Federated Learning with Diffusion Models for Privacy-Sensitive Vision Tasks [Paper URL]

1 Summary

1.1 **Motivation:** Diffusion models are trained on vast amounts of data to create new images from random noise. Collecting and storing image data from different sources is difficult and raises privacy concerns. This motivated exploring federated learning (FL) to train diffusion models on privacy-sensitive data, to enable the development of federated diffusion models.

1.2 **Contribution:** The paper explores the use of federated learning to train diffusion models for privacy-sensitive vision tasks, demonstrating the potential of federated diffusion models to deliver vision services to domains like the medical field where privacy concerns are prominent.

1.3 **Methodology:** The FedAvg algorithm optimised the central model by reducing local loss. The study used three datasets, CIFAR10, Fashion-MNIST, and SVHN, and a UNet with residual blocks. Edge models were trained for 5 epochs with 300 communications rounds. The local training process involved forward and reverse diffusion processes, adding Gaussian noise to the input image and predicting and removing it to recover the original image. The centralized model was trained for 1500 epochs, with image augmentation techniques applied. Performance was evaluated using the Inception score and frechet inception distance.

1.4 **Conclusion:** The paper explores federated diffusion models for privacy-sensitive vision services, focusing on weights from trained edge devices, and suggests future research on mitigating challenges in federated learning.

2 Limitations

2.1 The impact of increasing the number of clients on the quality of the federated diffusion model is not fully explored.

2.2 The personalization potential of local models in the federated setting is not fully investigated.

2.3 Medical experts didn't evaluate the quality of the medical images generated by the diffusion model.

3 Synthesis

3.1 Develop lightweight diffusion models that can facilitate training and deployment on edge devices.

3.2 Investigating the personalized properties of the local models in the federated learning setting, as these local models can act as personalized models and add extra information.