Audio signal interpolation using optimal transportation of spectrograms

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Problem setting

- **Problem**: Given two audio signals $\mathbf{y}^s$ (source) and $\mathbf{y}^t$ (target), generate an interpolant $\mathbf{y}^\alpha$ with $\alpha \in [0, 1]$, using optimal transport (OT).

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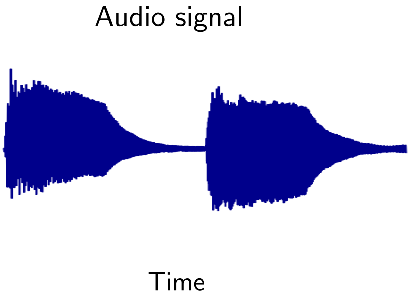

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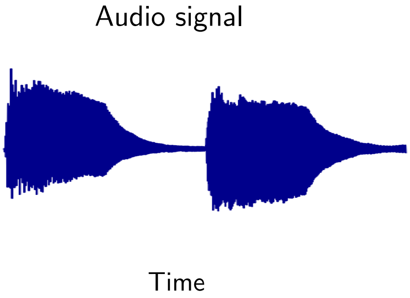

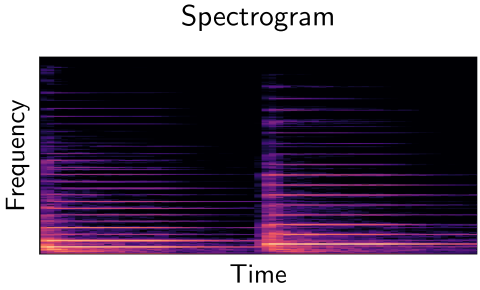

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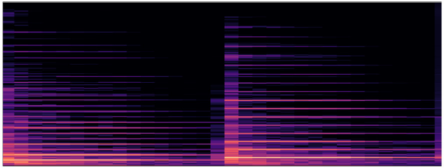
- **Idea**: Treat the normalized spectrogram $\mathbf{X} \in \mathbb{R}_+^{M \times N}$ as a **discrete probability distribution** μ:

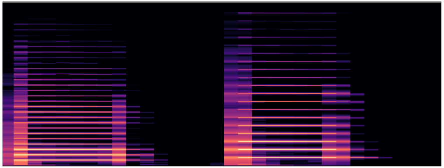
$$\mu := \sum_{m=1}^{M} \sum_{n=1}^{N} X_{mn} \delta_{(f_m, t_n)}.$$

Baseline approach with OT

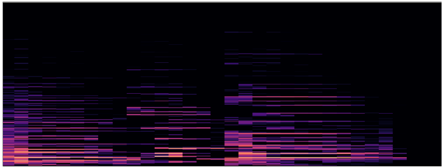
Piano (source)



Guitar (target)

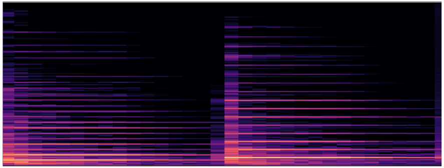


Wasserstein barycenter



Limit temporal transportation with structured cost matrix and UOT

Piano (source)



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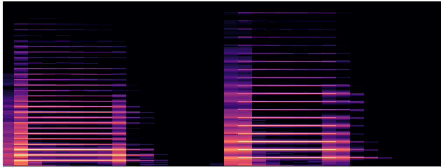

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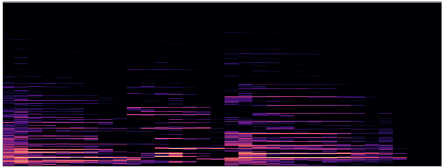

Structured cost matrix and UOT