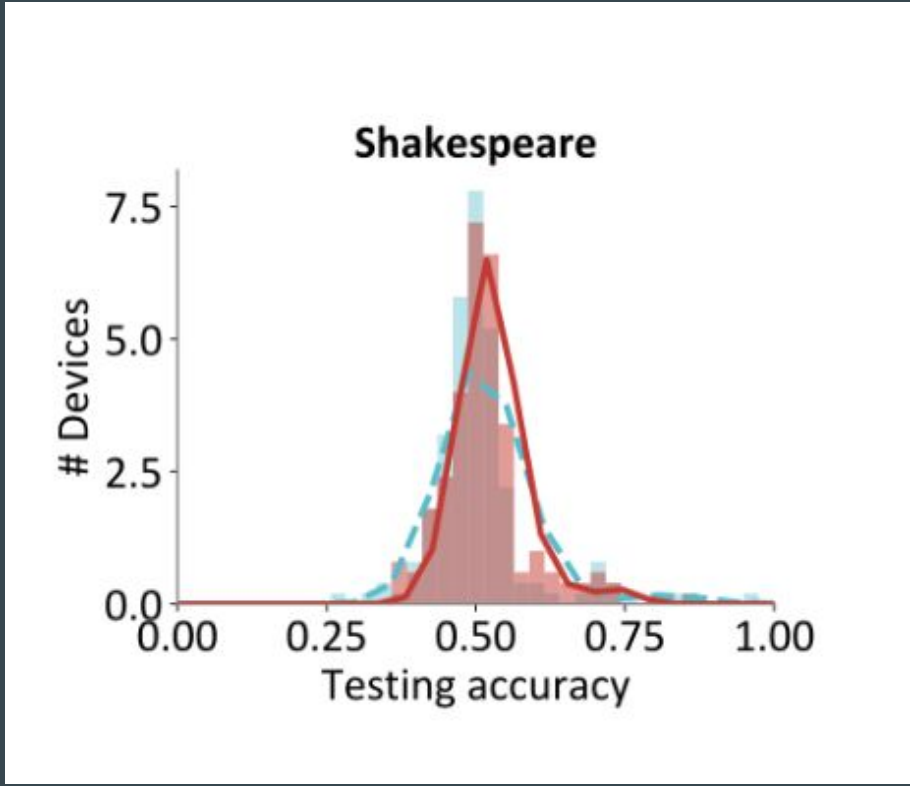


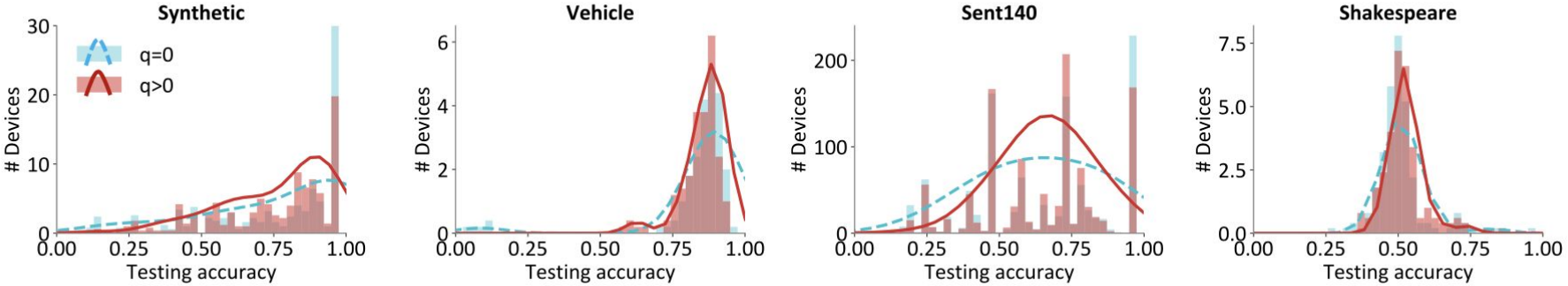
synthetic

vehicle

tweet

shakespeare



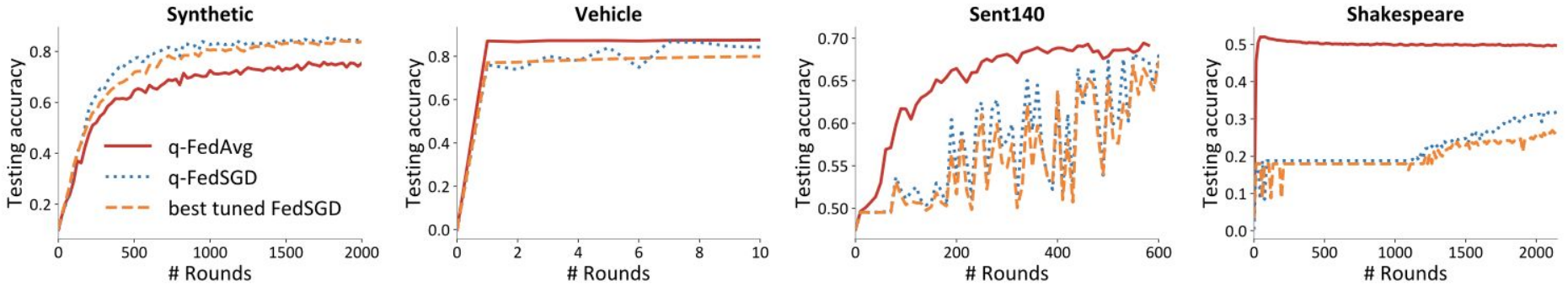

Synthetic
q=0
q>0
Devices
Testing accuracy
Vehicle
Devices
Testing accuracy
Sent140
Devices
Testing accuracy
Shakespeare
Devices
Testing accuracy

45%

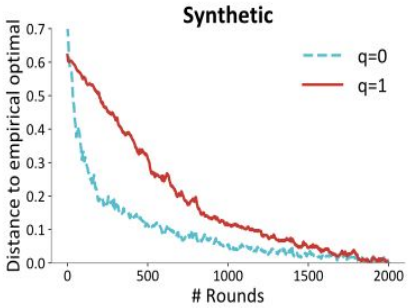
fairness comparison

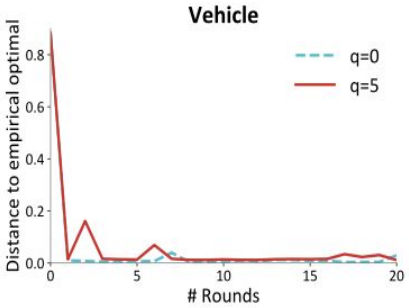
Agnostic FL

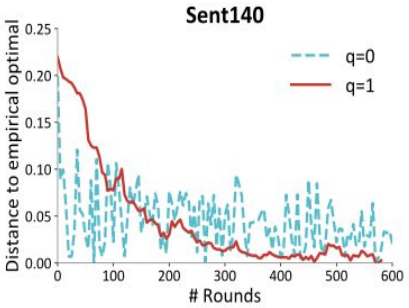
solver efficiency

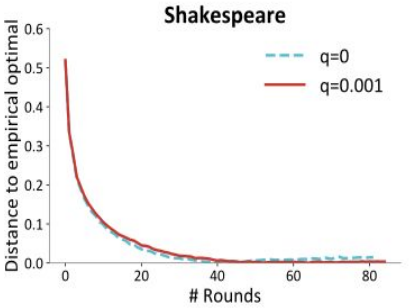

Synthetic
Testing accuracy
Rounds
q-FedAvg
q-FedSGD
best tuned FedSGD
Vehicle
Testing accuracy
Rounds
Sent140
Testing accuracy
Rounds
Shakespeare
Testing accuracy
Rounds

q
convergence rate


Synthetic
Distance to empirical optimal
# Rounds
q=0
q=1


Vehicle
Distance to empirical optimal
# Rounds
q=0
q=5


Sent140
Distance to empirical optimal
# Rounds
q=0
q=1


Shakespeare
Distance to empirical optimal
# Rounds
q=0
q=0.001

q↑
fairness↑

THANK YOU :)

Reference

Appendix - q vs fairness

Dataset	Objective	Average (%)	Worst 10% (%)	Best 10% (%)	Variance
Synthetic	q=0	80.8 ± .9	18.8 ± 5.0	100.0 ± 0.0	724 ± 72
	q= 0.1	81.1 ± 0.8	22.1 ± .8	100.0 ± 0.0	666 ± 56
	q=1	79.0 ± 1.2	31.1 ± 1.8	100.0 ± 0.0	472 ± 14
	q=2	74.7 ± 1.3	32.2 ± 2.1	99.9 ± .2	410 ± 23
	q=5	67.2 ± 0.9	30.0 ± 4.8	94.3 ± 1.4	369 ± 51

Appendix - device-specific q vs fairness

Dataset	Objective	Average (%)	Worst 10% (%)	Best 10% (%)	Variance
Vehicle	q=0	87.3 ± .5	43.0 ± 1.0	95.7 ± 1.0	291 ± 18
	q=5	87.7 ± .7	69.9 ± .6	94.0 ± .9	48 ± 5
	multiple q	88.5 ± .3	70.0 ± 2.0	95.8 ± .6	52 ± 7
Shakespeare	q=0	51.1 ± .3	39.7 ± 2.8	72.9 ± 6.7	82 ± 41
	q=.001	52.1 ± .3	42.1 ± 2.1	69.0 ± 4.4	54 ± 27
	multiple q	52.0 ± 1.5	41.0 ± 4.3	72.0 ± 4.8	72 ± 32