BAND FILTER ASSISTED U-NET DESIGNS FOR DENOISING TRAFFIC SOUNDS IN MUSICAL RECORDINGS

The 3rd HSSPF

Introduction

Modern deep learning models such as U-Net architectures have shown strong performance in audio restoration tasks but often suffer from high computational cost, limiting their practicality for users with constrained hardware. A combination of band filter and U-Net model is proposed to reduce the computational requirements of the U-Net while preserving denoising quality. Additionally, a composite loss function is also introduced that allows for the model to train more effec-tively on traffic noise.

U-Net Loss Function Design

- MAE treats all errors linearly
- MSE disproportionately penalizes larger errors
- Composite loss as a weighted sum of MAE and MSE losses
- Weights are adjustable, add to 1.

Training Result

NMSE provides an objective measure of how much the desired signal remains relative to residual noise after denois-ing, with a lower NMSE indicating better preservation of the cle

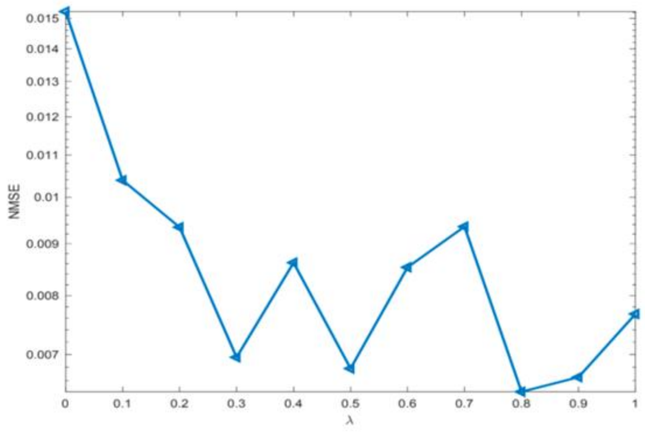

Fig. 2. Normalized Mean Squared Error (NMSE) versus λ in the composite loss function.

Hybrid U-Net Based Music Denoising Filter

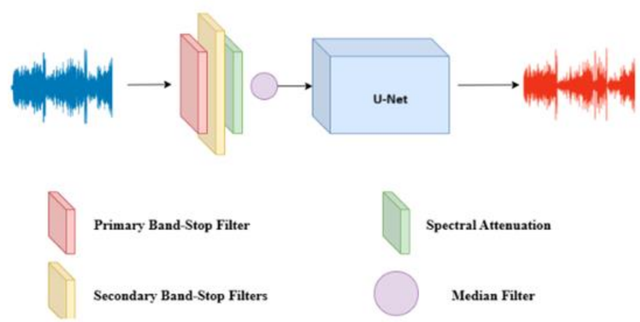

Fig. 1. Hybrid U-Net Based Music Denoising Filter

Filtering pipeline design

- Broad band-stop filtering.
- narrowband notch filtering.
- STFT-based spectral suppression.
- Weighted blending strategy.

Bio:

- Brady Zhang is a senior at Chattahoochee High School
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- President of the CHS Math Team and Band, Vice President of Math Honor Society and Physics Olympiad Team, and participates in community service activities including tutoring and musical performances.

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SAM meets STEM