

# MuseGAN: Multi-track Sequential Generative Adversarial Networks for Symbolic Music Generation and Accompaniment

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**Demo Page** <https://salu133445.github.io/musegan/>

*\*these authors contributed equally to this work*

# Outline

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- Goals & Challenges
- Data
- Proposed Model
- Results & Evaluation
- Future Works

**Source Code** <https://github.com/salu133445/musegan>  
**Demo Page** <https://salu133445.github.io/musegan/>

# Goals

[Source Code]

<https://github.com/salu133445/musegan>

[Demo Page]

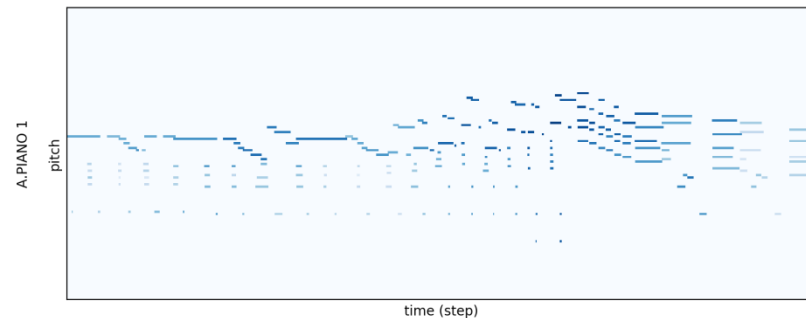
<https://salu133445.github.io/musegan/>

## Generate pop music

- of **multiple tracks**



- in **piano-roll** format

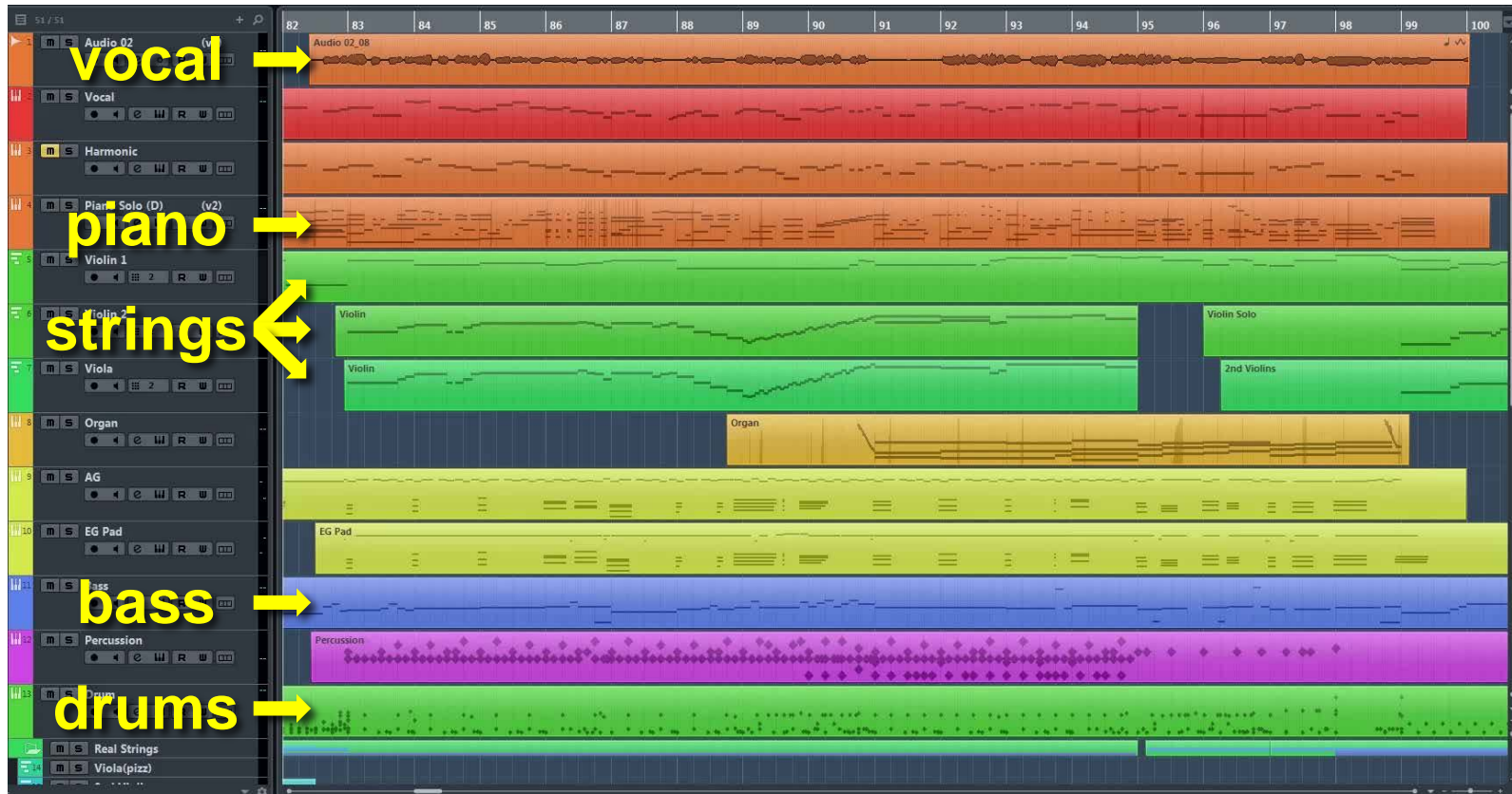


- using **GAN** with **CNNs**

# Challenge I

# Multi-track GAN

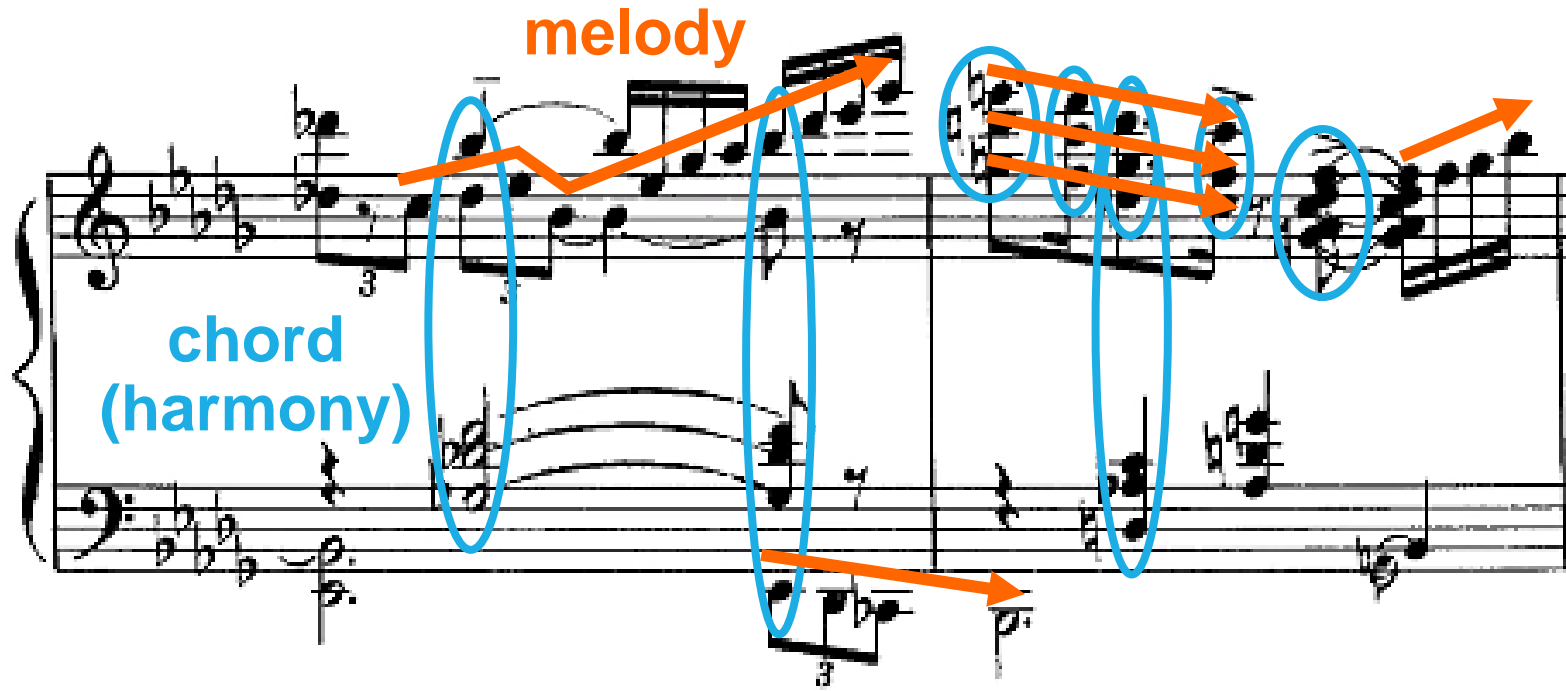
# Multitrack Interdependency



music & clip by *phycause*

# Challenge II Music Texture

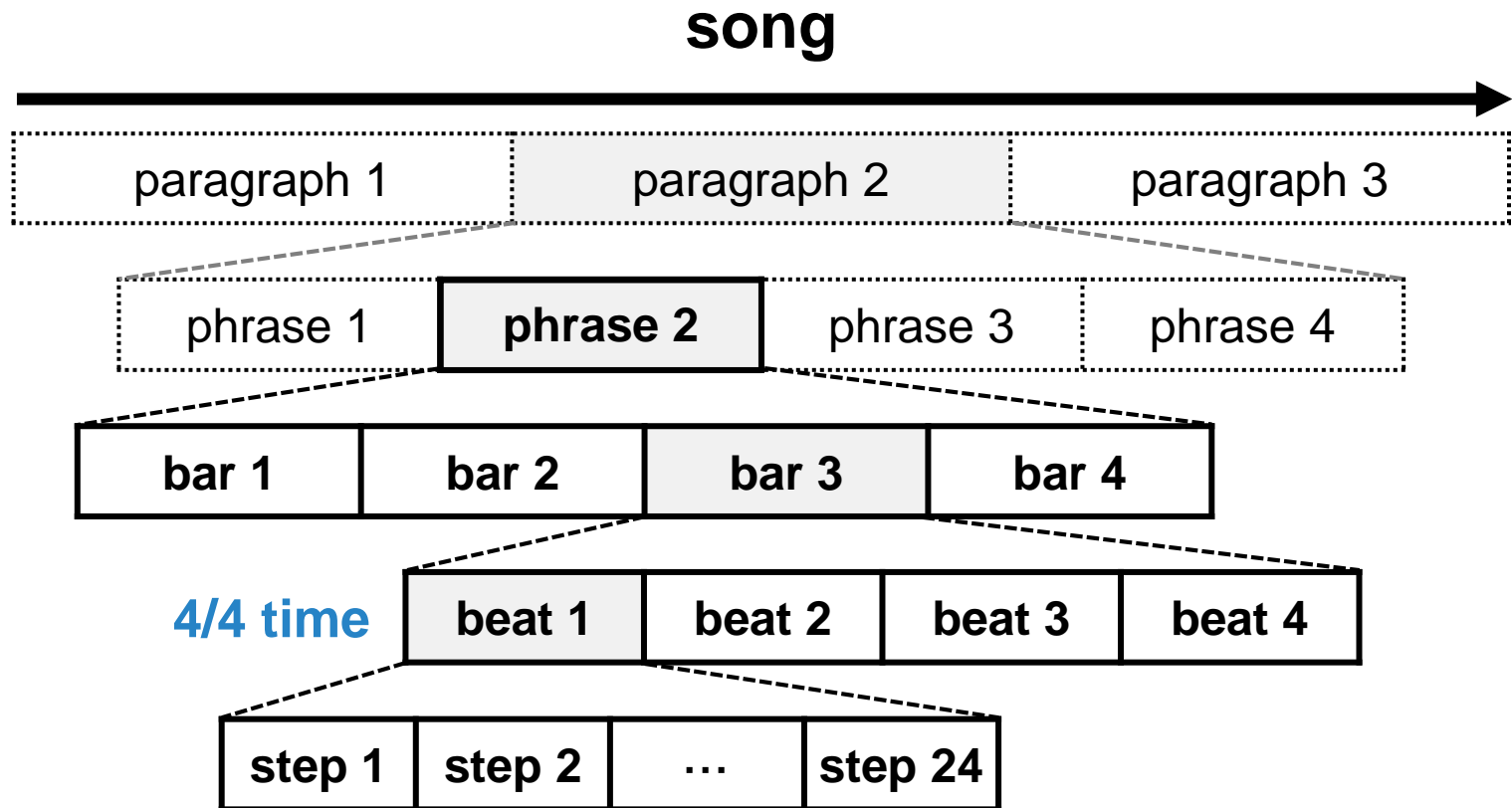
# Convolutional Neural Networks



# Challenge III

## Temporal Structure

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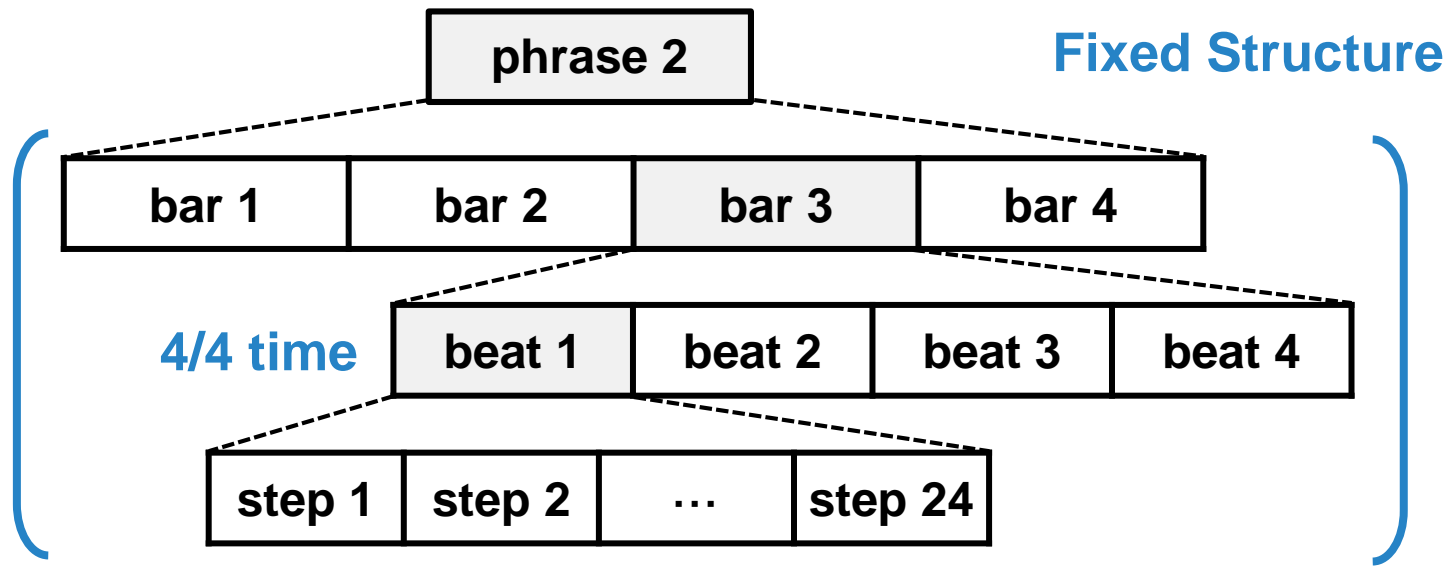


# Challenge III

## Temporal Structure

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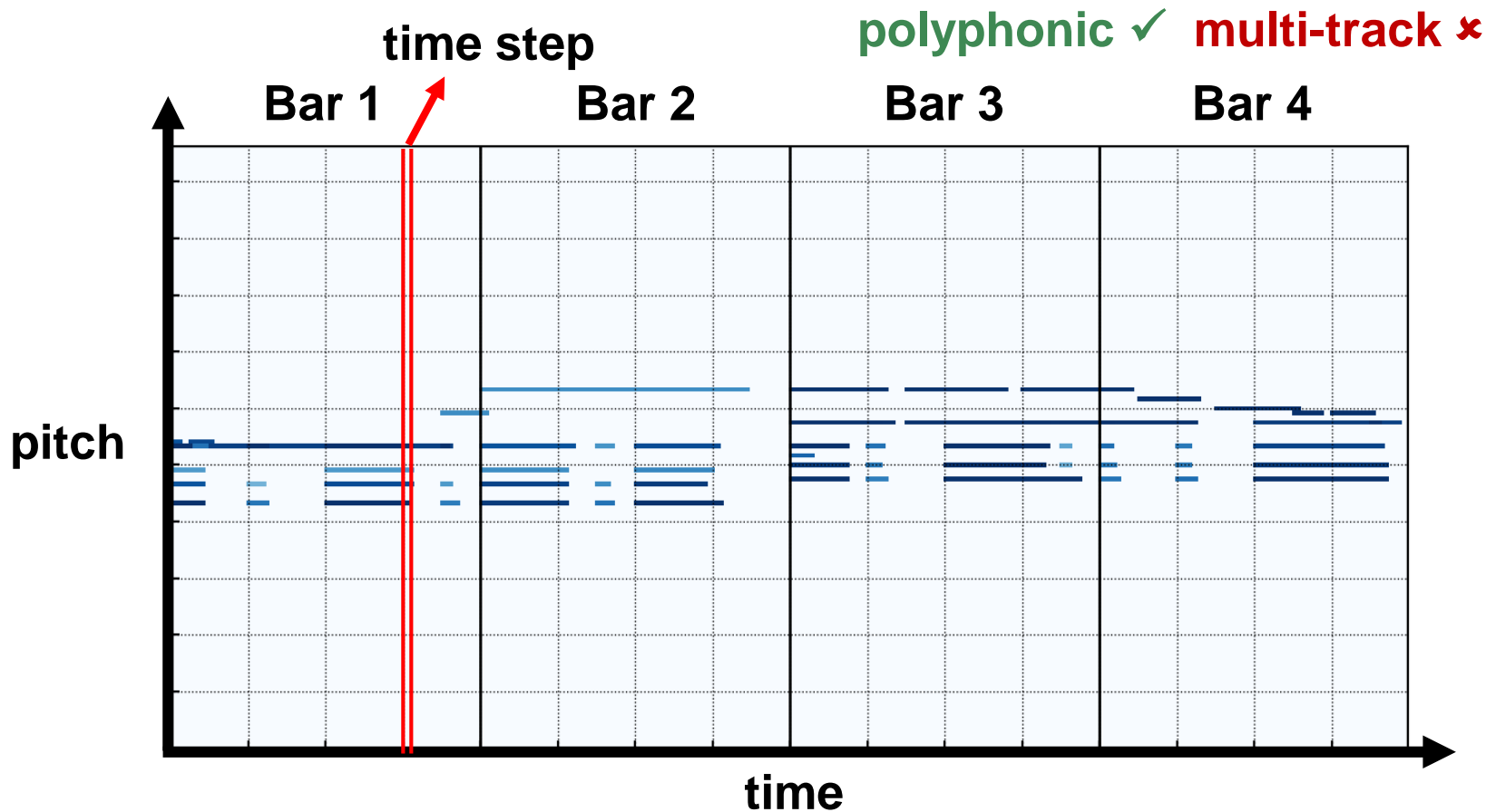
### Convolutional Neural Networks



# Piano-roll

(with symbolic timing)

## Data Representation



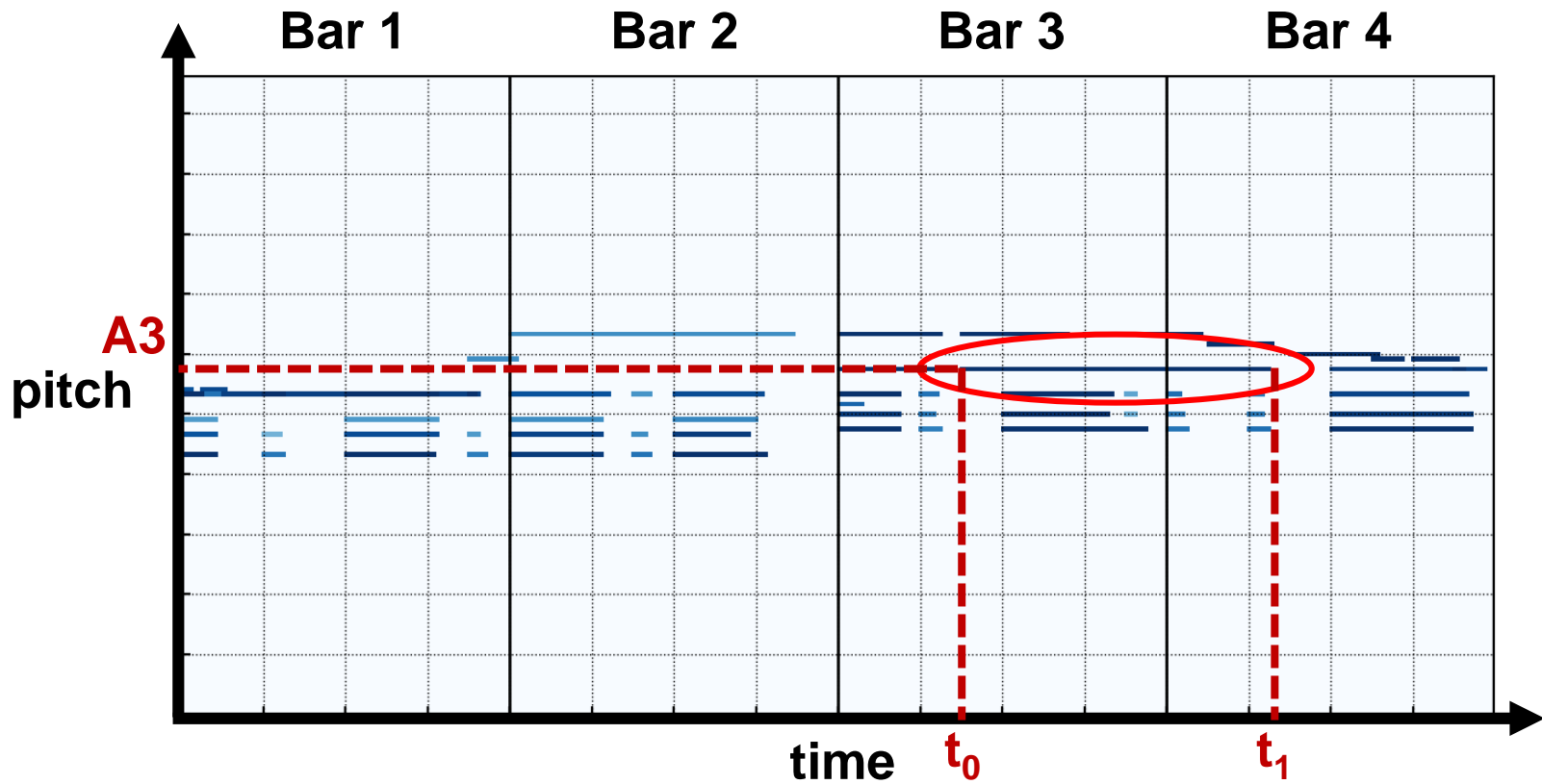


# Piano-roll

(with symbolic timing)

## Data Representation

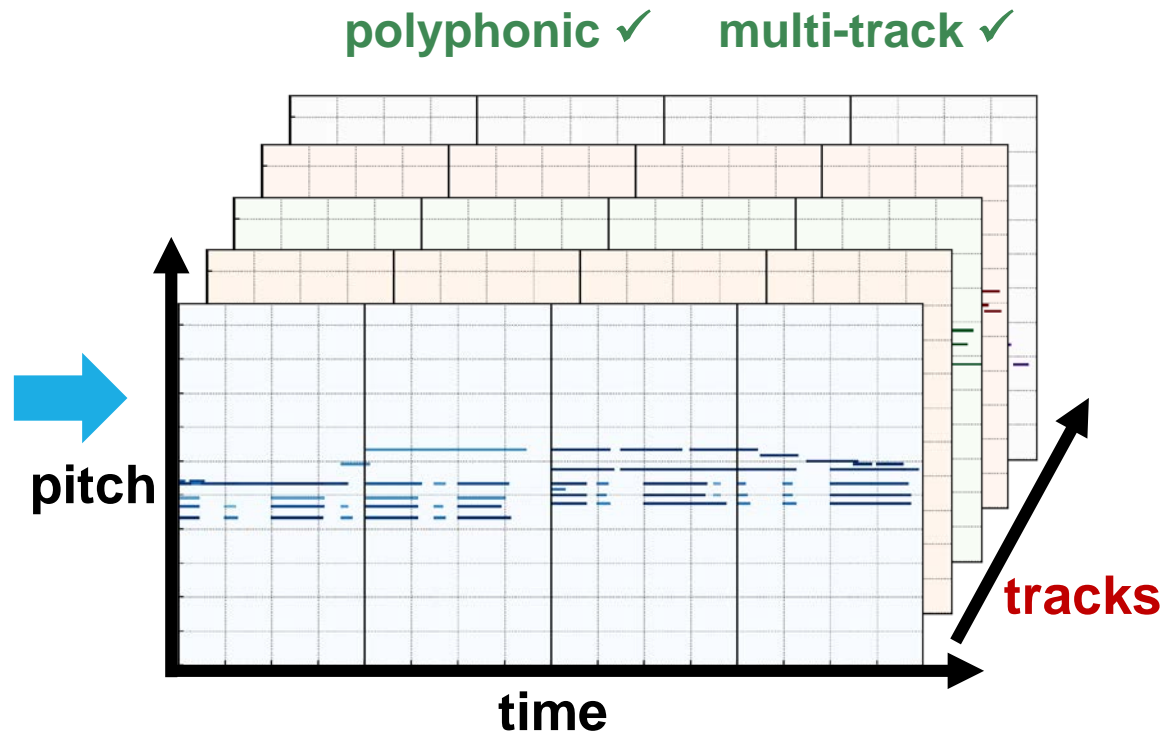
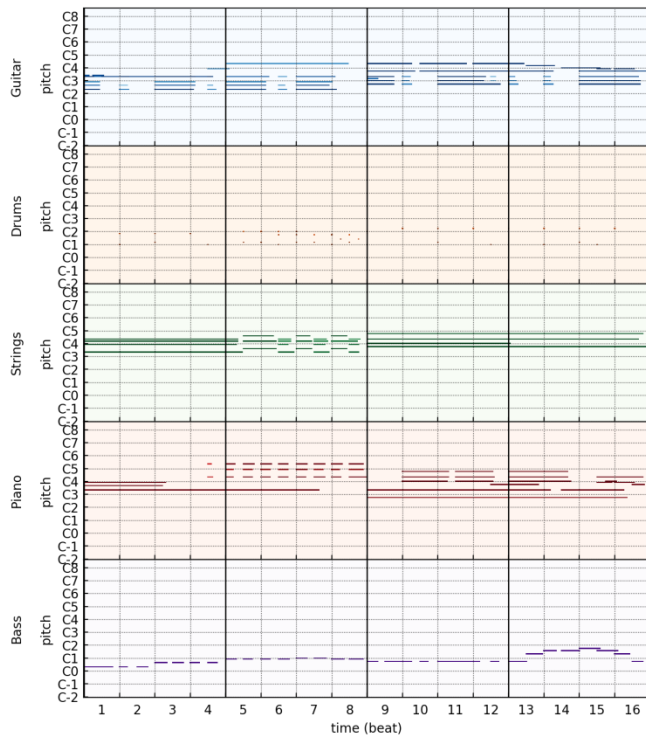
polyphonic ✓ multi-track ✗



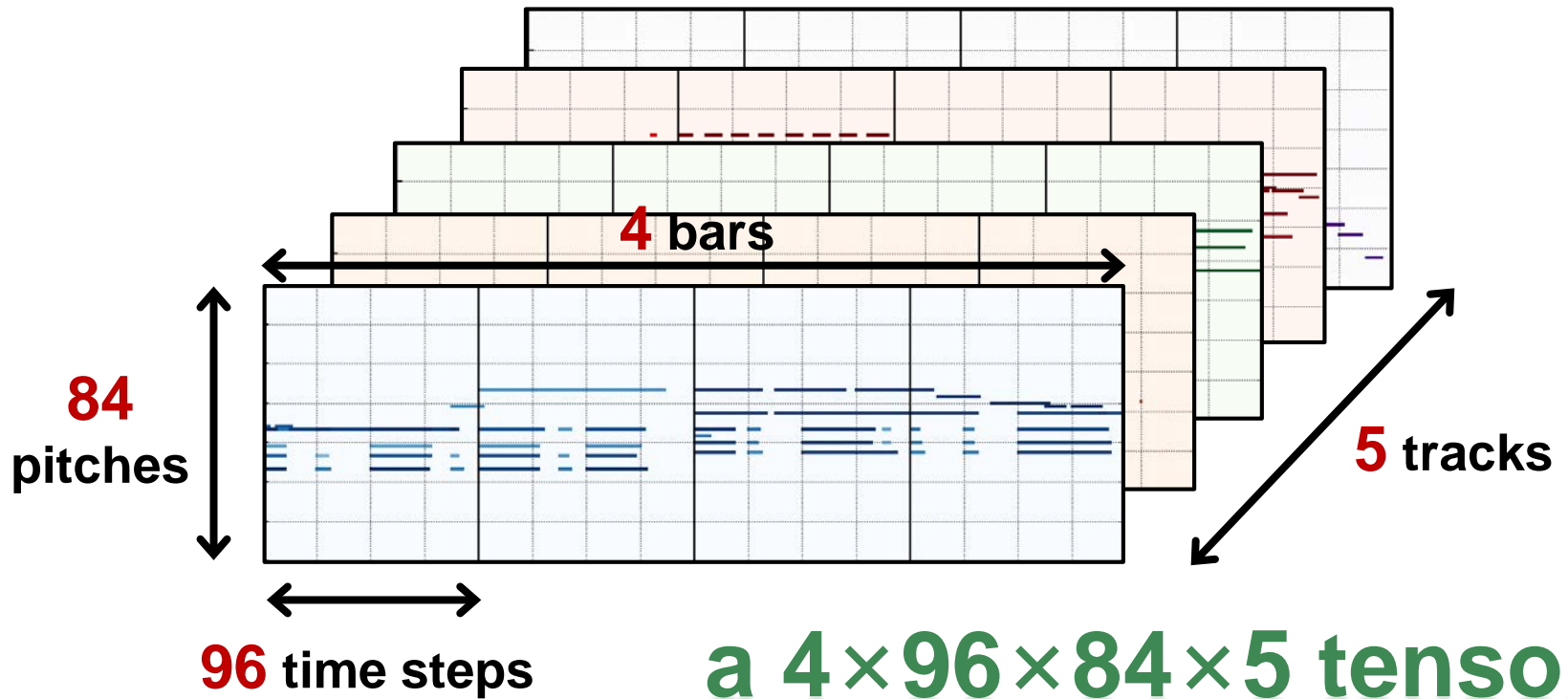
# Multi-track Piano-roll

(with symbolic timing)

## Data Representation



# Data Representation



# Data

## [Dataset]

<https://salu133445.github.io/musegan/dataset>

## [Pypianoroll]

<https://salu133445.github.io/pypianoroll/>

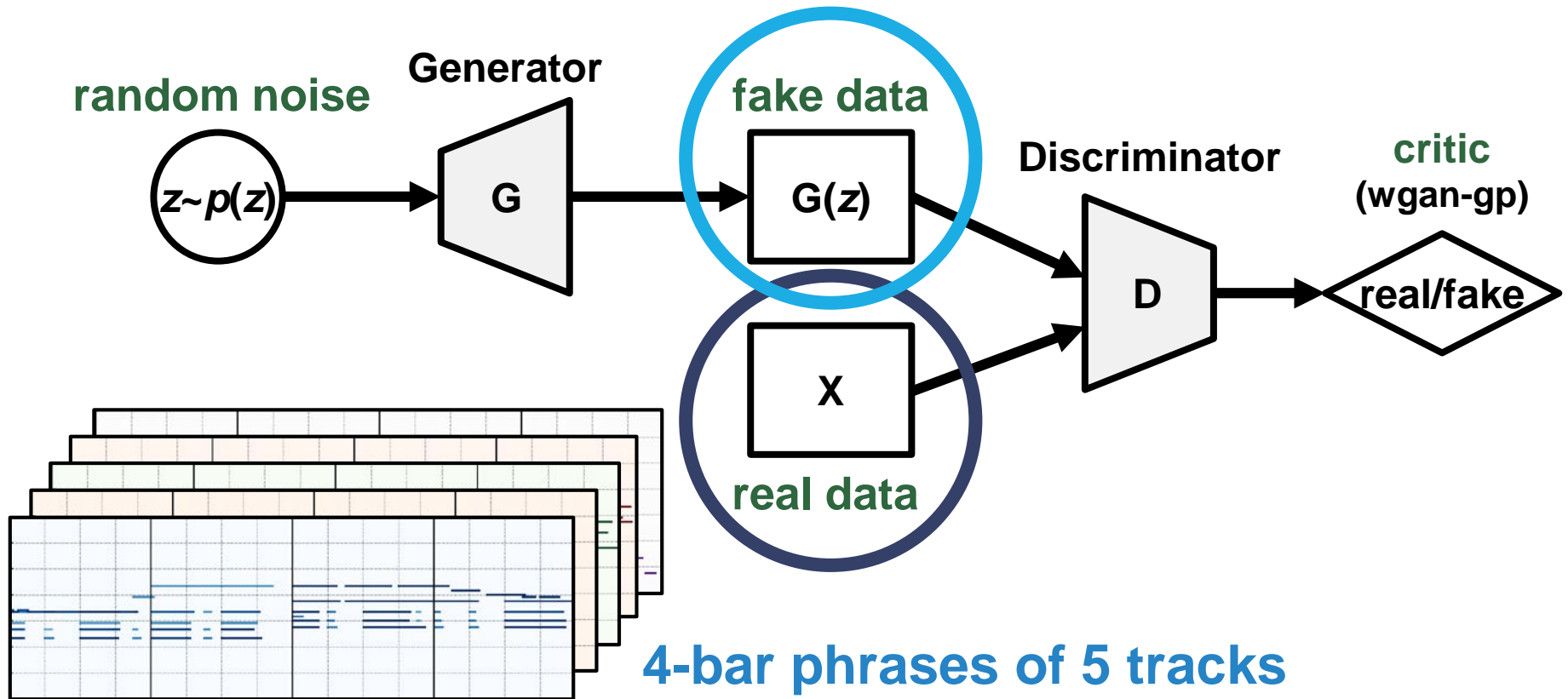
## LPD (Lakh Pianoroll Dataset) <sup>NEW!!</sup>

- **>170,000** multi-track piano-rolls
- Derived from Lakh MIDI Dataset
- Mainly pop songs

## Pypianoroll (Python package) <sup>NEW!!</sup>

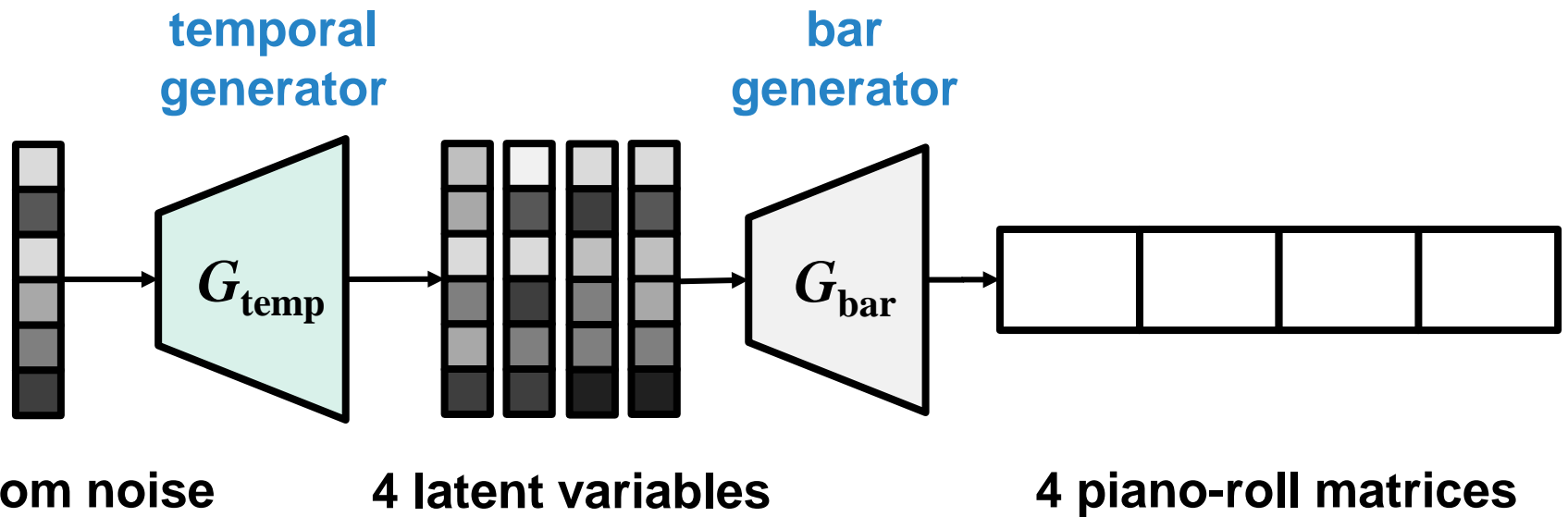
- Manipulation & Visualization
- Efficient Save/Load
- Parse/Write MIDI files
- On **PYPI** (pip installable)

# Generative Adversarial Networks



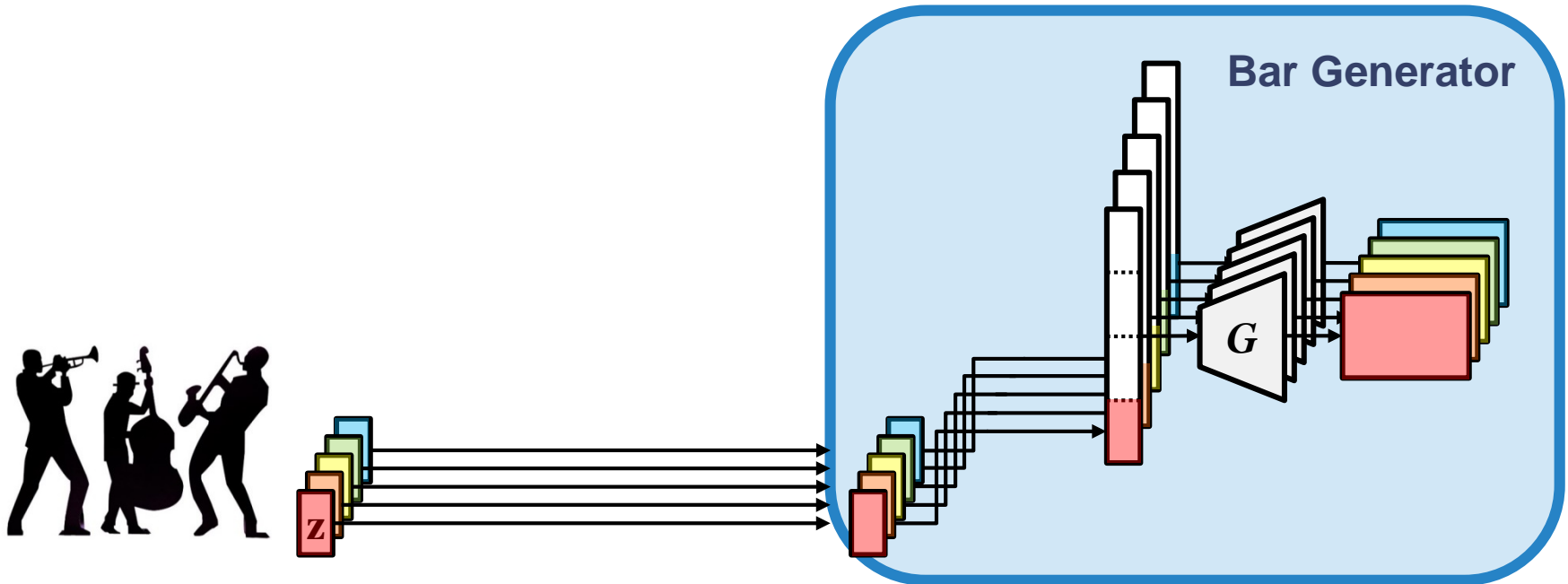
# MuseGAN – An Overview

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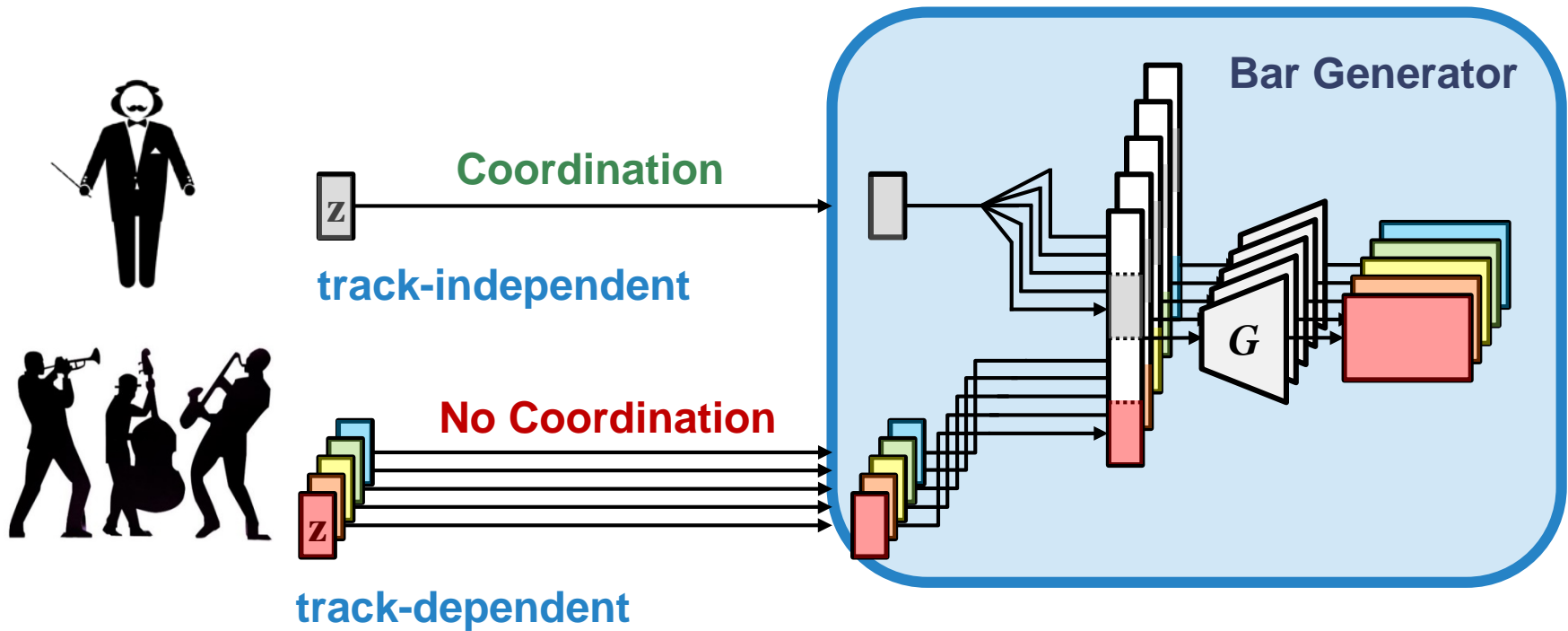


# MuseGAN

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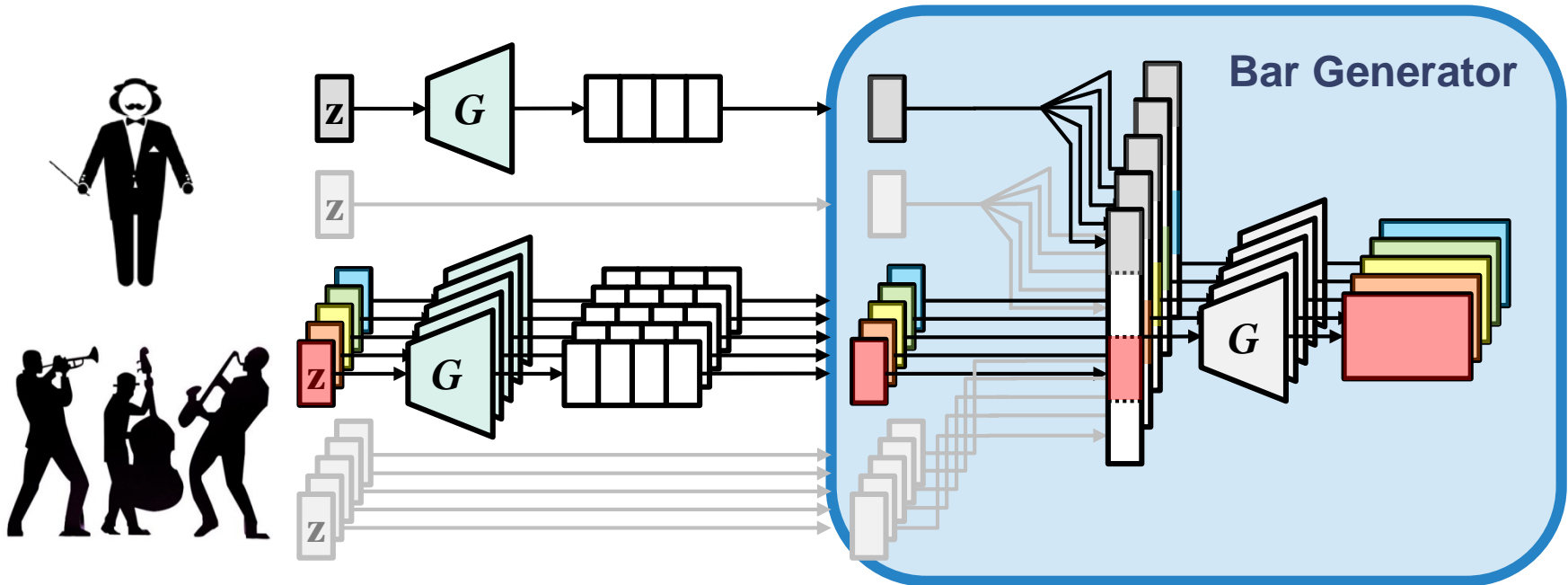


# MuseGAN

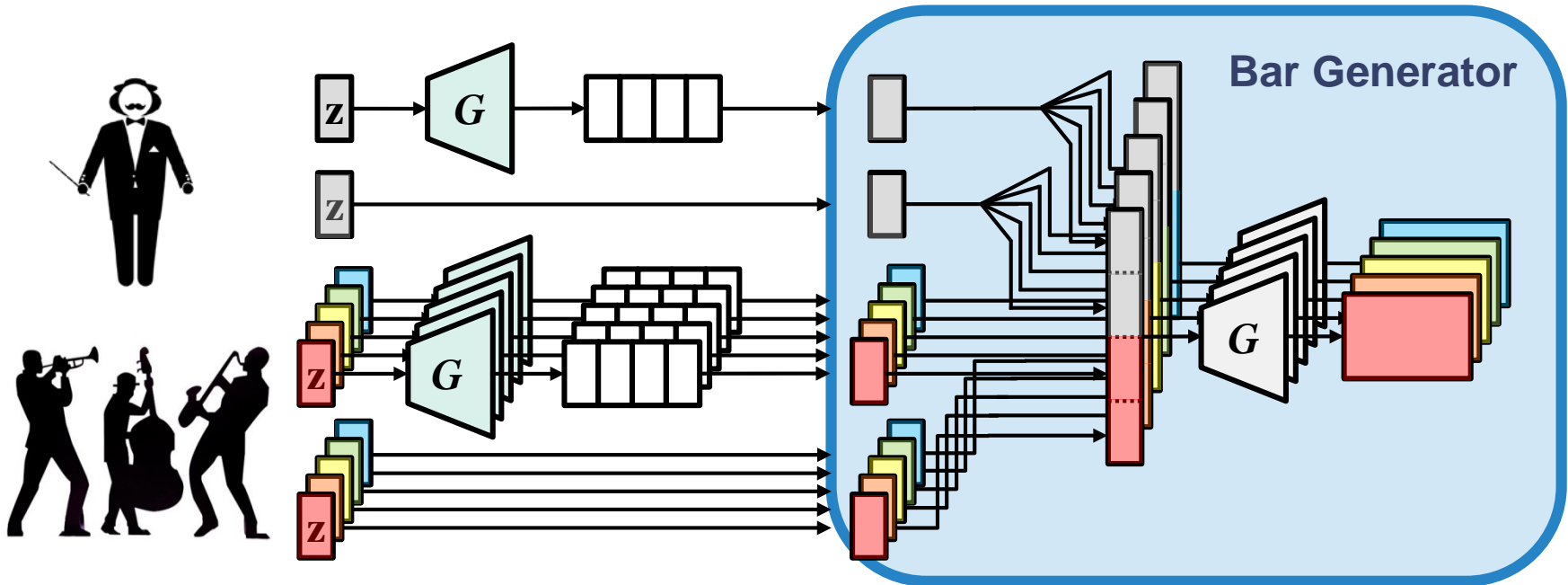




# MuseGAN

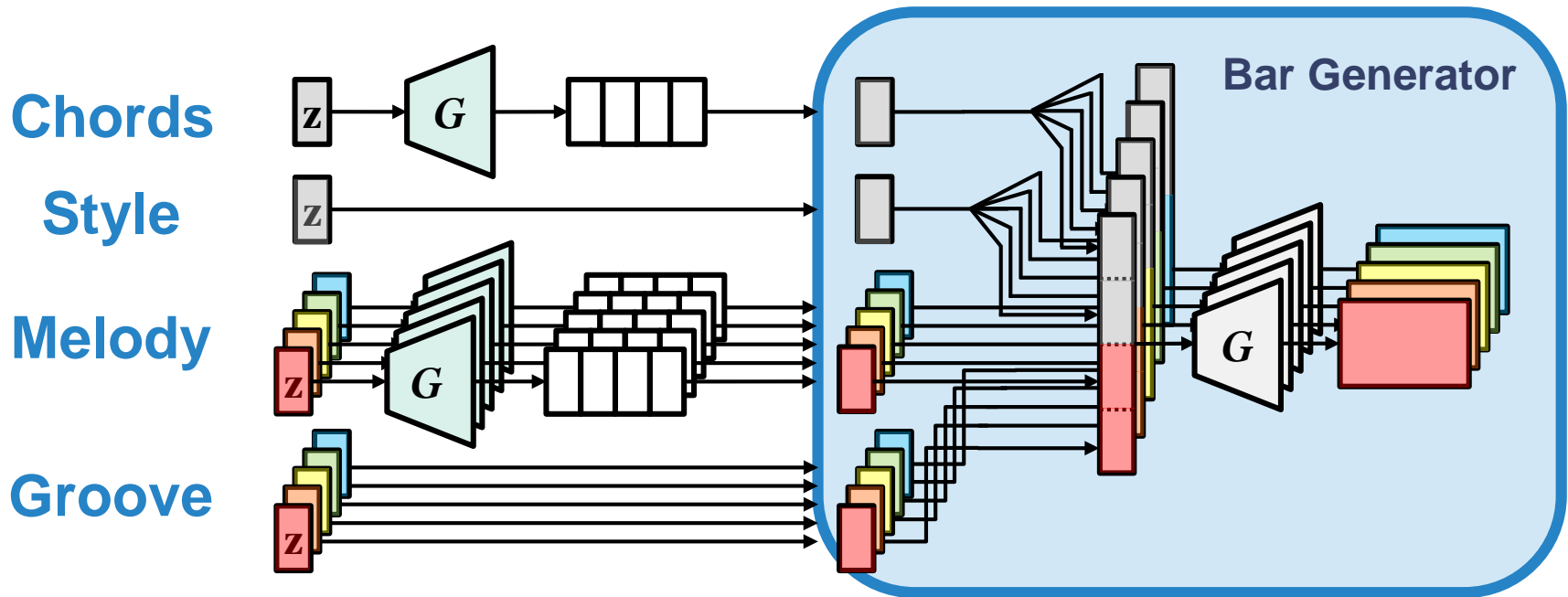


# MuseGAN



# MuseGAN

		Time	
		Dependent	Independent
Track	Dependent	Melody	Groove
	Independent	Chords	Style



# Results

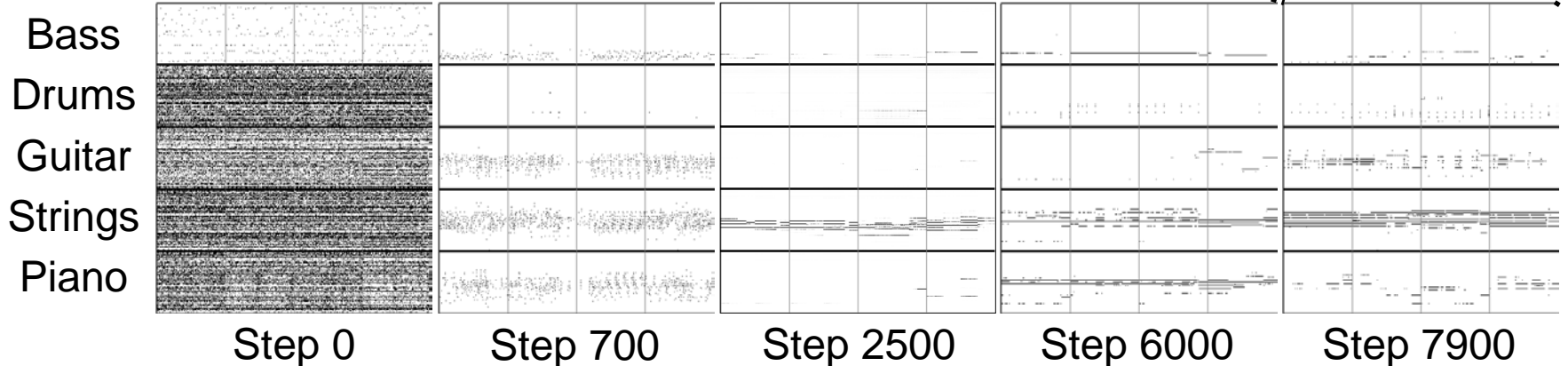
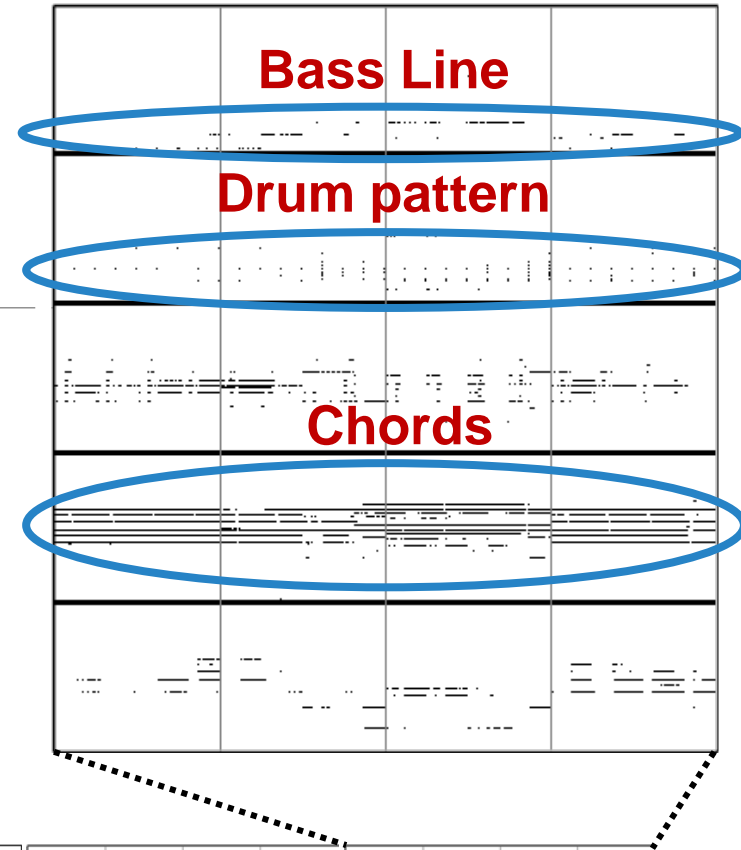
Sample 1



Sample 2



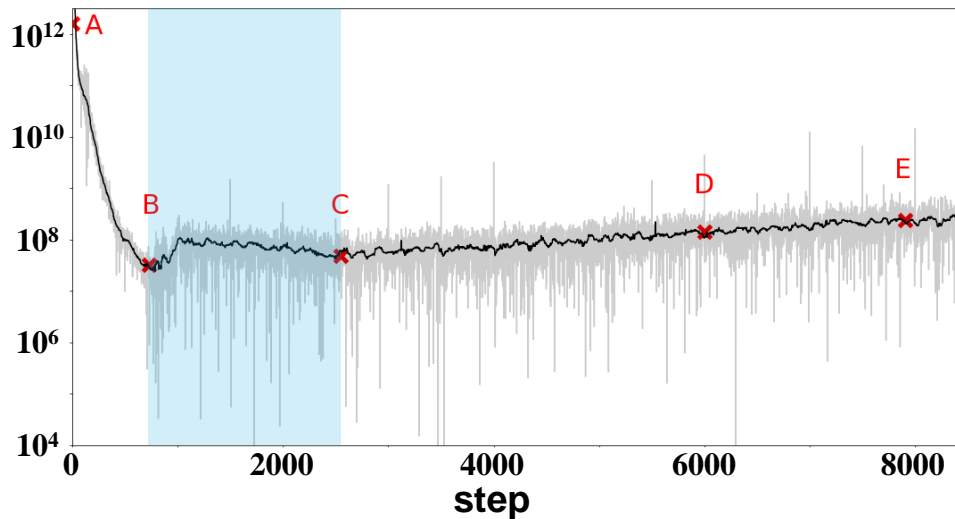
More Samples on Demo Page  
<https://salu133445.github.io/musegan/>



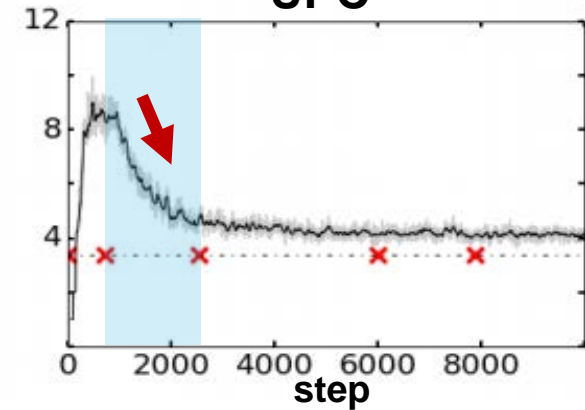
# Monitor the Training

## Objective Metrics

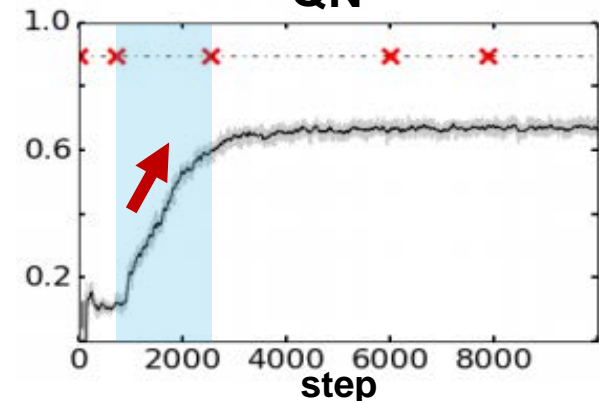
Negative Critic Loss



UPC



QN



<b>UPC</b>	number of used pitch classes per bar
<b>QN</b>	ratio of qualified notes

# User Study

from scratch		H	R	MS	C	OR
non-pro	jam	2.83	3.29	2.88	2.84	2.88
	comp	3.12	<b>3.36</b>	2.95	3.13	3.12
	hybrid	<b>3.15</b>	3.33	<b>3.09</b>	<b>3.30</b>	<b>3.16</b>
pro	jam	2.31	3.05	2.48	2.49	2.42
	comp	2.66	3.13	2.68	2.63	2.73
	hybrid	<b>2.92</b>	<b>3.25</b>	<b>2.81</b>	<b>3.00</b>	<b>2.93</b>

**H:** harmonious

**R:** rhythmic

**MS:** musically structured

**C:** coherent

**OR:** overall rating



composer



jamming



hybrid

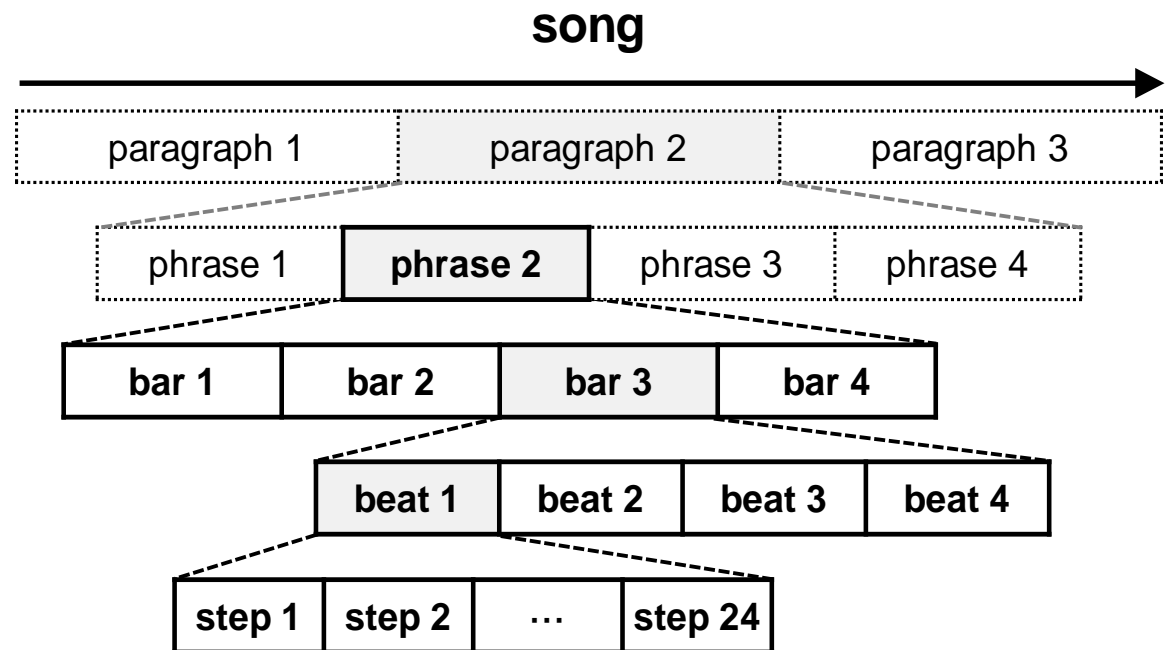
# Summary

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- **MuseGAN**
  - a novel GAN for multi-track sequence generation
  - multi-track, polyphonic music
  - human-AI cooperative scenario (see the paper)
- **Lakh Pianoroll Dataset (LPD)** (new dataset!!)
- **Pypianoroll** (new package!!)

# Future Works

## Full Song Generation



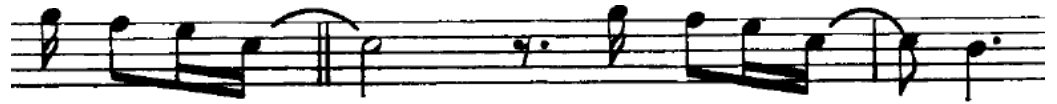
**Hierarchical Temporal Structure**



# Future Works

## Cross-modal Generation

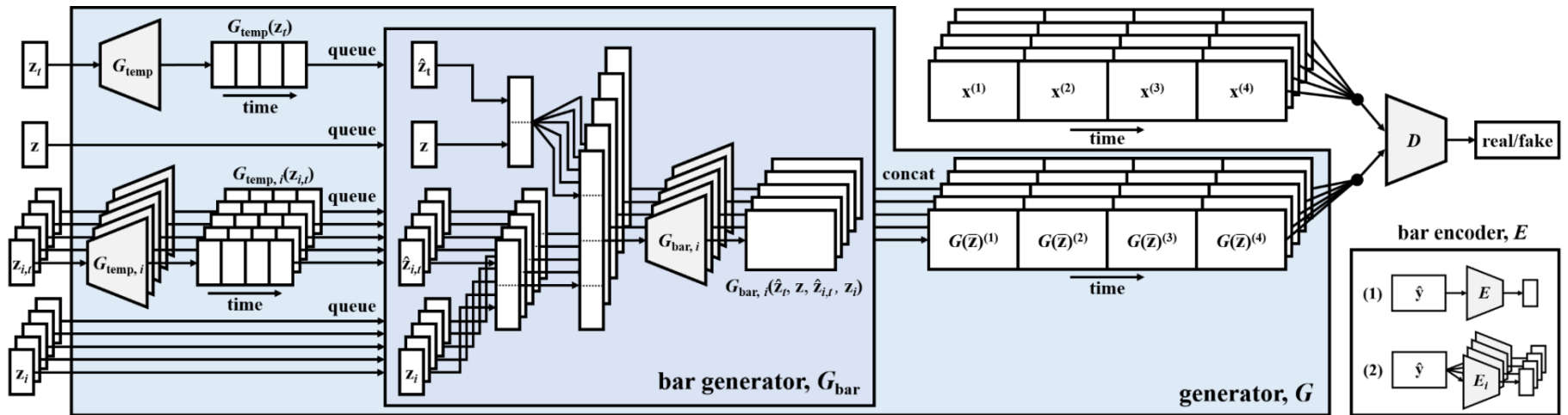
- Music + Video
- Music + Lyrics
- Video + Text



We are the world, \_\_\_ we are the chil - dren,



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# Q&A

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