

Adaptasi Positional Encoding pada Arsitektur Transformer untuk Sintesis Notasi Gamelan yang Koheren dan Terkendali

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Rumusan Masalah

Dalam pemodelan sekuensial, deretan notasi musik mengandung multi dimensi informasi. Namun, model LSTM mereduksi informasi koherensi antarnotasi sehingga hasil prediksi notasi menjadi tidak akurat. Kegagalan ini terlihat pada penelitian Syarif, A.M., dkk (2023) dan Fanani A.Z., dkk. (2025) yang menggabungkan algoritma genetika tanpa operator crossover karena asumsi prematur terhadap kemampuan LSTM dalam menghasilkan deret notasi musik gamelan. Akibatnya, model hanya mampu membuat sekuens notasi yang mirip secara statistik namun tidak logis.

Previous Work

Plotting Structure

Seri pada **Tutur**, lantunan slendro patet sangga

Buka kembang



Figure: Notasi Gamelan

Javanese Gamelan Structure

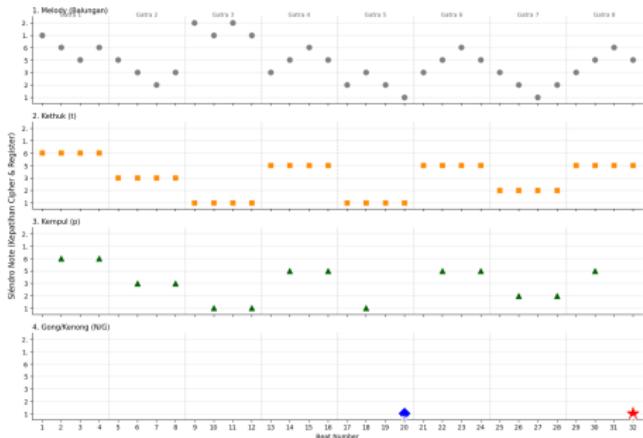
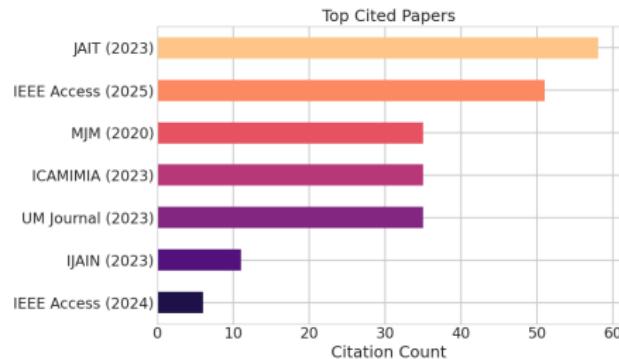


Figure: Plot Struktur

Dataset Insight

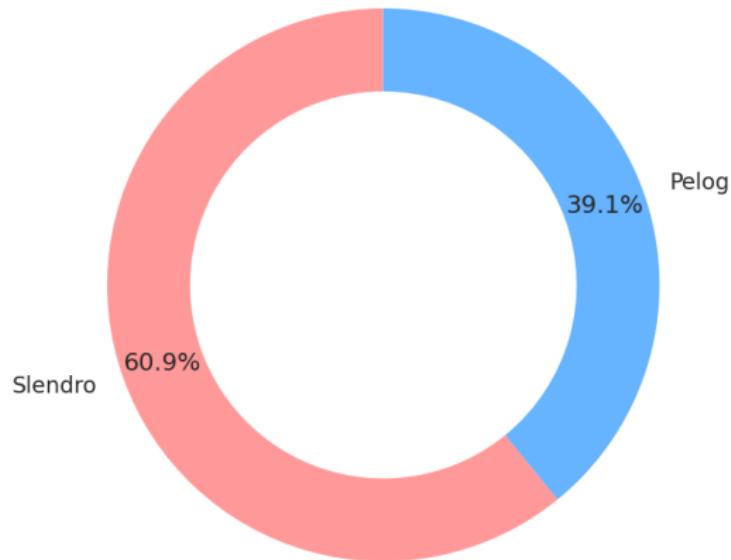


Dataset Overview

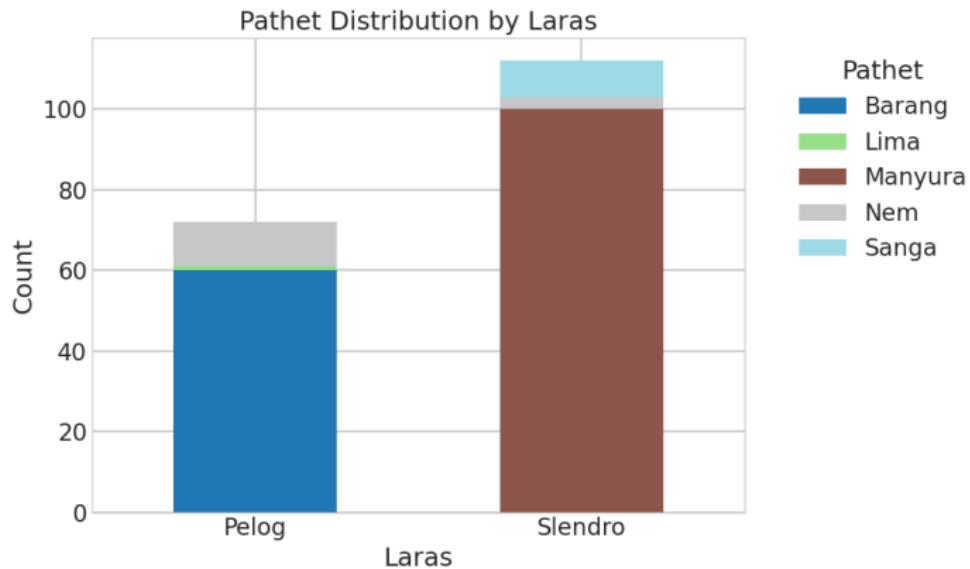
- Total Songs : 189
- Laras : 2
- Cited in Research (Q3-Q1) : 100 %

Dataset Insight

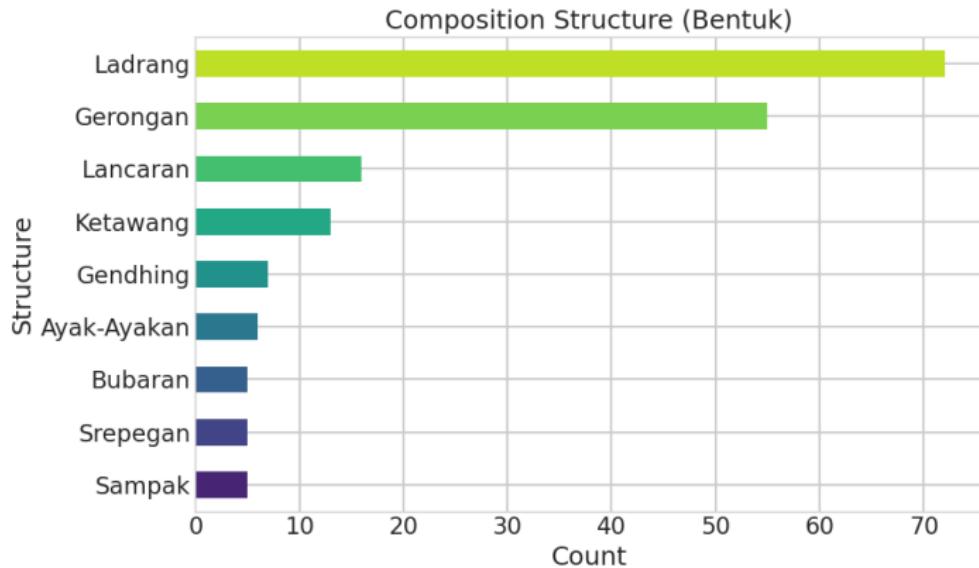
Tuning System (Laras)



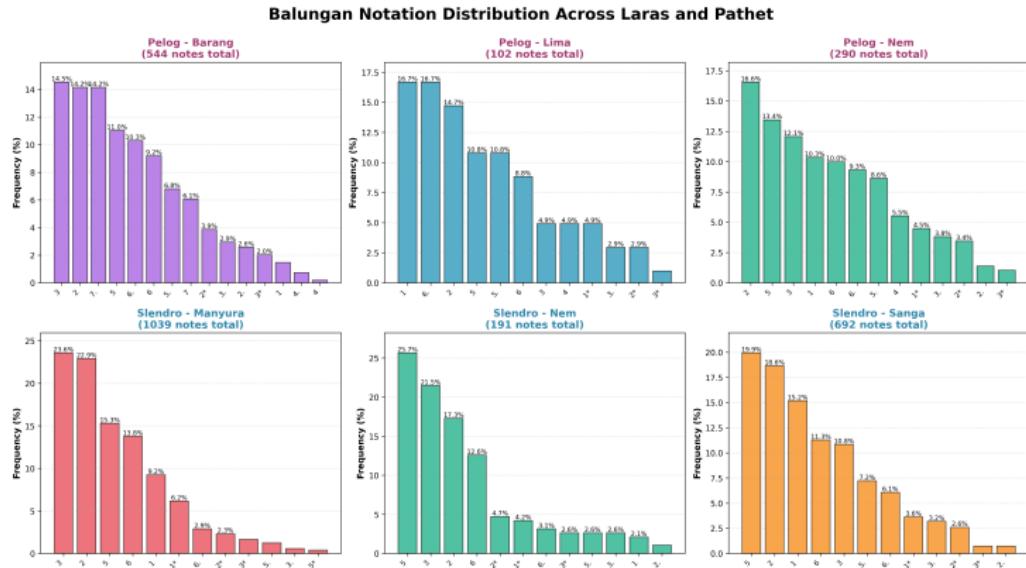
Dataset Insight



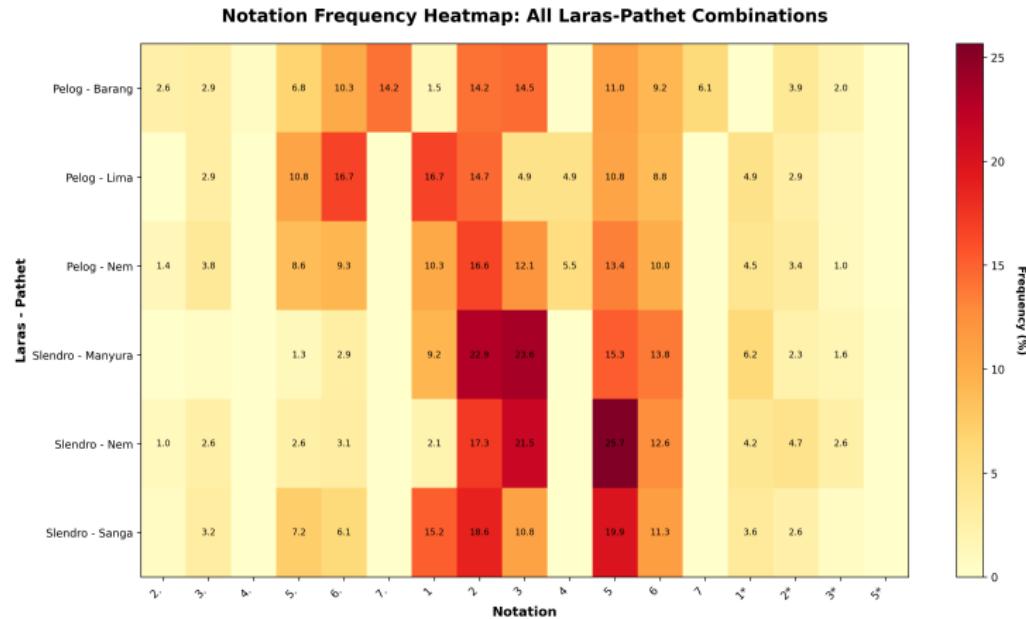
Dataset Insight



Dataset Insight



Dataset Insight



Dataset Extraction Strategy

Decoding PDF files

Ayek-Ayeken **Nem**, lenes sléndro pethet nem

83

	(6)	•	5	•	6	•	5	•	6
	•	2	•	1	•	3	•	2	6
1	3	2	3	5	2	3	5	6	3
5	6	5	3	5	6	5	3	2	1
5	6	5	3	2	1	3	2	6	2
3	2	3	5	3	2	3	5	3	5

570

9 (6) 1 (6)

Unicode Code (Hex)	Visual Character	ASCII/Unicode Value (Dec)	Glyph ID (GID)
U+0020		32	3
U+0029)	41	26
U+002B	+	43	28
U+002D	-	45	29
U+0040	@	64	49
U+0042	B	66	51
U+0043	C	67	52
U+0045	E	69	54
U+0046	F	70	55
U+0048	H	72	57
U+0049	I	73	58
U+004A	J	74	59
U+004C	L	76	61
U+004D	M	77	62
U+004F	O	79	64
U+0050	P	80	65
U+0051	Q	81	66
U+0053	R	93	76
U+005D	Z	93	78
U+005E	z	95	79

Notasi gamelan Ayak-ayakan Nem Slendro

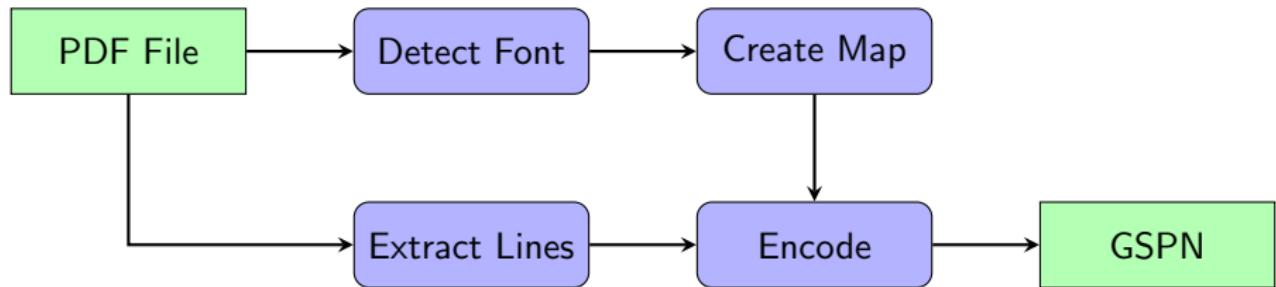
pt. Nem

Cmap font balungan.

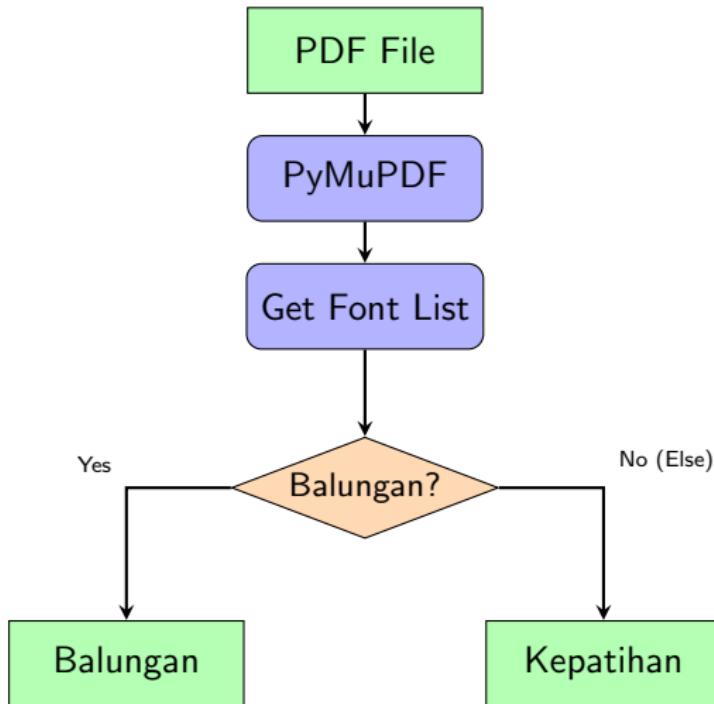
```
##Page 0##
Ayak-Ayakan Nem, laras sléndro pathet nem
Buka
M@ -+ L) -+ M)^ -+ L) -+ M)^
-+ P) -+ O)^ -+ Q) -+ P)^ M+- L) J+ L@]
[ + J + I) + J + L)^ + I + J) + L + M)^ + L + J) + L + M)^ + J + L) + J + I @
L M) L J)^ L M) L J)^ I H) I F)^ I H) I J@]
L M) L J)^ I H) J I)^ F E) C E@]
C B) C E)^ C B) C E)^ I J) L J)^ L I) J L@ ]
Suwuk
F F) E F)^ J I) H F@]
```

Figure: Notasi ayakan decoded

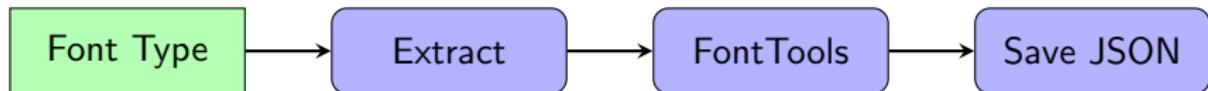
System Overview



Step 1: Font Detection



Step 2: Glyph Map Creation



Example Output (JSON):

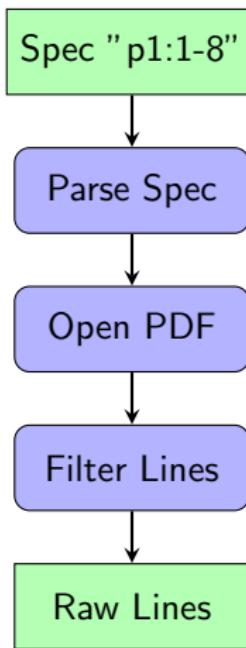
Balungan

"H": "1", "I": "2"

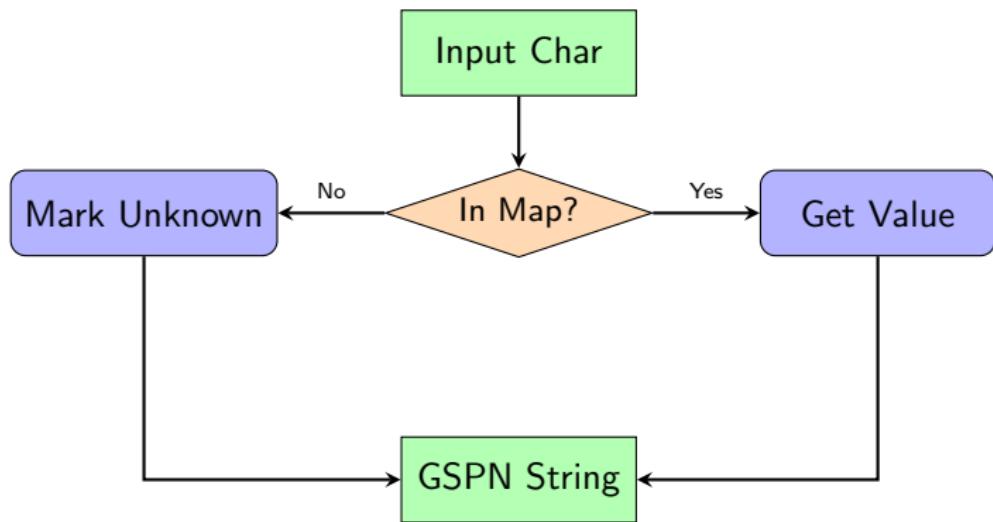
Kepatihan

"1": "1", "e": "3a"

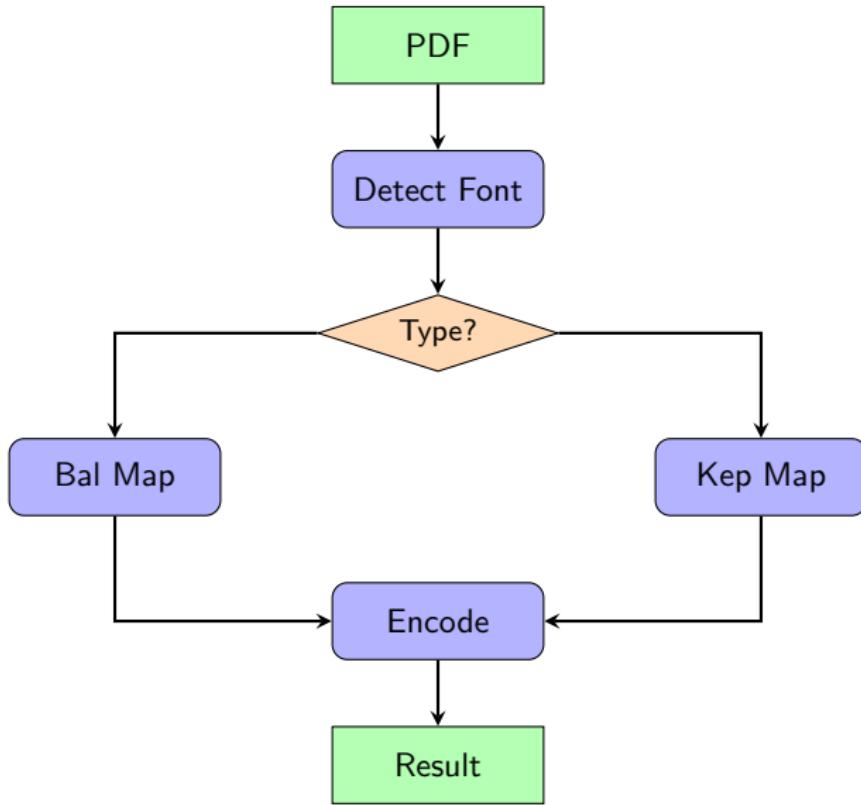
Step 3: Line Extraction



Step 4: Encoding Logic



Complete Processing Flow



Abiyasa: Gamelan Preset Dataset

Capabilities

- **Extraction:** PDF to data.
- **Systems:** Balungan & Kepatihan.
- **Encoders:** GSPN / QAP / OVENS / GENS.

Install

```
pip install abiyasa
```

Quick Start API

```
import abiyasa

# Load and encode 5 items
data = abiyasa.load_data(
    encoder='GSPN',
    notation_system='kepatihan',
    limit=5
)

for item in data:
    print(item['encoded_data'][0]['encoded'])
```

Dataset Format

Curated JSON including titles, PDF sources, and line-specific markers (p1:1-5).

The GSPN Encoding Strategy

The **Gendhing Scientific Pitch Notation (GSPN)** is the core computational format.

Formula: $T + W + V + G$

- **T (Note)**: 0–7 (0 = rest).
- **W (Octave)**: empty (mid), a (low), b (high).
- **V (Value)**: empty (1), A (1/2), B (1/4).
- **G (Legato)**: x (start), y (end).

System	Notation Example	GSPN Result
Balungan	F F	6a 6a
Balungan	-_-F_-	0A 6aA
Kepatihan	e t y u	3a 5a 6a 7a
Kepatihan	1 2 3	1 2 3

Based on research by Syarif et al. (2020)

Other Encoding Strategy

Research	Encoding	Note
10.17977/um018v6i12023p41-56	GENSS	Gendhing Structure Sequence
10.26555/ijain.v9i2.1031	GENSS	Gendhing Structure Sequence
10.1109/ICAMIMIA60881.2023.10427579	GENSS	Gendhing Structure Sequence
10.37134/mjm.vol9.7.2020	GSPN	Gamelan Scientific Pitch Notation
10.1109/ACCESS.2024.3457880	QAP	Question Answer Phrase
10.12720/jait.14.1.26-38	GSPN	Gamelan Scientific Pitch Notation
10.1109/ACCESS.2025.3578449	OVENS	Odd-Even Pattern Sequence

What Next?

- Menganalisa pola hubungan antar notasi
- Eksperimental membangun kembali penelitian sebelumnya