GenAI for Sound Design

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Sound Design

Art and practice of creating audio elements for various media, including films, television, video games, theater, etc.

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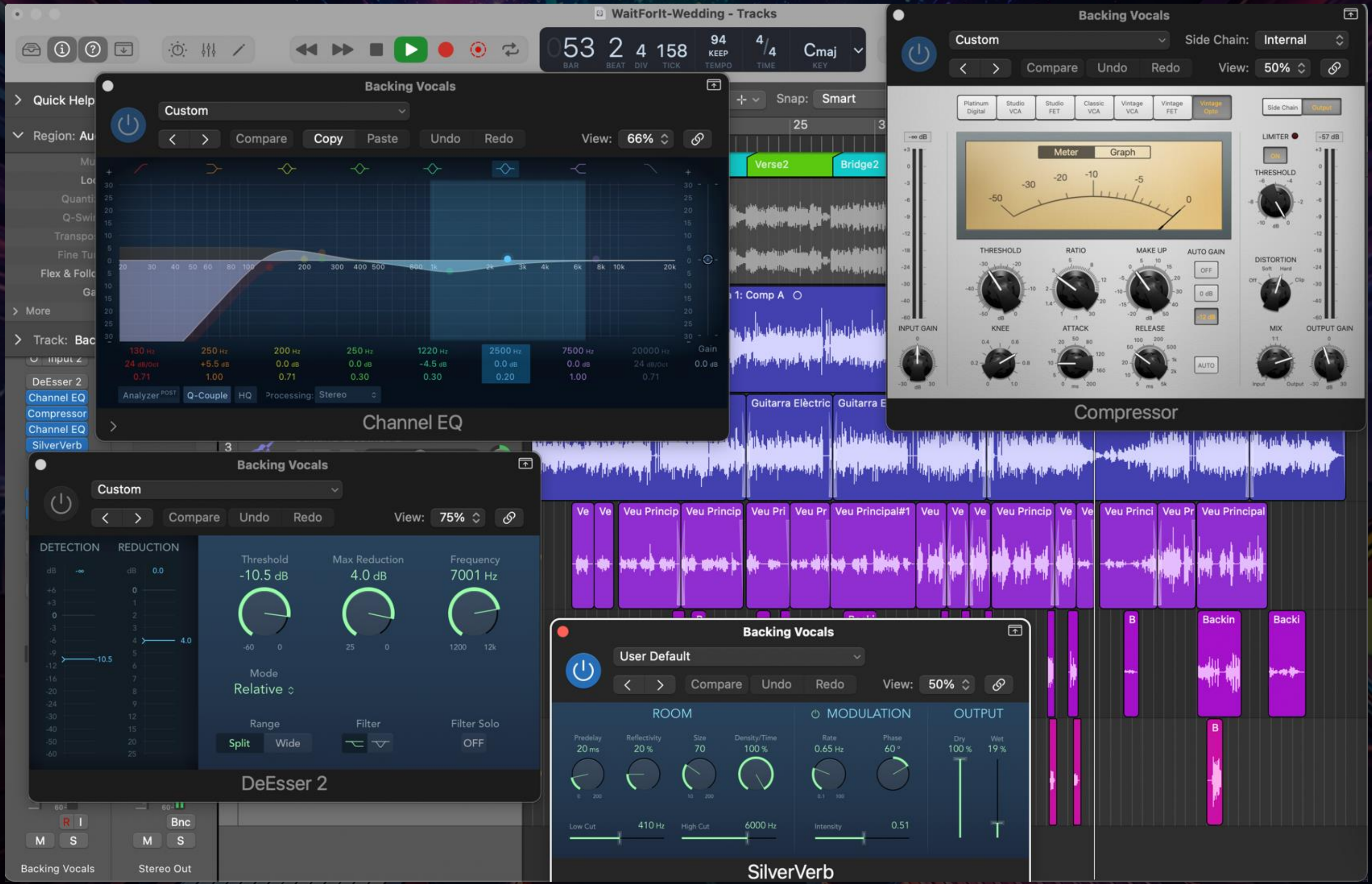

Art and practice of creating audio elements for various media, including films, television, video games, theater, etc.

Sound Design AI Group (SODA)

AdobeResearch

CAVAORG

The SODA Team

Justin Salamon

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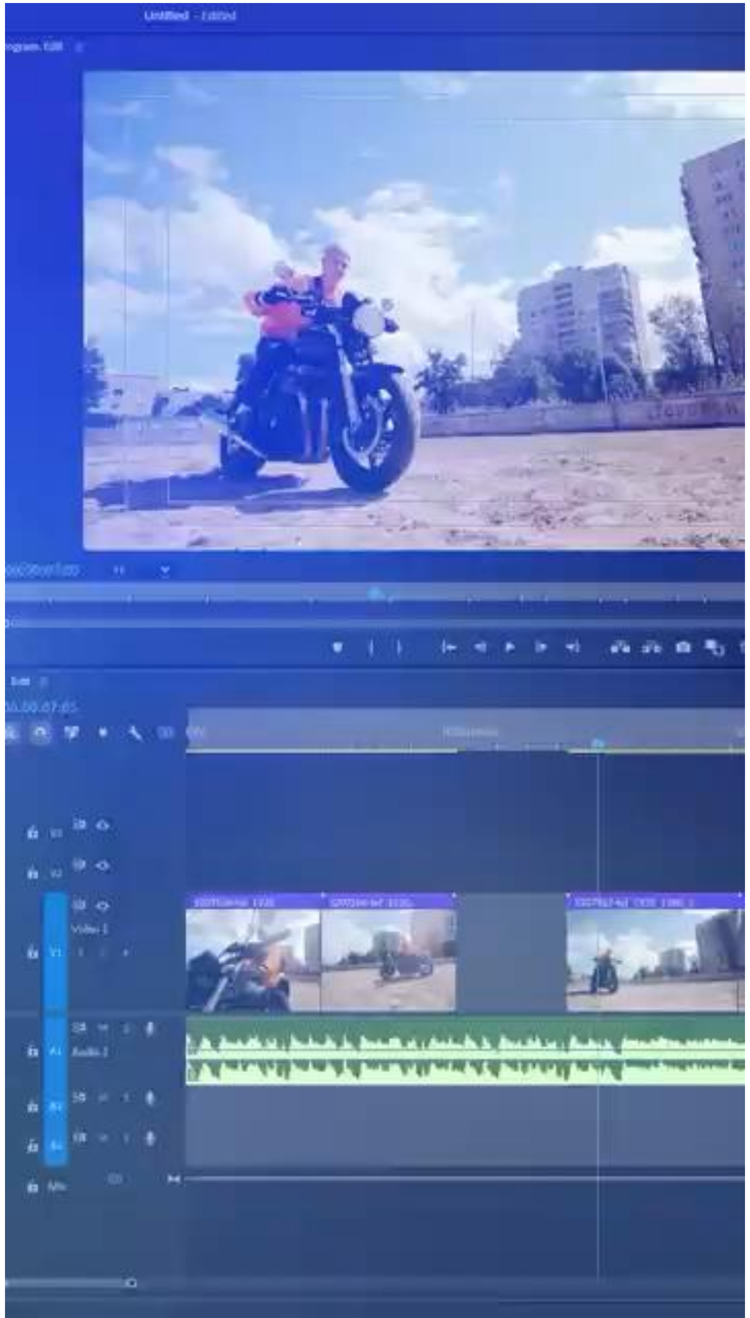
Generative Extend in Premiere Pro



https://www.youtube.com/shorts/PY4PKBI2Zac

Outline

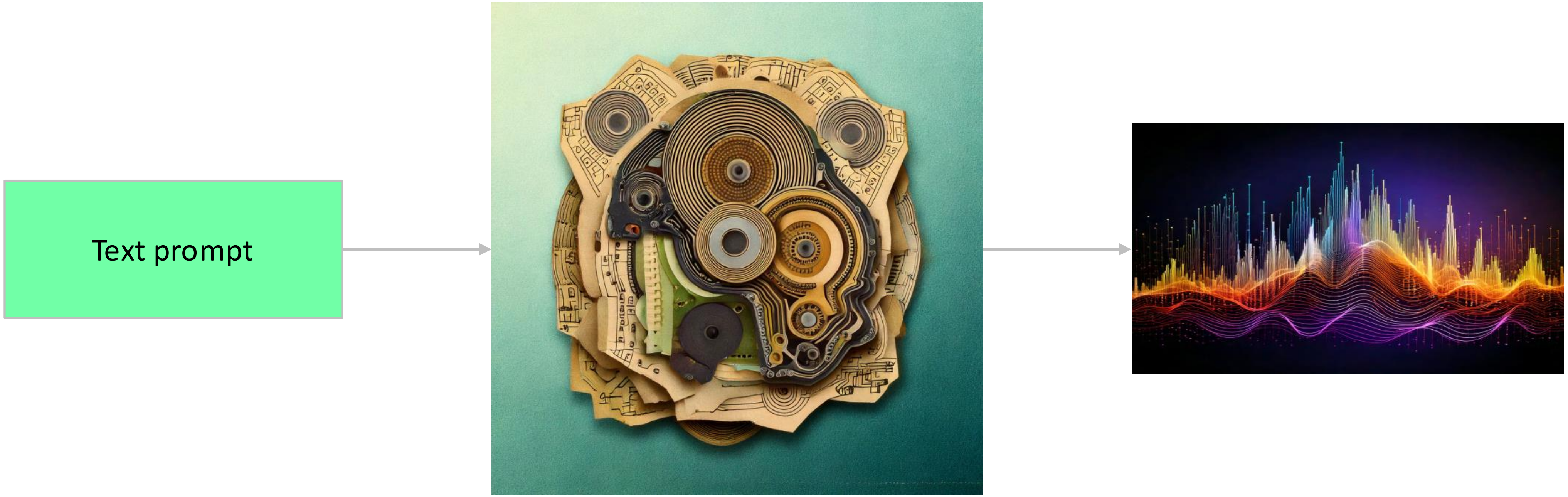
Diffusion Models for Audio Generation

SILA

Sketch2Sound

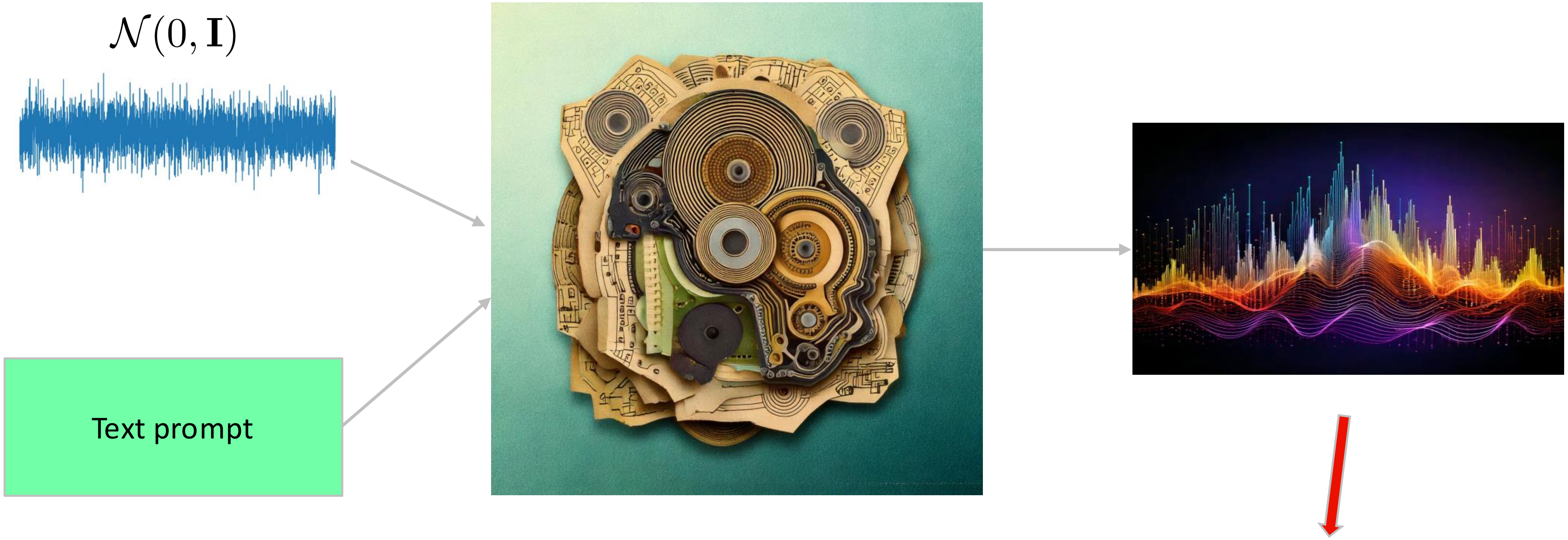
MultiFoley

Diffusion Models for Audio Generation



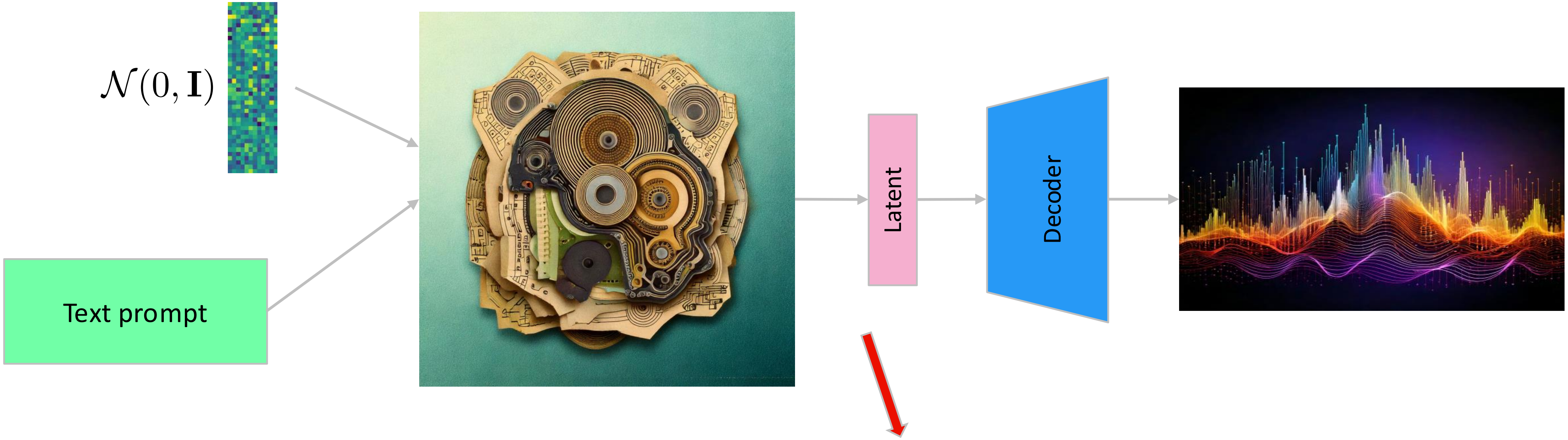
Text prompt

Diffusion Models for Audio Generation



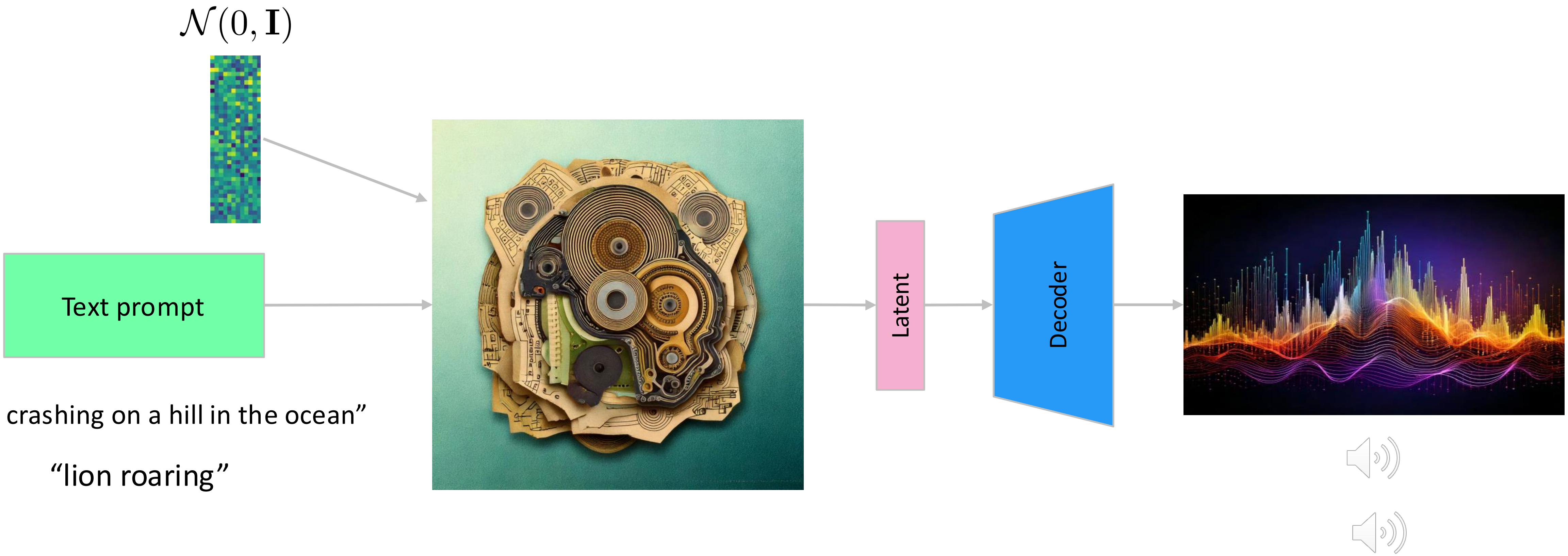
High quality audio is very high dimensional (~48kHz!)

Latent Diffusion Models for Audio Generation



- Audio **latent** space is much more compact (~40Hz)
- E.g., VAEs [1], RVQ [2], DAC [3]

Examples of Latent Diffusion Models for Audio Gen

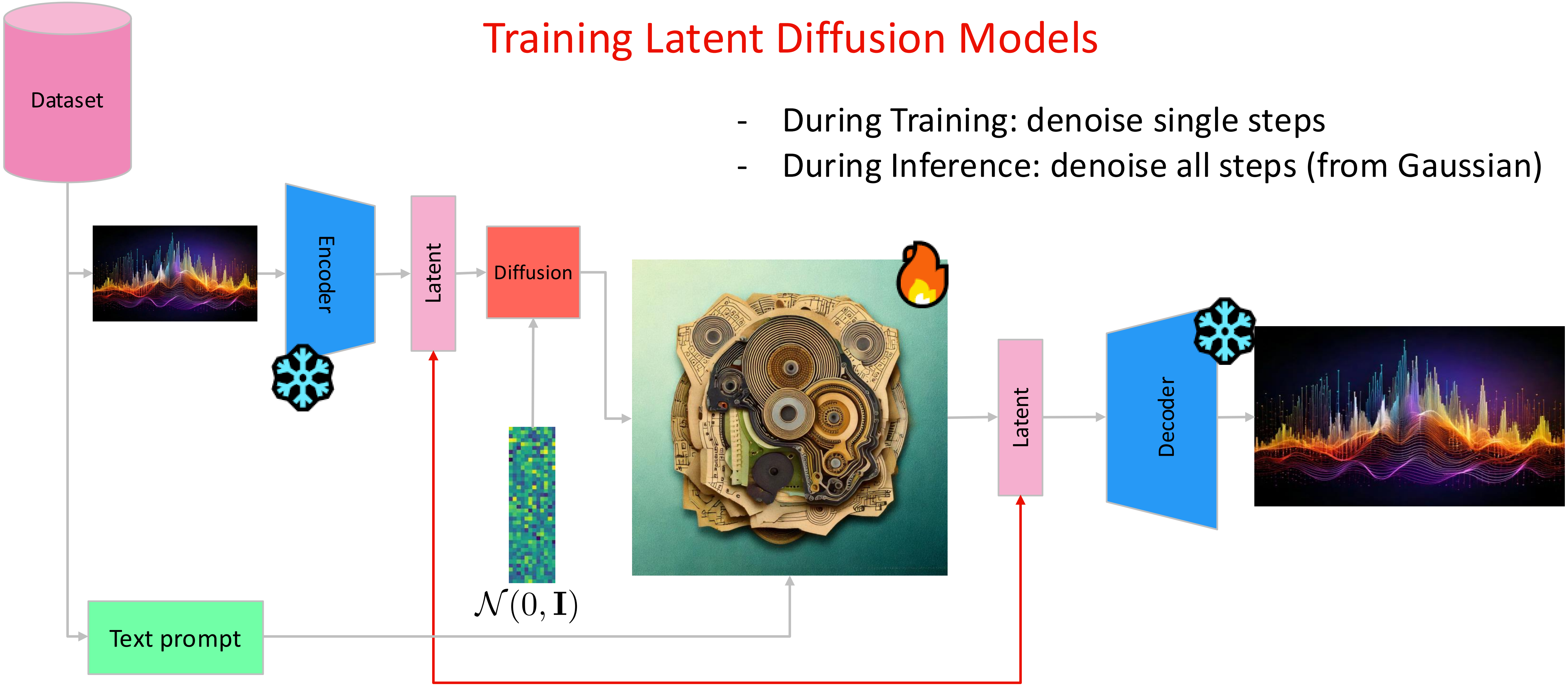


”waves crashing on a hill in the ocean”

“lion roaring”

Training Latent Diffusion Models

- During Training: denoise single steps
- During Inference: denoise all steps (from Gaussian)



$$\mathcal{L}_\theta = \mathbb{E}[||\mathbf{z} - \hat{\mathbf{z}}||^2]$$

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Diffusion Models for Audio Generation

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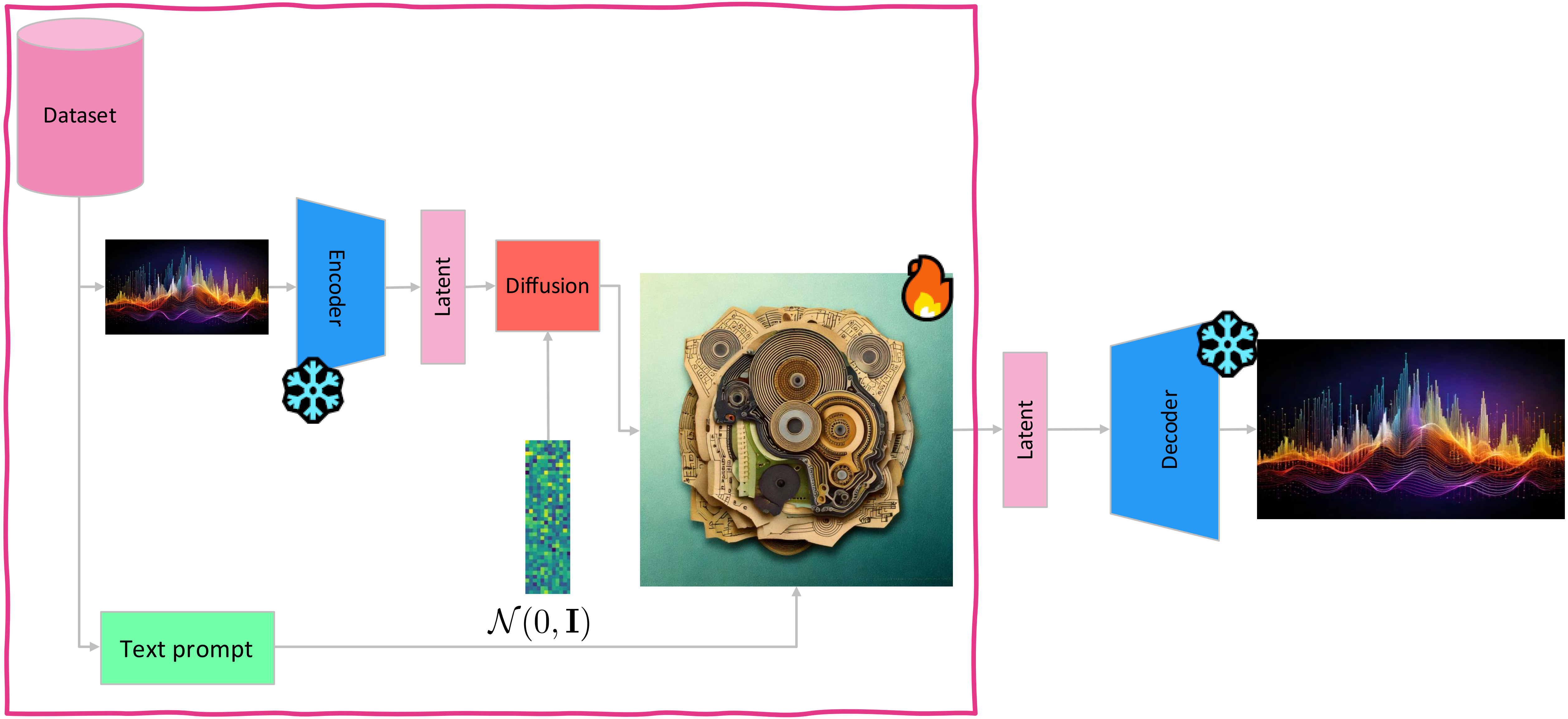
SILA: Signal-to-Language Augmentation for Enhanced Control in Text-to-Audio Generation

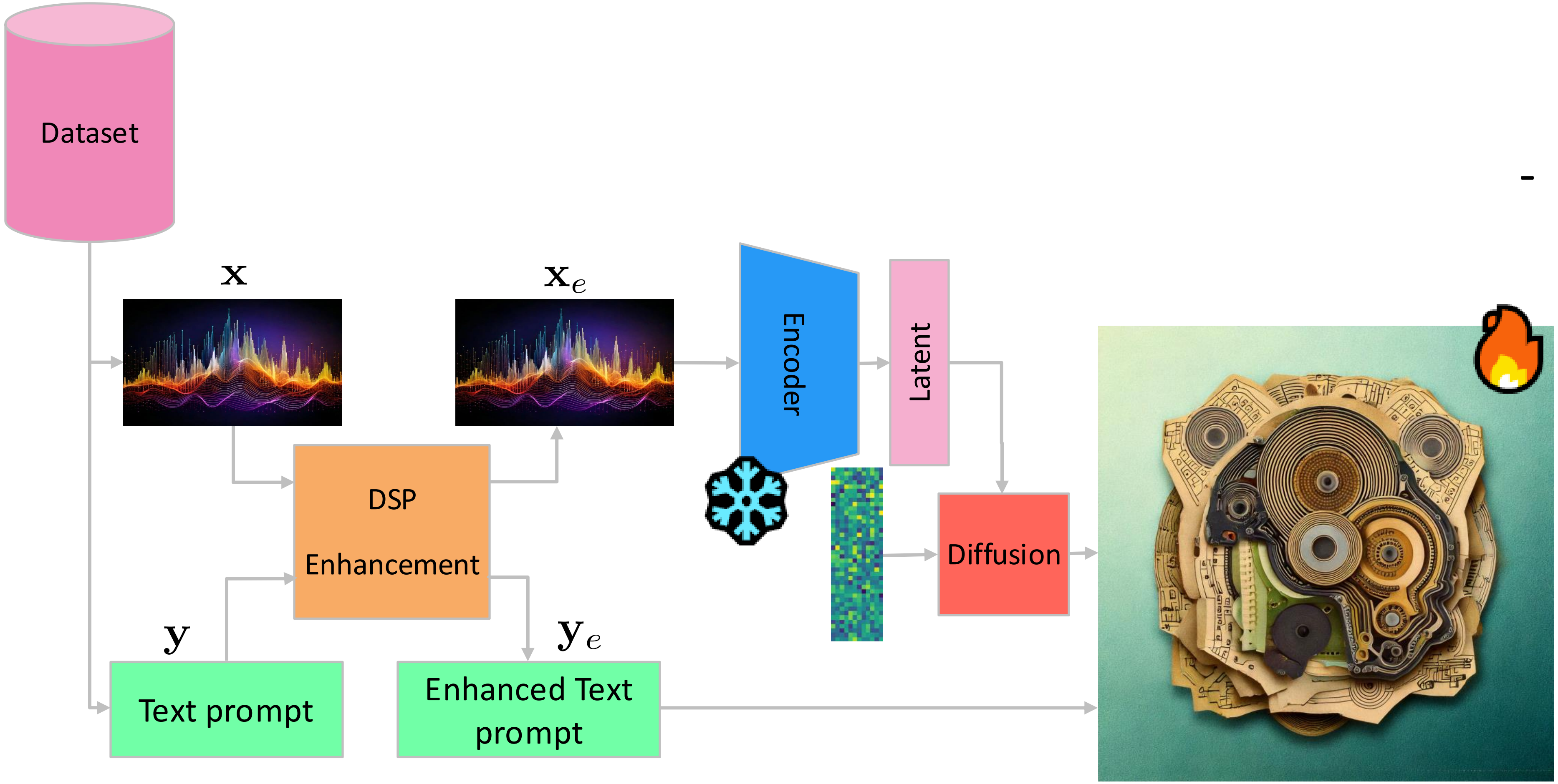
- Text-based models have limited control
- Hard to obtain desired results with a single text prompt
- Can we add control with minimal impact in architecture/performance?

Kumar, S., Seetharaman, P., Salamon, J., Manocha, D., Nieto, O., SILA: Signal-to-Language Augmentation for Enhanced Control in Text-to-Audio Generation. Submitted to IEEE Signal Processing Letters, 2025

SILA: Signal-to-Language Augmentation for Enhanced Control in Text-to-Audio Generation



SILA: Signal-to-Language Augmentation for Enhanced Control in Text-to-Audio Generation



- DSP Enhancement:
  - Loudness
  - Pitch
  - Reverb
  - Noise
  - Brightness
  - Fade
  - Duration

SILA: Signal-to-Language Augmentation for Enhanced Control in Text-to-Audio Generation

- Signal

  - Volume (LKFS): -10
  - Brightness (SC): 65
  - Reverb: Add a lot
  - …

- Signal output

- Language

- Original prompt:
  - “A thunder echoes through the sky”

- + “, & loudness: very loud”
- + “, & brightness: bright”
- + “, & reverb: very wet”
- …

- SILA prompt:
  - “A thunder echoes through the sky, & loudness: very loud, & brightness: bright, & reverb: very wet, …”

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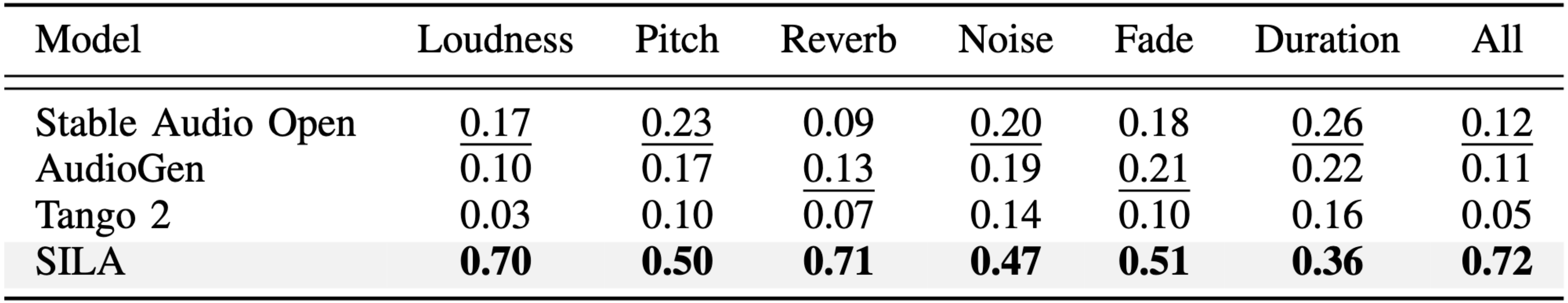
SILA: Signal-to-Language Augmentation for Enhanced Control in Text-to-Audio Generation

- Perceptual Evaluation Results (22 subjects)



Model	Loudness	Pitch	Reverb	Noise	Fade	Duration	All
Stable Audio Open	0.17	0.23	0.09	0.20	0.18	0.26	0.12
AudioGen	0.10	0.17	0.13	0.19	0.21	0.22	0.11
Tango 2	0.03	0.10	0.07	0.14	0.10	0.16	0.05
SILA	**0.70**	**0.50**	**0.71**	**0.47**	**0.51**	**0.36**	**0.72**

SILA: Signal-to-Language Augmentation for Enhanced Control in Text-to-Audio Generation

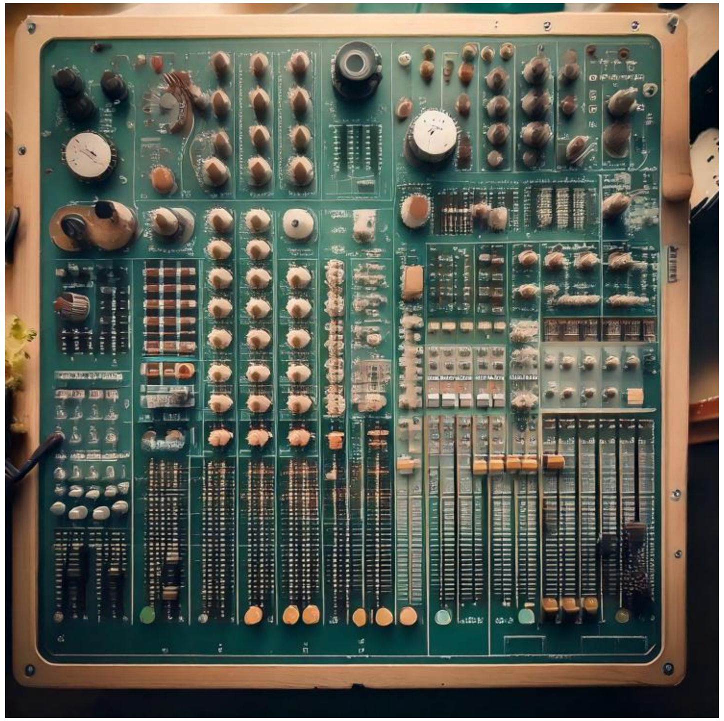
Examples

“The deep rumble of the storm echoes through the sky, & loudness: soft” 🔊

“The deep rumble of the storm echoes through the sky, & loudness: very loud” 🔊

“A dog barking nearby, & reverb: dry” 🔊

“A dog barking nearby, & reverb: wet” 🔊



SILA: Signal-to-Language Augmentation for Enhanced Control in Text-to-Audio Generation

- Added control across several acoustic features

- Highly efficient
    - No added computation during inference

- Model agnostic

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Diffusion Models for Audio Generation

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MultiFoley

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Sketch2Sound: Controllable Audio Generation via Time-Varying Signals and Sonic Imitations

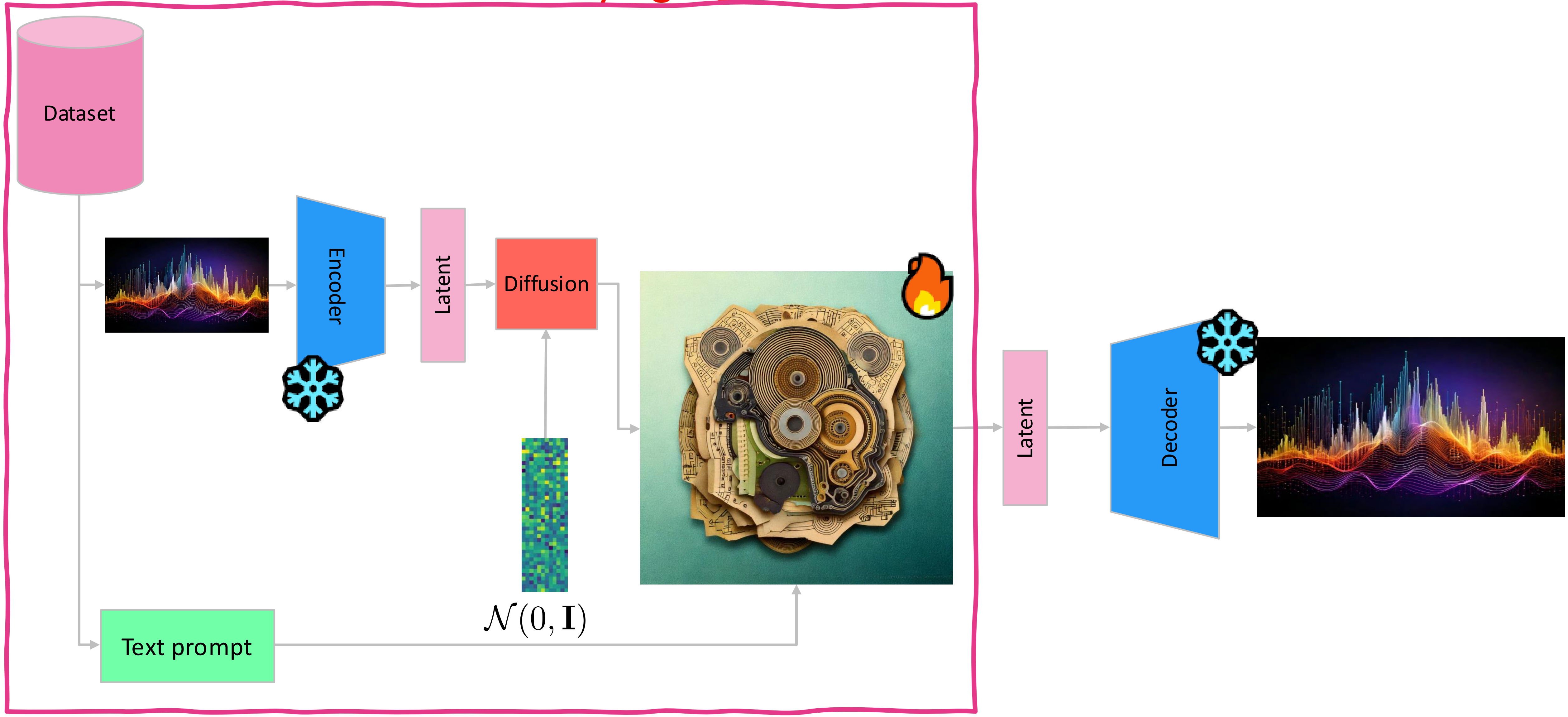
- Text prompts can be quite limiting
  - (Even with SILA alone!)

- Lack of fine-grained control/expression

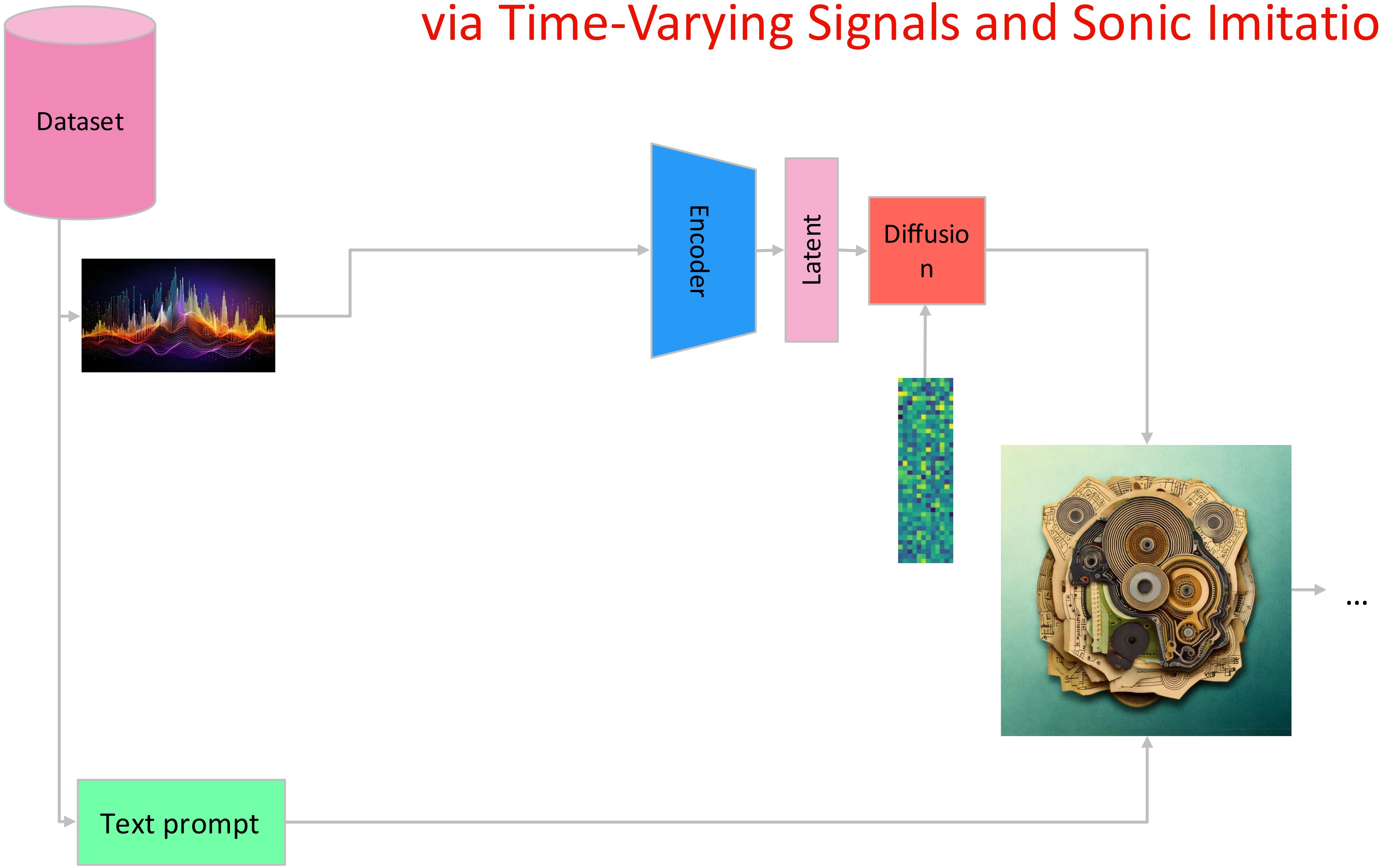
- Can we control the generation via *audio*?

Flores García, H., Nieto, O., Salamon, J., Pardo, B., Seetharaman, P., Sketch2Sound: Controllable Audio Generation via Time-Varying Signals and Sonic Imitations, In Proc. of the 50th International Conference on Acoustics, Speech, and Signal Processing (ICASSP), Hyderabad, India, 2025

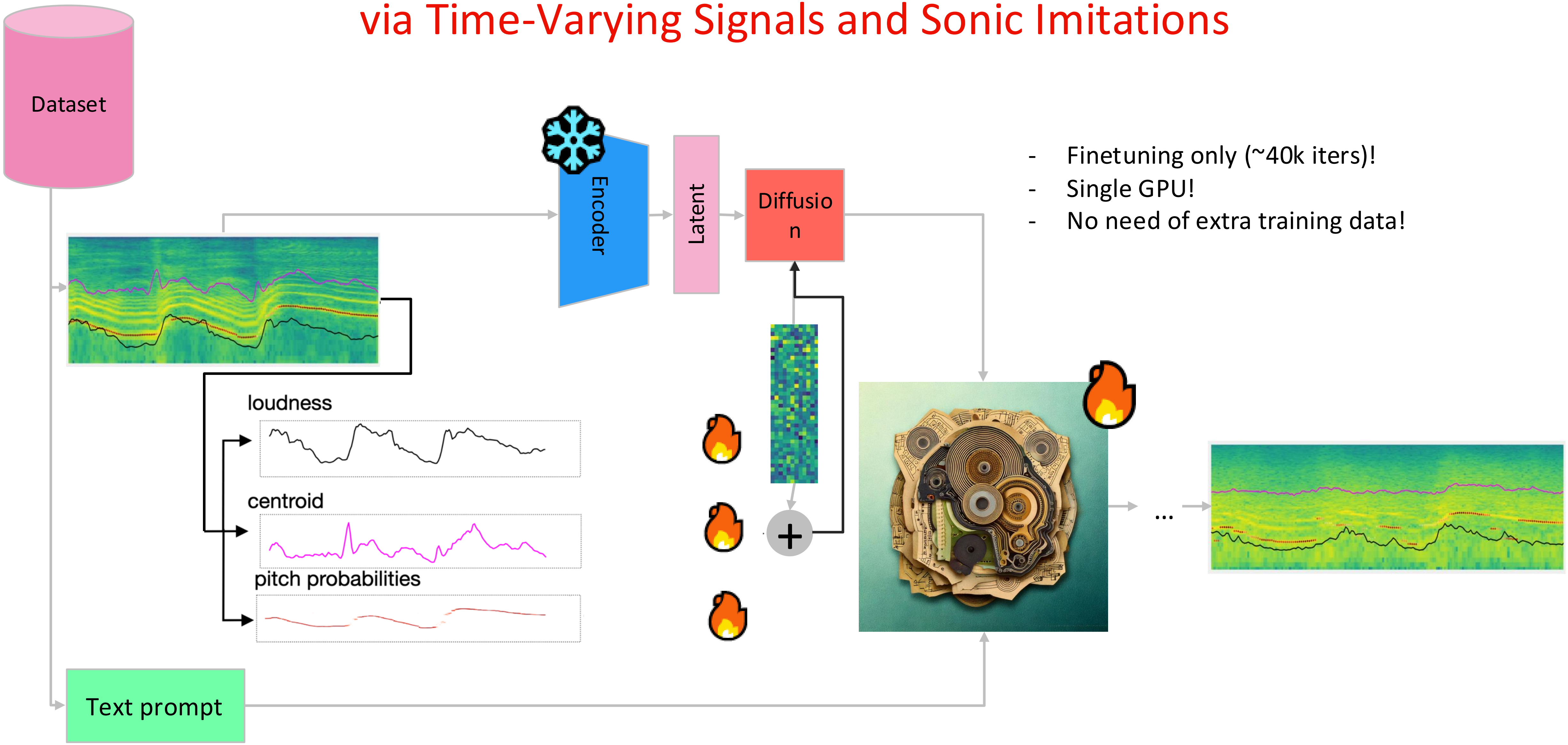
Sketch2Sound: Controllable Audio Generation via Time-Varying Signals and Sonic Imitations



Sketch2Sound: Controllable Audio Generation via Time-Varying Signals and Sonic Imitations



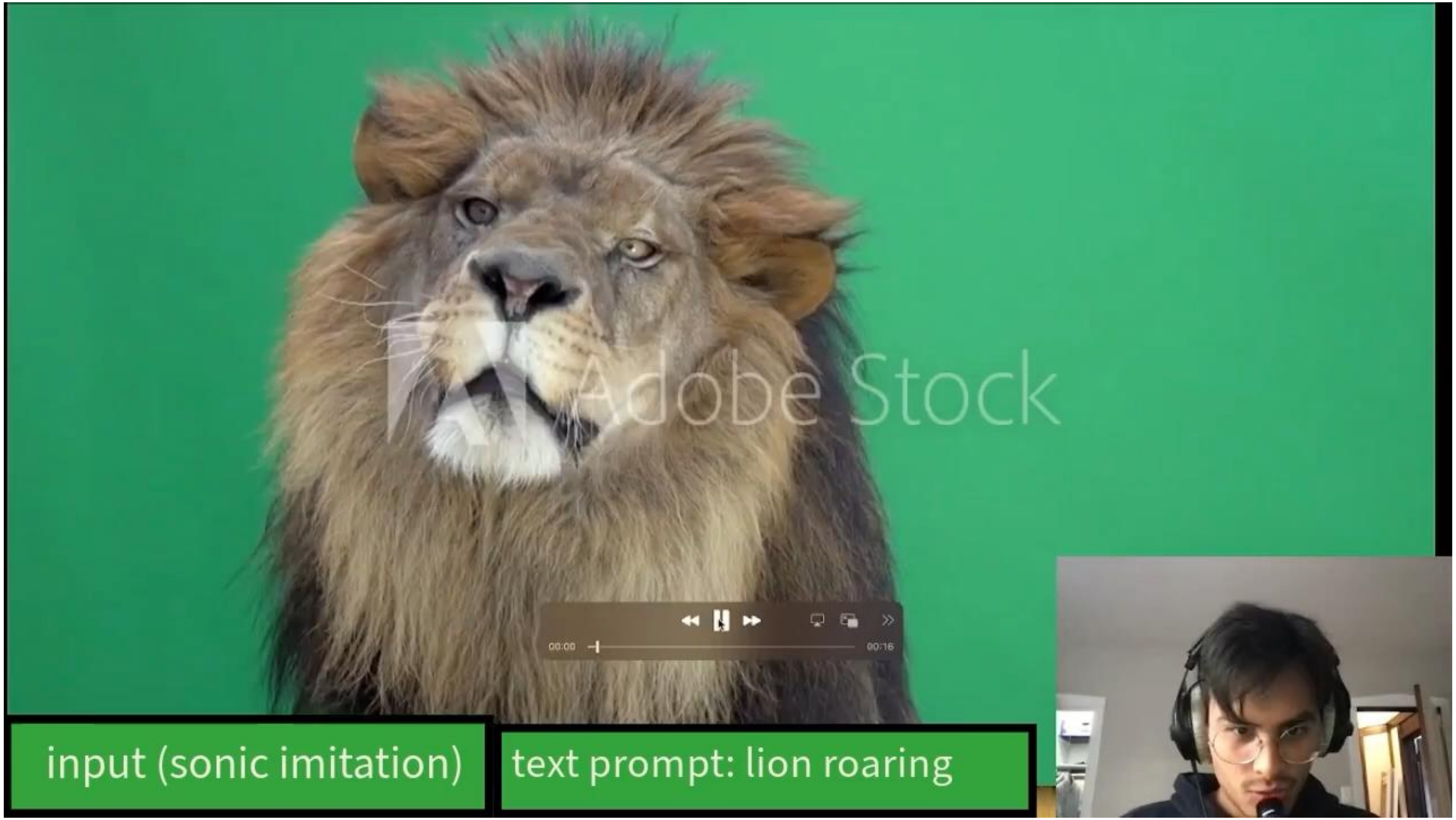
Sketch2Sound: Controllable Audio Generation via Time-Varying Signals and Sonic Imitations



- Finetuning only (~40k iters)!
- Single GPU!
- No need of extra training data!

Sketch2Sound: Controllable Audio Generation via Time-Varying Signals and Sonic Imitations

- Video examples:

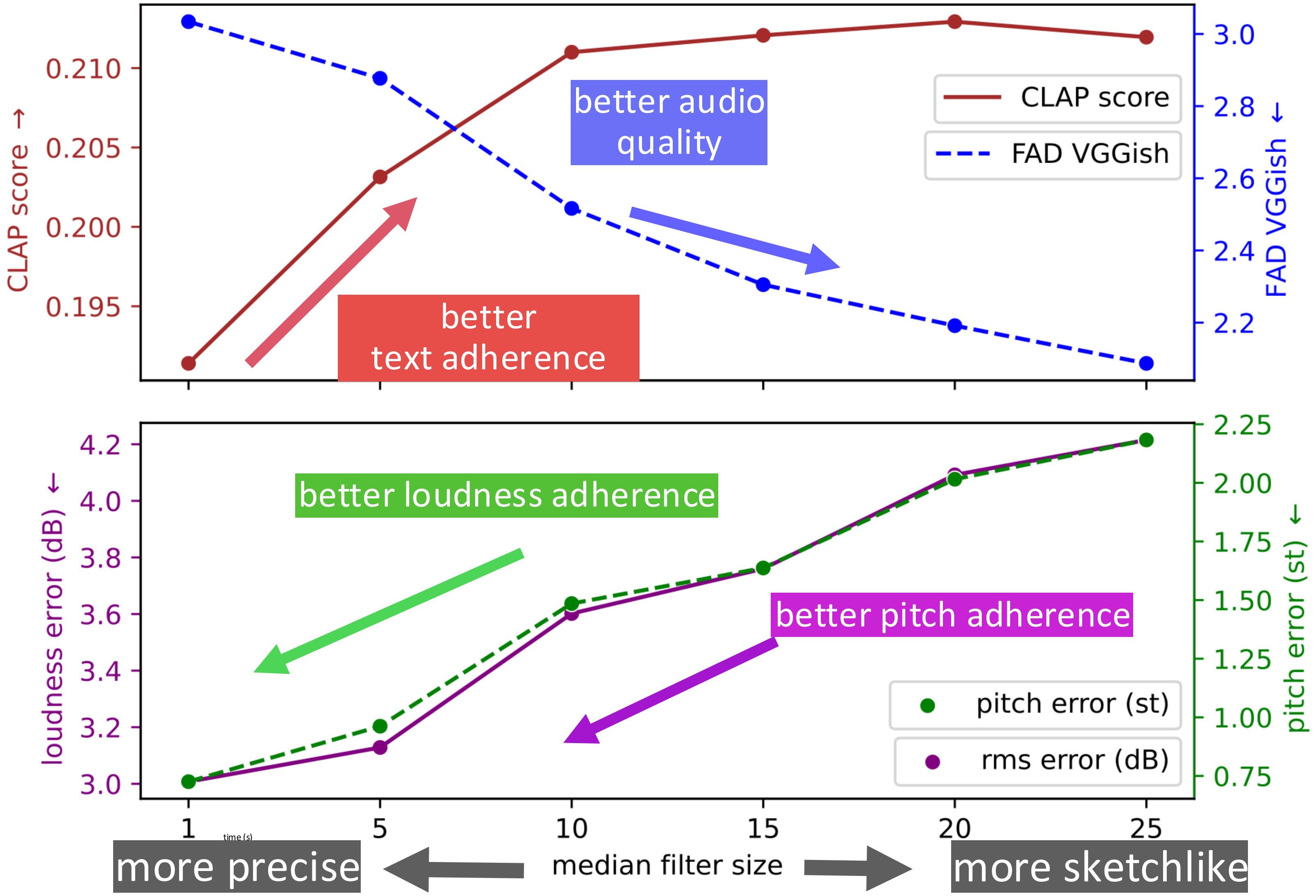


Sketch2Sound: Controllable Audio Generation via Time-Varying Signals and Sonic Imitations

- Video examples:

sketch types

median filter size randomized during training!



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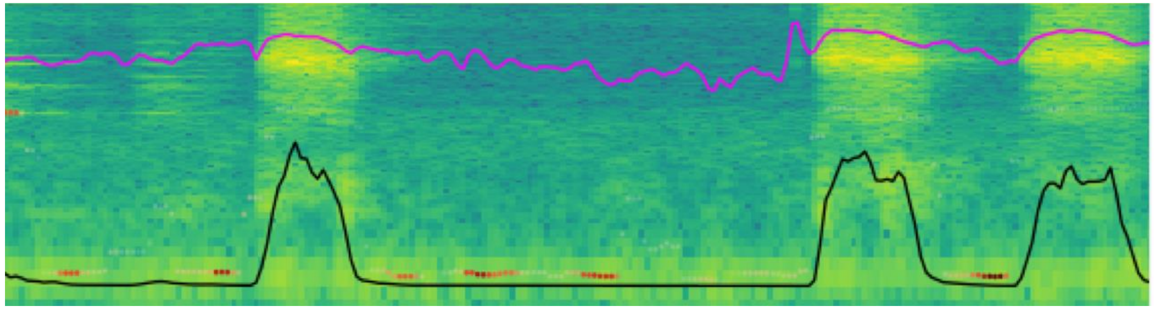
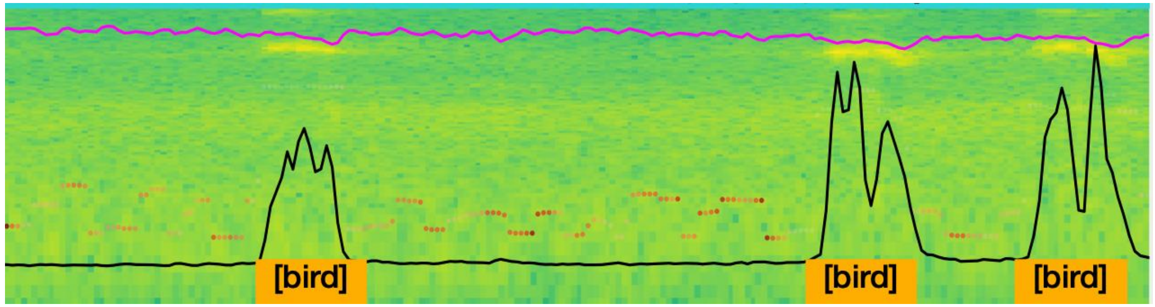
the semantics of control curves are implicitly modeled

input (sonic imitation)



prompt: **"forest ambience"**



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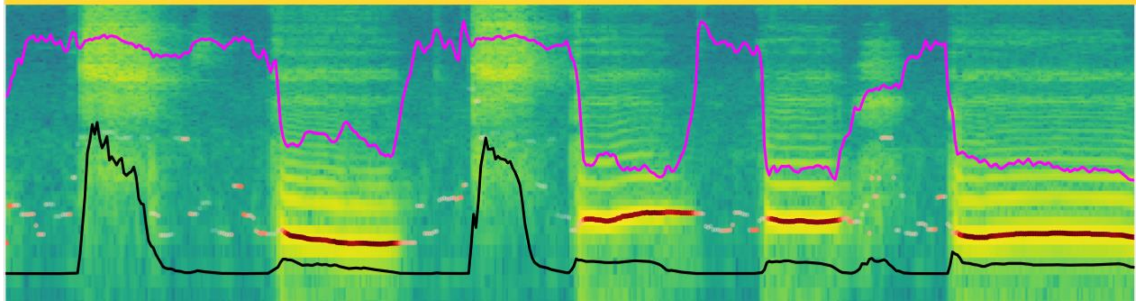
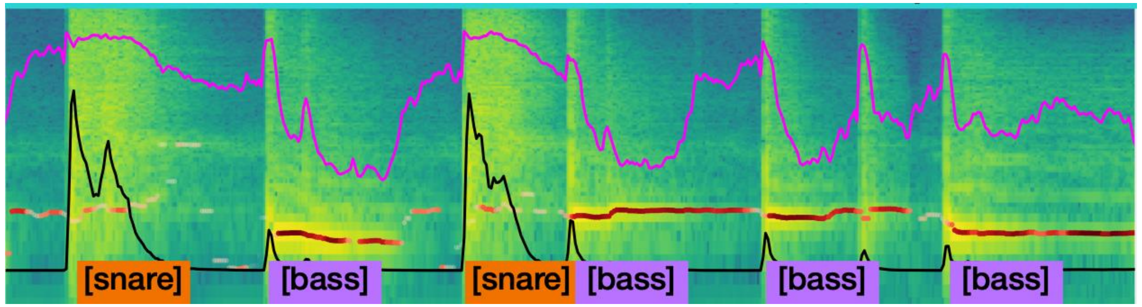


prompt: **"bass drum, snare drum"**



Sketch2Sound: Controllable Audio Generation via Time-Varying Signals and Sonic Imitations

- Control generation with *audio*
  - Fine-grained control

- Keep human in the loop!
  - Expressive vocal input
  - Tunable sketch types (median filter)!

- Efficient method
  - Model agnostic!

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SILA

Sketch2Sound

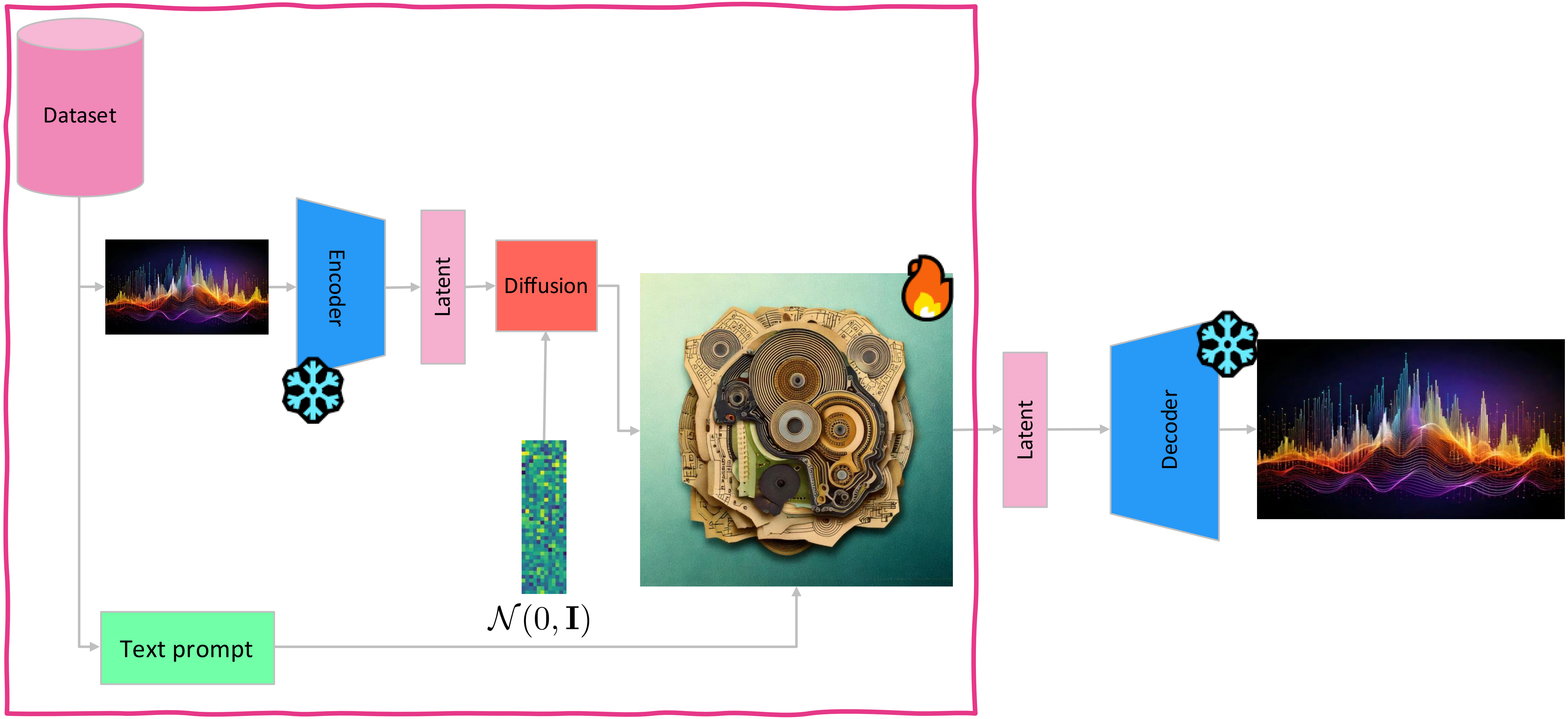
MultiFoley

MultiFoley: Video-Guided Foley Sound Generation with Multimodal Controls

- Perfect synchronization with video can be tedious
- Can we use videos as an additional condition for the generation?
- How about a combination of **text, audio, and video** as conditions?

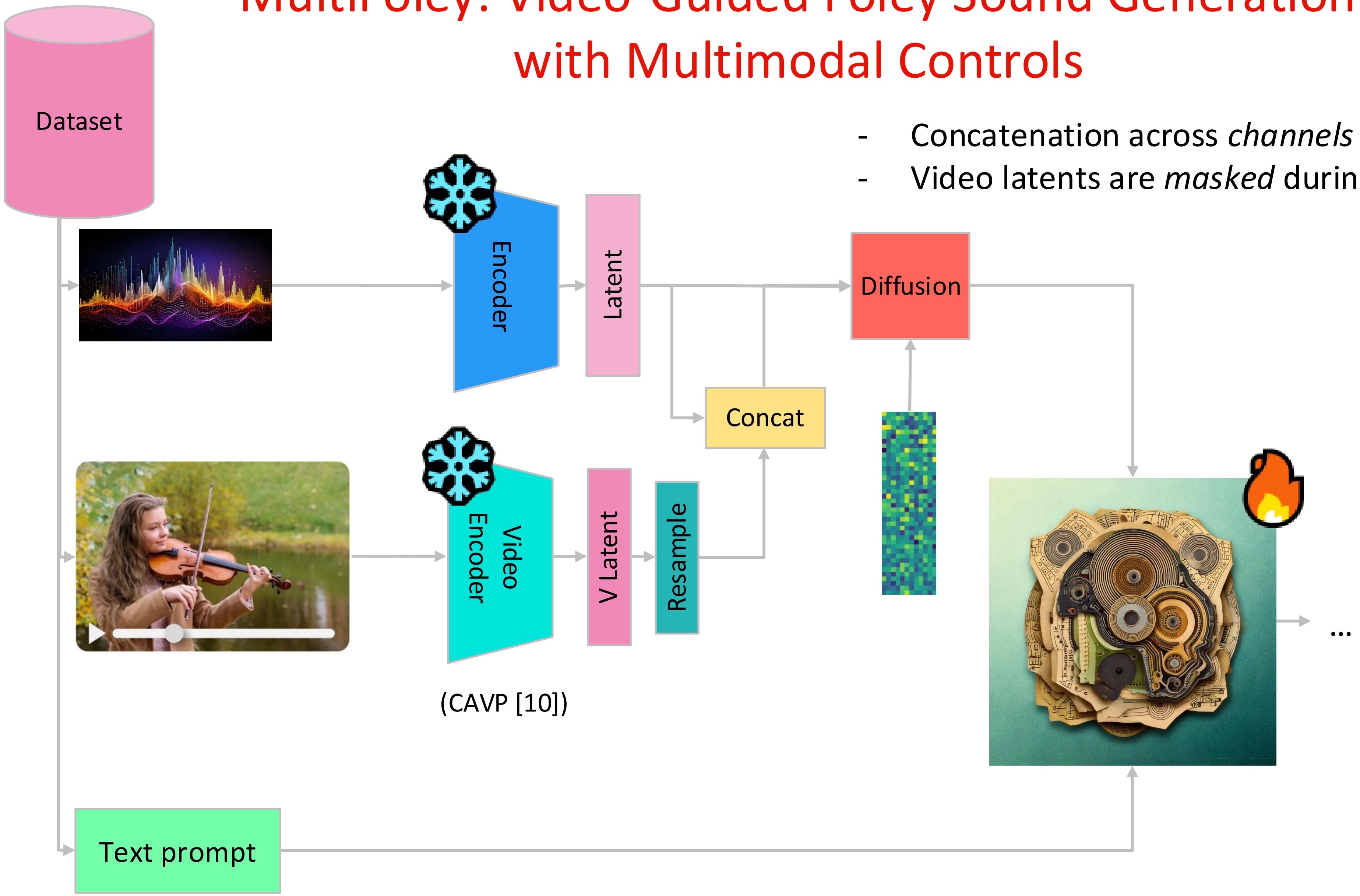
Chen, Z., Seetharaman, P., Russell, B., Nieto, O., Bourgin, D., Owens, A., Salamon, J., Video-Guided Foley Sound Generation with Multimodal Controls, Submitted to IEEE / CVF Computer Vision and Pattern Recognition Conference (CVPR), 2025

MultiFoley: Video-Guided Foley Sound Generation with Multimodal Controls



MultiFoley: Video-Guided Foley Sound Generation with Multimodal Controls

- Concatenation across *channels* dim
- Video latents are *masked* during diff (ie, no video gen)



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MultiFoley: Video-Guided Foley Sound Generation with Multimodal Controls

“Bird Chirping”

MultiFoley: Video-Guided Foley Sound Generation with Multimodal Controls

“Rooster Crowing”

Adobe

MultiFoley: Video-Guided Foley Sound Generation with Multimodal Controls

“Male Speaking”

MultiFoley: Video-Guided Foley Sound Generation with Multimodal Controls

"Sheep Bleating"

Adobe

MultiFoley: Video-Guided Foley Sound Generation with Multimodal Controls

“Typewriter”

MultiFoley: Video-Guided Foley Sound Generation with Multimodal Controls

“Piano”

MultiFoley: Video-Guided Foley Sound Generation with Multimodal Controls

“Keyboard”

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MultiFoley: Video-Guided Foley Sound Generation with Multimodal Controls

“Cello”

MultiFoley: Video-Guided Foley Sound Generation with Multimodal Controls

“Erhu”

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MultiFoley: Video-Guided Foley Sound Generation with Multimodal Controls

“Chainsaw”

MultiFoley: Video-Guided Foley Sound Generation with Multimodal Controls

Given this reference dog bark audio

We generate sound for this silent video

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MultiFoley: Video-Guided Foley Sound Generation with Multimodal Controls

- Method to generate audio from video
- Multimodal control: audio, video, and text!
- High quality output even when trained on low-quality video dataset (VGGSound)

Closing Remarks

SILA
(enhanced text control)

Sketch2Sound
(voice control)

MultiFoley
(video, text, and audio control)

ROYAL OAK

References

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[5] Flores García, H., Nieto, O., Salamon, J., Pardo, B., Seetharaman, P., Sketch2Sound: Controllable Audio Generation via Time-Varying Signals and Sonic Imitations, In Proc. of the 50th International Conference on Acoustics, Speech, and Signal Processing (ICASSP), Hyderabad, India, 2025

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[7] Ho, J., Jain, A., Abbeel, P., Denoising Diffusion Probabilistic Models, In Proc. of Neural Information Processing Systems (NeurIPS), 2020

[8] Liu, H., Chen, Z., Yuan, Y., Mei, X., Liu, X., Mandic, D., Wang, W., Plumbley, M. D., AudioLDM: Text-to-Audio Generation with Latent Diffusion Models, In Proc. of the International Conference on Machine Learning (ICML), 2023

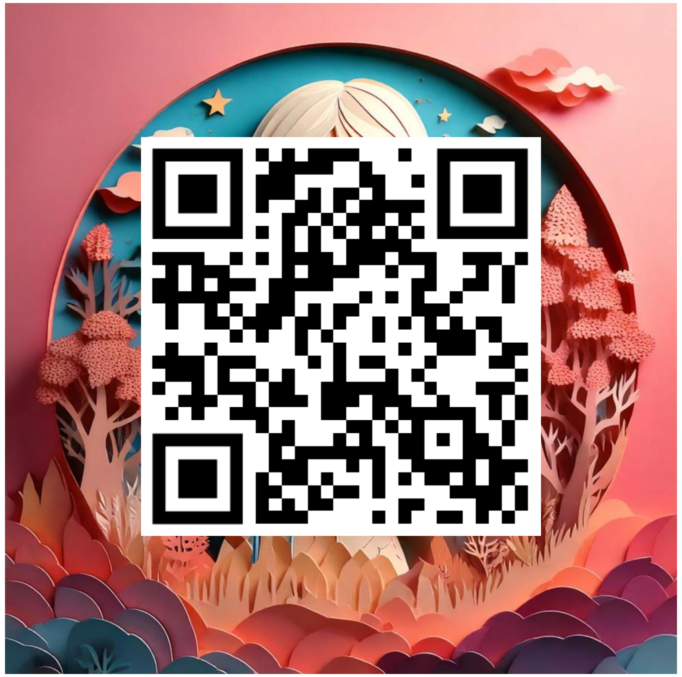
[9] Peebles,W., Xie, S., Scalable Diffusion Models with Transformers, In. Proc. of the IEEE / CVF Computer Vision and Pattern Recognition Conference (CVPR), 2023

[10] Luo, S., Yan, C., Hu, C., Zhao, H., Diff-Foley: Synchronized Video-to-Audio Synthesis with Latent Diffusion Models, In Proc. of Neural Information Processing Systems (NeurIPS), 2023

Thank you!

SILA
(enhanced text control)

Sketch2Sound
(voice control)



MultiFoley
(video control)

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