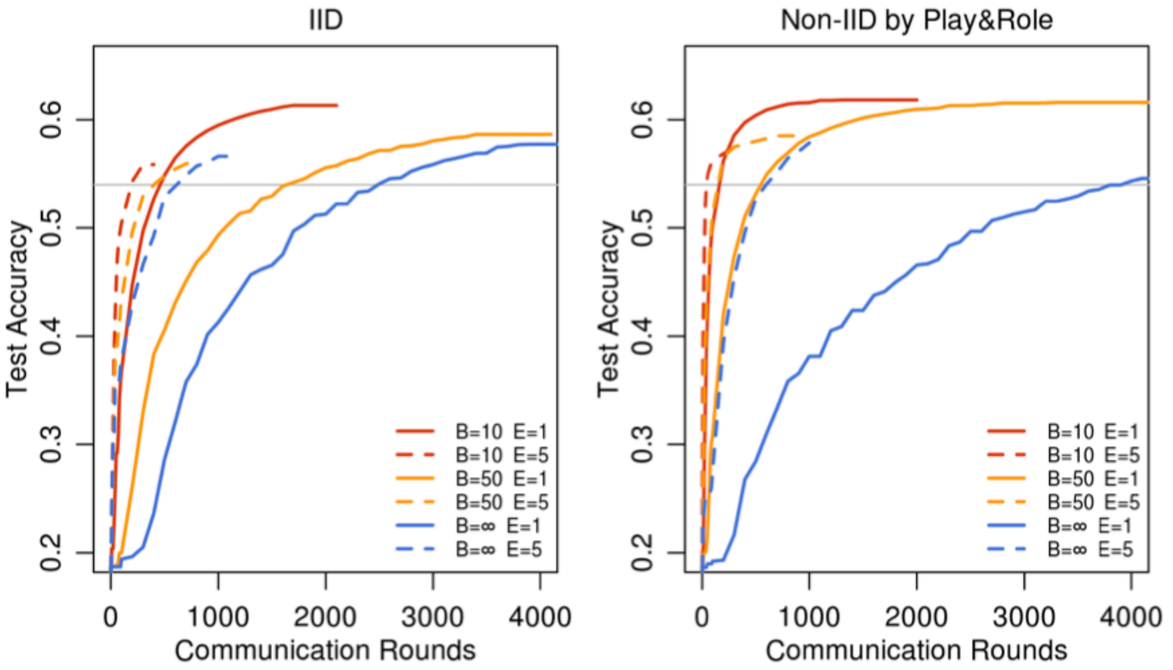
MNIST CNN, 99% ACCURACY							
CNN	E	B	u	IID		NON-IID	
FEDSGD	1	∞	1	626		483	
FEDAVG	5	∞	5	179	(3.5×)	1000	(0.5×)
FEDAVG	1	50	12	65	(9.6×)	600	(0.8×)
FEDAVG	20	∞	20	234	(2.7×)	672	(0.7×)
FEDAVG	1	10	60	34	(18.4×)	350	(1.4×)
FEDAVG	5	50	60	29	(21.6×)	334	(1.4×)
FEDAVG	20	50	240	32	(19.6×)	426	(1.1×)
FEDAVG	5	10	300	20	(31.3×)	229	(2.1×)
FEDAVG	20	10	1200	18	(34.8×)	173	(2.8×)
SHAKESPEARE LSTM, 54% ACCURACY							
LSTM	E	B	u	IID		NON-IID	
FEDSGD	1	∞	1.0	2488		3906	
FEDAVG	1	50	1.5	1635	(1.5×)	549	(7.1×)
FEDAVG	5	∞	5.0	613	(4.1×)	597	(6.5×)
FEDAVG	1	10	7.4	460	(5.4×)	164	(23.8×)
FEDAVG	5	50	7.4	401	(6.2×)	152	(25.7×)
FEDAVG	5	10	37.1	192	(13.0×)	41	(95.3×)



Communication-Efficient Learning of Deep Networks from Decentralized Data, AISTATS, 2017

Statistical Challenges

Each node collects data in a *non-IID* manner $X_t \sim P_t$

The number of data points on each node may vary significantly

Systems Challenges

Large number of nodes causes a significant bottleneck

The storage, computational, and communication capacities of each nodes differ

Multi-Task Learning(MTL) is a natural choice to handle statistical challenges in the federated setting

Federated Multi-Task Learning, NIPS, 2017