MULTI-FLGANs: Multi Distributed Adversarial Networks for NON-IID distributed datasets.

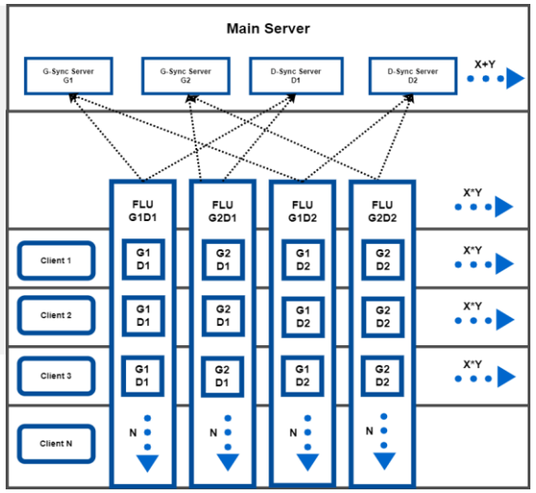
1. Problem & Approach

- Federated learning(FL) allow GANs to train using distributed client data.
- In a non-iid setting, federated learning GANs are unstable leading to model collapse and low-quality images for increasing clients.
- MULTI-FLGAN uses cascades of generators and discriminators to train non-iid distributed data.
- MULTI-FLGAN is tested against AFLGAN, and baseline FLGAN for 2, 3, 5, 10, and 20 clients on MNIST and FMNIST.

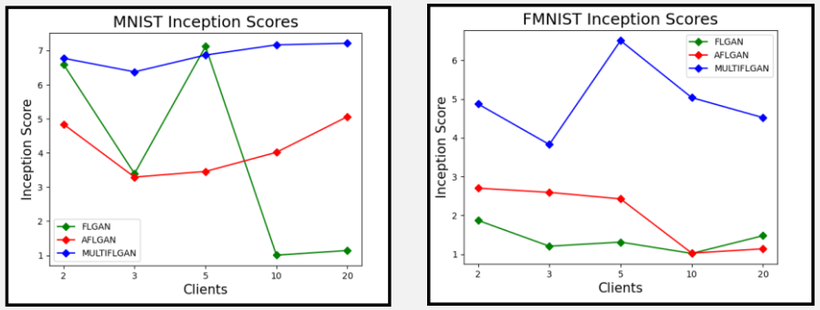
2. MULTI-FLGAN Learning Procedure

Using X Discriminators, Y generators and N clients:

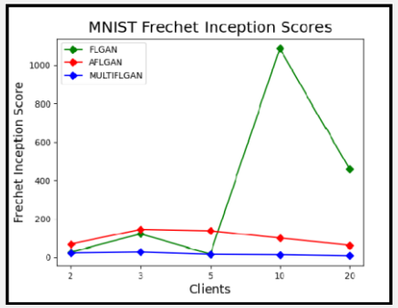
- **Step 1:** Main server allocates X*Y Flus and X+Y G-sync and D-sync servers.
- **Step 2:** Sync servers connect to respective FLU.
- **Step 3:** FLUs create a partition for clients by replicating identical GANs.
- **Step 4:** Sync servers send their Sync model to FLUs.
- **Step 5:** Clients train their partition of models.
- **Step 6:** FLU aggregates weights.
- **Step 7:** Sync servers aggregate generator and discriminator weights of connected FLUs.

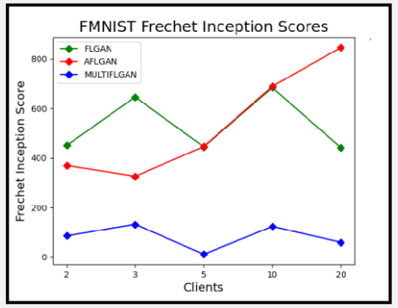


3. Results



MULTI-FLGAN produces high quality and diverse images

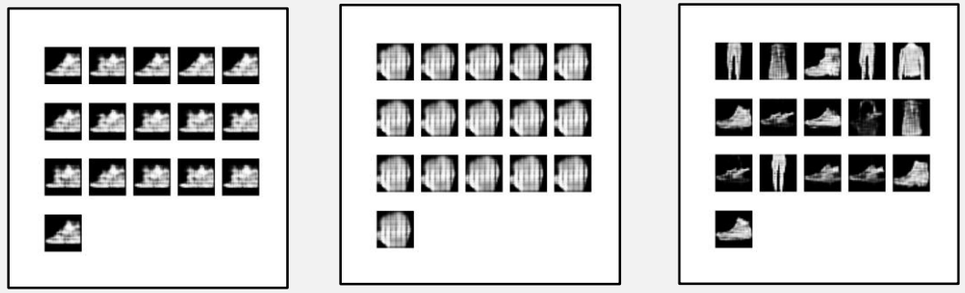




MULTI-FLGAN generates images that are very close to ground truth

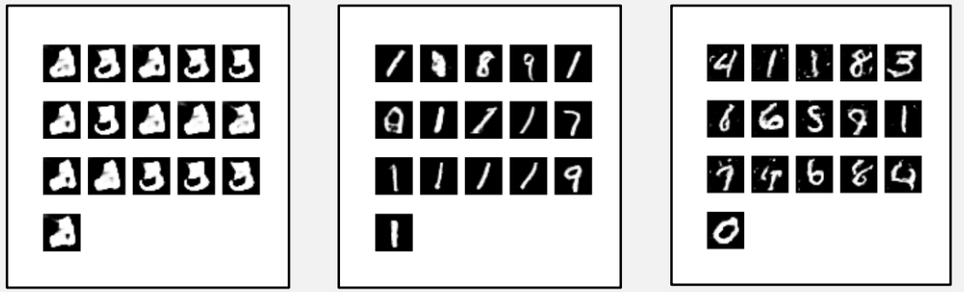
Sample Images - FMNIST(20 Clients)

FLGAN AFLGAN MULTI-FLGAN



Sample Images - MNIST(20 Clients)

FLGAN AFLGAN MULTI-FLGAN



4. Conclusion

- **MULTI-FLGAN outperforms its competitors on MNIST and FMNIST**
- **MULTI-FLGAN is stable across 20 clients**
- **MULTI-FLGAN does not show mode collapse**
- **MULTI-FLGAN is computationally and memory intensive compared to baseline FLGAN.**

5. References

J BrownLee, 18 impressive application of generative adversarial networks(gans), Jul 2019.[Online]Available: https://machinelearningmastery.com/impressive -applications-generative-adversarial-networks

P.Isola J-Y.Zhu T.Zhou and A.A.Efros, “Image-to-Image translation with conditional adversarial networks,” in Proceedings on Computer Vision and Pattern Recognition(CVPR).Jul.2017

Author: **Akash Amalan**

Supervisor: **I.r Rui Wang**

Responsible Professor: **dr Kaitai Liang**