# **Denoising Autoencoder for Audio Noise Reduction**

This repository contains a **Denoising Autoencoder** model developed in PyTorch, designed to reduce noise in audio data by learning to reconstruct clean versions of noisy spectrograms. The model can effectively separate noise from relevant audio features, making it a powerful tool for applications like speech enhancement and audio restoration.

The Denoising Autoencoder model uses a convolutional neural network (CNN) architecture to learn mappings between noisy and clean Mel spectrograms. The model is trained on pairs of noisy-clean spectrograms, allowing it to output cleaned versions of previously unseen noisy audio.The model was trained on the LibriSpeech dataset, a publicly available corpus of clean speech recordings. Gaussian noise is added to each audio sample to generate noisy inputs, while the original clean samples are used as targets.

## **Model Architecture**

* **Encoder**: Three convolutional layers progressively down-sample the noisy spectrogram input, compressing it into a latent representation and reducing noise.
* **Decoder**: Three transpose convolutional layers up-sample the compressed representation back to the original spectrogram dimensions, reconstructing a cleaner version of the input.

The model is trained using a Mean Squared Error (MSE) loss function, which measures the difference between the model’s output and the target clean spectrogram, optimizing it through backpropagation with the Adam optimizer.

**Requirements**

* PyTorch (1.6 or later)
* Librosa
* NumPy
* Scikit-learn

Will be working on other models in order to improve performance .