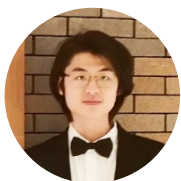




Structured Multi-Track Accompaniment Arrangement via Style Prior Modelling



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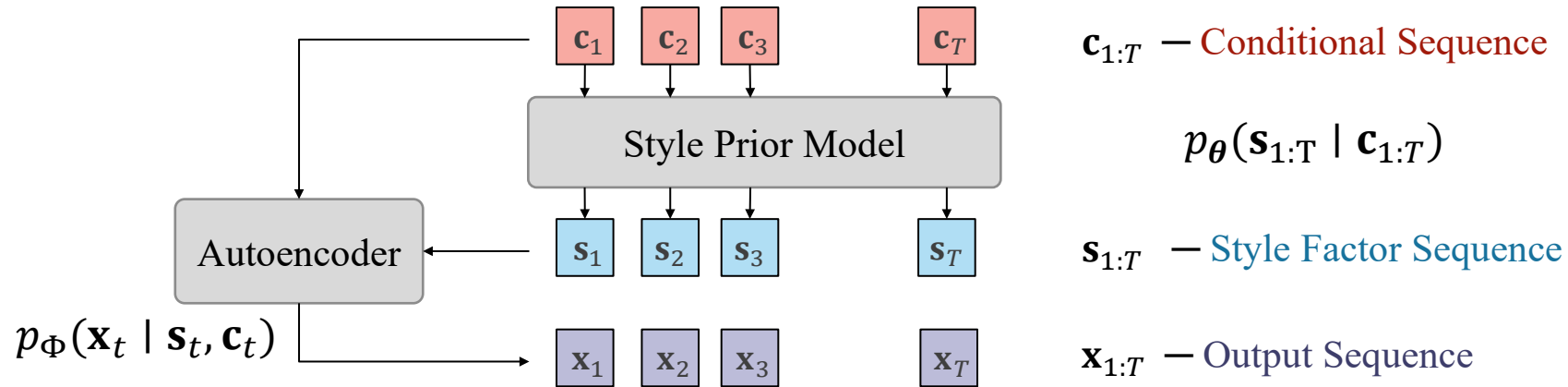


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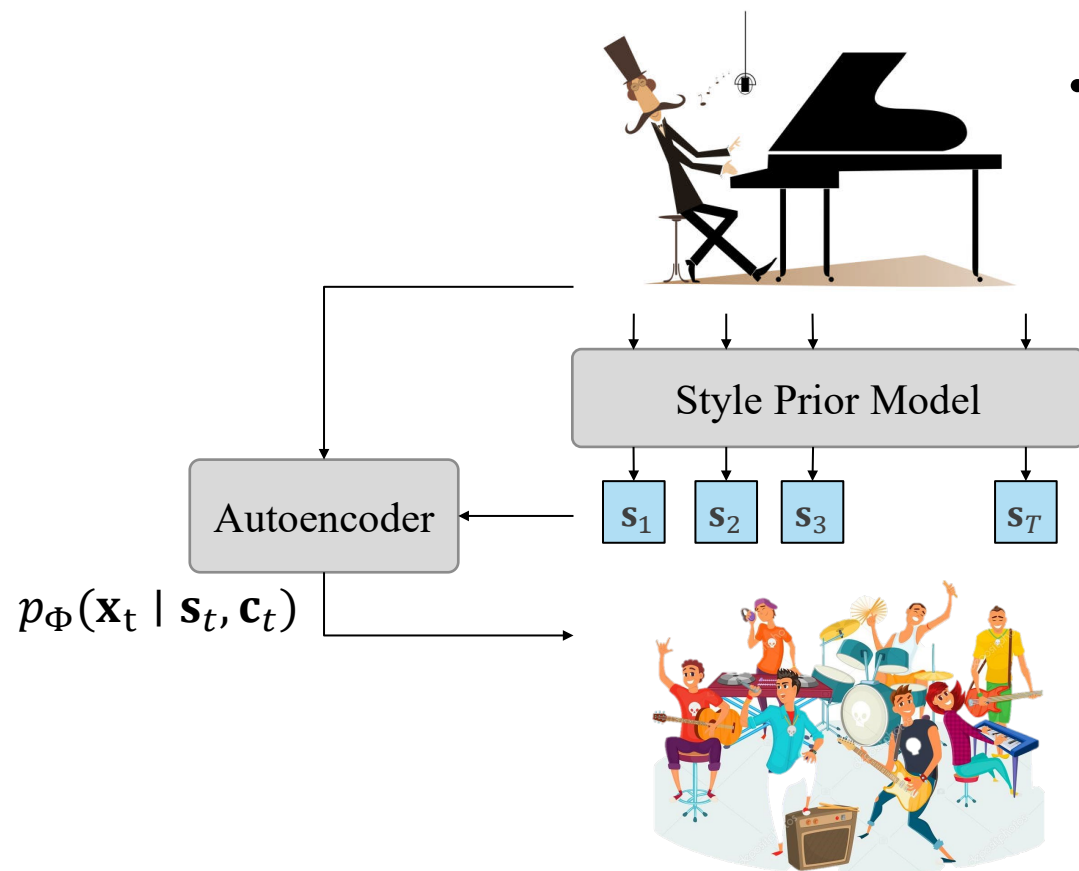


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Conditional Sequence Generation



Accompaniment Arrangement



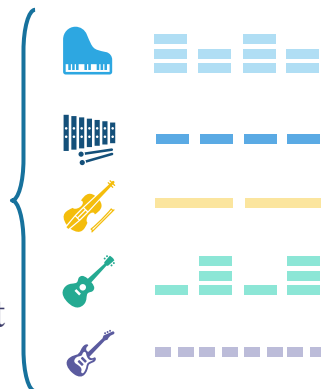
- A *whole-song* arrangement framework

$\mathbf{c}_{1:T}$ — Piano Accompaniment

$$p_\theta(\mathbf{s}_{1:T} | \mathbf{c}_{1:T})$$

$\mathbf{s}_{1:T}$ — Orchestral Form/Layout

$\mathbf{x}_{1:T}$ — Multi-Track Arrangement

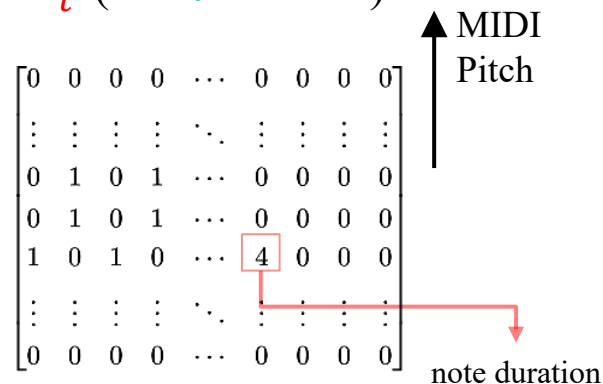


Music Data Representation

multi-track music \mathbf{x}_t (the t -th segment)



\mathbf{x}_t^k (the k -th track)



“piano reduction”
(content)

$$\text{pn}[\mathbf{x}]_t = \max_k(\mathbf{x}_t^{1:K})$$



(essential music content)

“orchestral function”
(style)

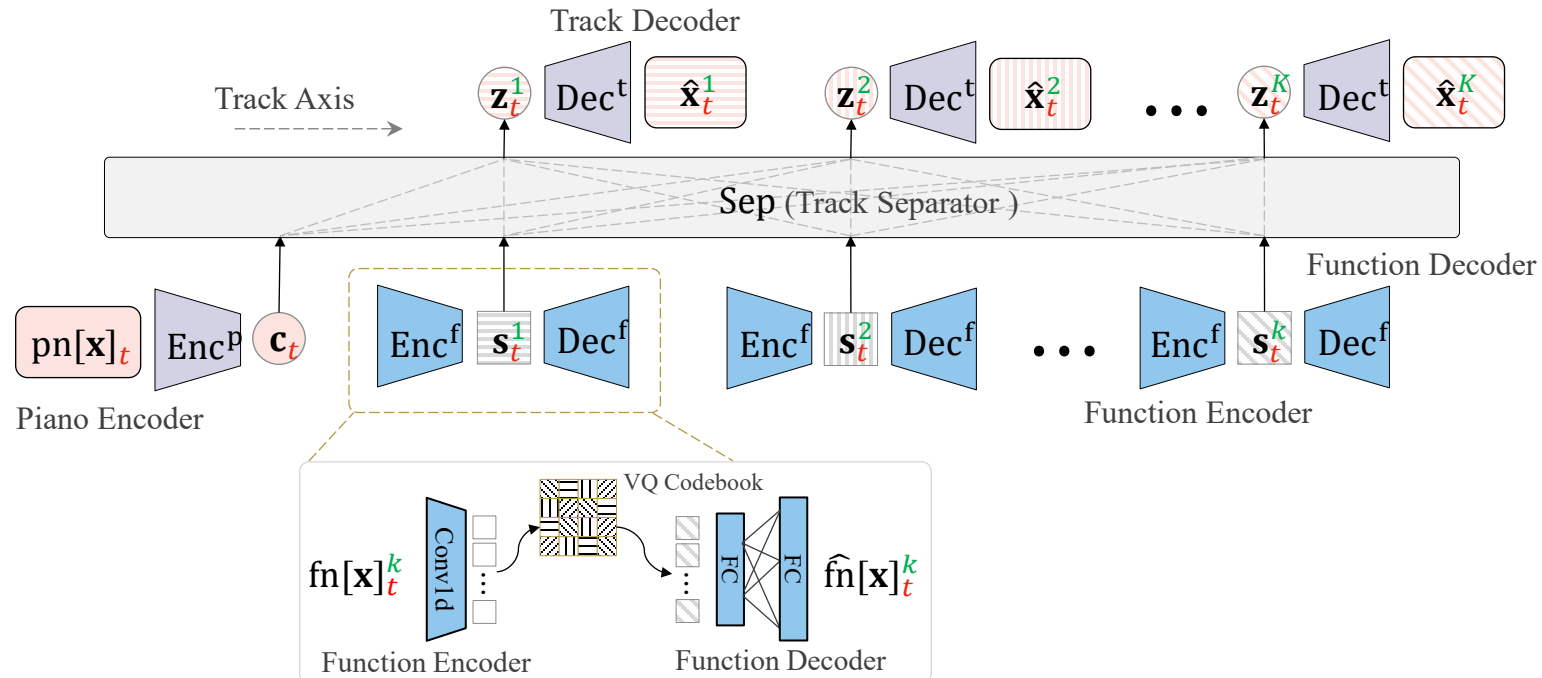
$$\text{fn}[\mathbf{x}]_t^k = \text{colsum}(\mathbf{1}_{\{\mathbf{x}_t^k > 0\}}) / \text{max_sum}$$



(multi-track form)

Autoencoder

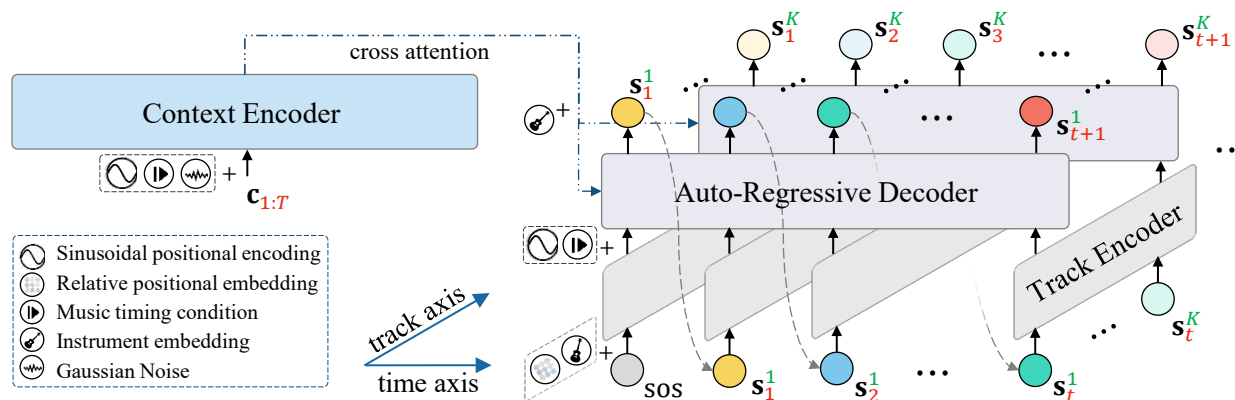
- Representation learning at 2-bar segment level
 - Style code $\mathbf{s}_t^k = \text{Enc}^f(\text{fn}[\mathbf{x}_t^k])$ for segment $t = 1, 2, \dots, T$ and track $k = 1, 2, \dots, K$
 - Content code $\mathbf{c}_t = \text{Enc}^p(\text{pn}[\mathbf{x}_t])$ for segment $t = 1, 2, \dots, T$
 - Reconstruction $\hat{\mathbf{x}}_t^k = \text{Dec}^t(\mathbf{z}_t^k)$, where $\mathbf{z}_t^1, \mathbf{z}_t^2, \dots, \mathbf{z}_t^K = \text{Sep}(\mathbf{s}_t^1, \mathbf{s}_t^2, \dots, \mathbf{s}_t^K \mid \mathbf{c}_t)$



Style Prior Modelling

- Representation learning at 2-bar segment level
 - Style code $\mathbf{s}_t^k = \text{Enc}^f(\text{fn}[\mathbf{x}_t^k])$ for segment $t = 1, 2, \dots, T$ and track $k = 1, 2, \dots, K$
 - Content code $\mathbf{c}_t = \text{Enc}^p(\text{pn}[\mathbf{x}_t])$ for segment $t = 1, 2, \dots, T$
- Style planning at whole-song level
 - Target: model $p(\mathbf{s}_{1:T}^{1:K} | \mathbf{c}_{1:T})$

$$\mathcal{L}(\theta) = -\frac{1}{K} \sum_{k=1}^K \log p_{\theta}(\mathbf{s}_t^k | \mathbf{s}_{<t}^{1:K}, \mathbf{c}_{1:T})$$



Cascaded Style Prior Modelling

- *Piano texture prior*

- Content: lead sheet
- Style: piano texture

- *lead sheet to piano* arrangement

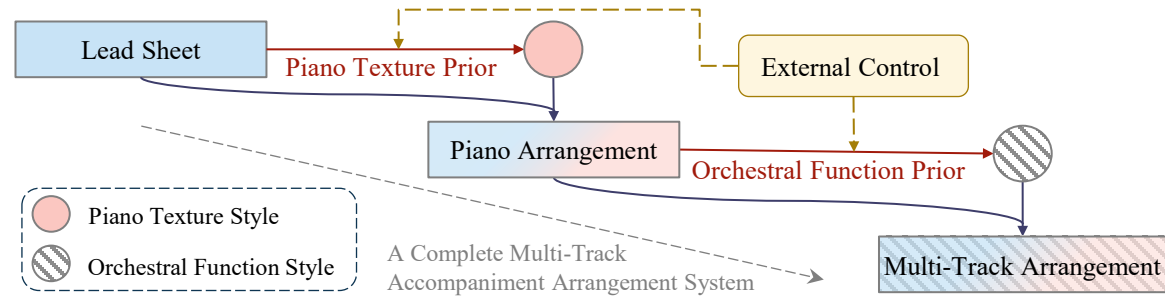
- Control: texture density

- *Orchestral function prior*

- Content: piano accompaniment score
- Style: orchestral function

- *piano to multi-track* arrangement

- Control: instrumentation



Can You Feel the Love Tonight

Lead Sheet

Lead sheet for 'Can You Feel the Love Tonight' in B-flat major, 4/4 time, tempo 70. The sheet includes four systems of music with chord symbols: 1. Measure 1-4 (Chords: Bb, F/A, Eb/G, Bb/F, Eb, Bb/D, F/A, Cm7, Bb/D). 2. Measure 5-8 (Chords: Eb, Bb/D, Eb, Bb/D, Eb, Bb/D, Cm7, F/A). 3. Measure 9-12 (Chords: Eb, Bb/D, Eb, Bb/D, Eb, Gm, Ab, F). 4. Measure 13-16 (Chords: Bb, F/A, Gm, Eb, Bb, Eb, F).

Stage 1
Piano Arrangement



Piano arrangement of 'Can You Feel the Love Tonight' in B-flat major, 4/4 time, tempo 70. The arrangement features a vocal line (Mel.) and a piano accompaniment (Pno.) with a steady eighth-note bass line. It includes four systems of music with chord symbols: 1. Measure 1-4 (Chords: Bb, F/A, Eb/G, Bb/F, Eb, Bb/D, F/A, Cm7, Bb/D). 2. Measure 5-8 (Chords: Eb, Bb/D, Eb, Bb/D, Eb, Bb/D, Cm7, F/A). 3. Measure 9-12 (Chords: Eb, Bb/D, Eb, Bb/D, Eb, Gm, Ab, F). 4. Measure 13-16 (Chords: Bb, F/A, Gm, Eb, Bb, Eb, F).

Stage 2
Band Orchestration



Can You Feel the Love Tonight

Band Cover

Band cover for 'Can You Feel the Love Tonight' in B-flat major, 4/4 time, tempo 70. The cover includes ten staves: 1. Vocal (Vocalist). 2. Celesta. 3. Acoustic Guitar. 4. Jazz Guitar. 5. Piano. 6. Electric Piano 1. 7. Electric Piano 2. 8. Violins. 9. Brass. 10. Electric Bass. The arrangement features a vocal line and a rich instrumental texture with piano accompaniment, celesta, acoustic and jazz guitars, electric pianos, violins, brass, and electric bass.

Demo Analysis

- Coherent whole-song structure
 - Phrase-level coherency
 - Natural development
- Cohesive multi-track patterns
 - Counterpoint
 - Metrical division
 - Function division

The image displays two musical score excerpts, Chorus 1 and Chorus 3, with various annotations and highlights. Chorus 1 starts at measure 13, and Chorus 3 starts at measure 41. The score includes tracks for Melody (Mel.), Acoustic Guitar 1 (A.G. 1), Acoustic Guitar 2 (A.G. 2), Electric Piano 1 (E.P. 1), Violins (Vlns.), Brass (Br.), and Electric Bass (E.B.).

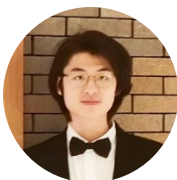
Chorus 1 (Measures 13-20):

- Annotations: "Counterpoint relation between tracks" (purple box), "Long-term phrase coherency over extended context" (red dashed box).
- Highlights: Purple boxes in A.G. 1 and E.P. 1 tracks; yellow boxes in Vlns. and Br. tracks.

Chorus 3 (Measures 41-48):

- Annotations: "Hamonic/Melodic division between two guitars" (green box), "Metrical division between string and Brass" (yellow box).
- Highlights: Green boxes in A.G. 1 and Pno. tracks; yellow boxes in Vlns. and Br. tracks.

Chord progressions for both choruses are: B \flat , F/A, Gm, E \flat , B \flat , E \flat , F, F/A, E \flat , B \flat /D.



Feel free to check our paper, demo, and code!

<https://zhaojw1998.github.io/structured-arrangement/>



Paper



Demo



GitHub