VIP Week 3

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1.Introduction

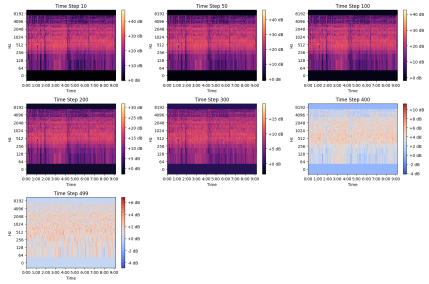
During this week, I focused on experimenting with diffusion models, aiming to build a functional pipeline using a U-Net-based architecture. The structure followed a progression of channels (32, 64, 128, 256, 512), where each layer was fully convolutional. My goal was to better understand how the model learns the denoising process and to identify ways to improve the reconstruction quality.

2.Work Summary

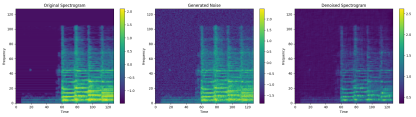
- Implemented a diffusion model using a U-Net pipeline with channel configuration (32, 64, 128, 256, 512).
- Read several research papers on denoising improvements and training stability in diffusion models.
- Experimented with both the noising and denoising processes, observing the effect of different noise schedules.
- Tested multiple loss functions, such as mean squared error (MSE) and mean absolute error (MAE), to compare convergence and output quality.
- Began collecting visual data for performance comparison between training iterations.

3.Results and Visualizations

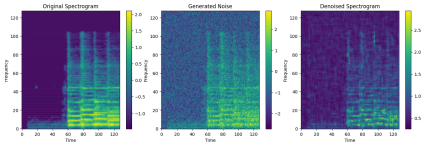
The figures below illustrate intermediate results from the denoising and noising experiments.



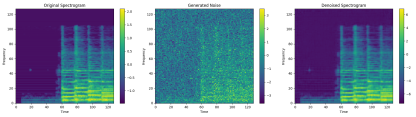
Plot 1: Noising process visualization



Plot 2: Denoising process



Plot 3: Loss function comparison



Plot 4: Final reconstructed sample

4.Conclusion

This week provided deeper insight into the inner workings of diffusion-based generative models. The experiments revealed how architectural depth and loss function choice affect denoising performance. The next step will involve optimizing training stability and exploring attention-based U-Net extensions.