

Adding Descriptors To Melodies Improves Pattern Matching: A Study On Slovenian Folk Songs

Vanessa Nina Borsan*
Univ. Lille

Mathieu Giraud
Univ. Lille, CNRS

Richard Groult
Univ. Rouen Normandie, LITIS

Thierry Lecroq
Univ. Rouen Normandie, LITIS

Combining **content** (melodic sequence) and **context** (descriptors) in **pattern-matching** queries enhances **precision** for classification tasks.

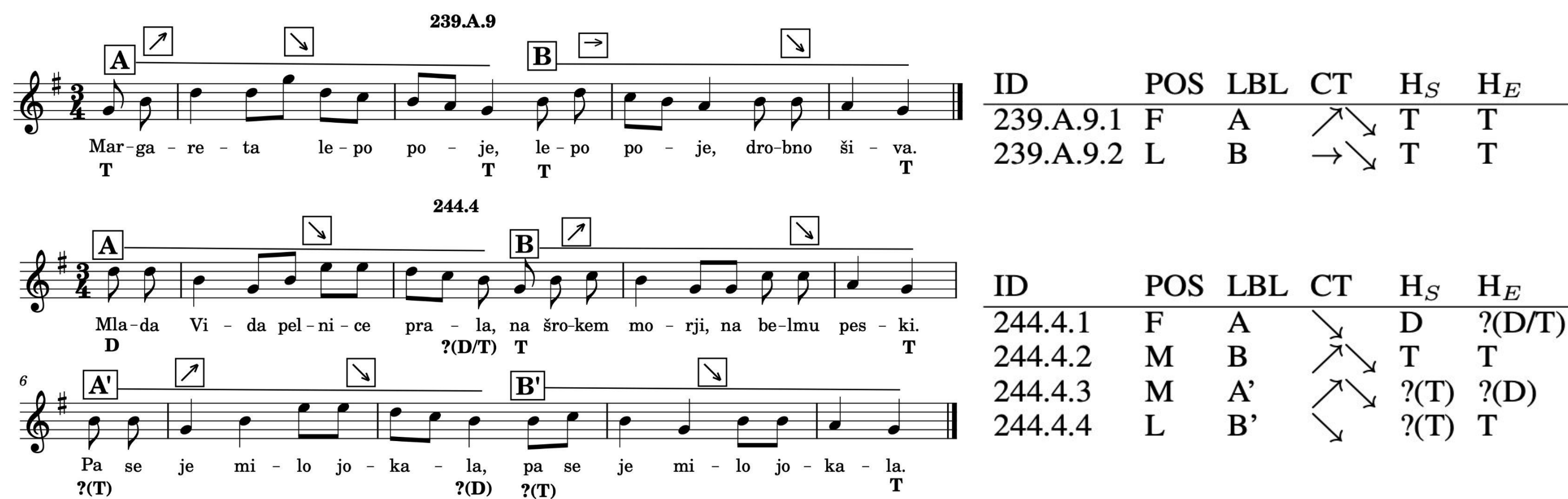


Figure 1: [Left] Two tune variants from the collection with annotated descriptors of phrase variation (in letters), contour (in arrows) and approximate harmonic functions (below the score). [Right] The table of tune examples annotations on the left by phrase position.

We present a study on analyzing **folk songs** using notational music representation, including melodic sequences and musical information. By examining a corpus of Slovenian narrative folk songs, we are releasing **annotations of structure, contour, and implied harmony**. We propose an efficient **algorithm** based on **suffix arrays** and **bitvectors** to match both music **content** (melodic sequence) and **context** (descriptors). By using the algorithm, we introduce a preliminary **case study** on selected corpus and **evaluate** the methodological approach.

Data digitization & annotation

Each phrase of a tune is assigned an ID, which consists of pre-determined type and variant number, as well as phrase number (and additional marks, if applicable). Apart from **metadata** and **melodic sequence** (letter representation with octaves, e.g., A4), each phrase is annotated with the following **musical descriptors**: *phrase position and number, structure (label+symbol), implied harmony, contour [1], time signature, and scale*.

Algorithm

The goal of melody-and-descriptor matching is to find all phrases (associated with their descriptors) matching in both the given pitch pattern and selected variation of descriptor pattern. We first retrieve phrases and positions from a **suffix array** [2], then filter these matches by the selected descriptor matches through **bit-wise operators** [3].

Case study

The 1502 phrases were split into first (400), middle (702), and last (400) positions. We observed that certain **descriptors** (contours, implied harmonies) are **strongly dependent on the phrase position**.

Evaluation

The evaluation of melodic variants of a specific tune type (286) shows that, **by adding descriptors, the queries are matched more precisely** than those, where the melodic pattern is detached from its melodic content.

$(\bar{d} \text{ xor } \pi(dp))$ and $\mu(dp) = 0$. For example, if $dp = (\star, A, \nearrow, \searrow, \star, \star)$, then

$$\begin{aligned} \overline{d_{239.9.1.A}} &= 00 \cdot 0 \cdot 0010 \cdot 01 \cdot 01 \\ \mu(dp) &= 00 \cdot 1 \cdot 1111 \cdot 00 \cdot 00 \\ \pi(dp) &= 00 \cdot 0 \cdot 0010 \cdot 00 \cdot 00 \\ \overline{d_{239.9.1.A}} \text{ xor } \pi(dp) &= 00 \cdot 0 \cdot 0000 \cdot 01 \cdot 01 \\ \overline{d_{239.9.1.A}} \text{ xor } \pi(dp) \text{ and } \mu(dp) &= 00 \cdot 0 \cdot 0000 \cdot 00 \cdot 00 \end{aligned}$$

		T	D	? _T	? _D	?
First	H _S	25%	54%	9%	<1%	12%
	H _E	22%	27%	15%	7%	29%
Middle	H _S	16%	36%	14%	6%	28%
	H _E	21%	16%	18%	6%	40%
End	H _S	19%	32%	10%	5%	34%
	H _E	60%	<1%	20%	None	19%
Total	H _S	19%	40%	11%	5%	25%
	H _E	32%	15%	18%	5%	32%

	\nearrow	\searrow	\nearrow	\searrow	$\nearrow \rightarrow$	$\searrow \rightarrow$
First	24%	16%	30%	15%	6%	1.2%
Middle	36%	21%	15%	8%	10%	1.3%
Last	44%	32%	2%	5%	4%	11%
Total	35%	23%	16%	9%	7%	1.5%

Figures 2 and 3: Statistical results of harmonic and contour descriptors by phrase position (first, middle, last).

Query (melody + descriptors)	TP	FP	FN	Prec.	Rec.	F ₁
d None 1 (34)	28	1191	6	0.02	0.82	0.04
d F	28	327	6	0.08	0.82	0.14
d F, H _S D	27	189	7	0.12	0.79	0.22
d F, \nearrow , H _S D	21	48	13	0.30	0.62	0.41
ddb None 1 (34)	18	75	16	0.19	0.53	0.28
ddb F	18	32	16	0.36	0.53	0.43
ddb F, H _S D	17	21	17	0.45	0.50	0.47
ddb F, \nearrow , H _S D	14	2	20	0.88	0.41	0.56

Figure 4: Evaluation of pattern-matching task with descriptors of tune type 286.

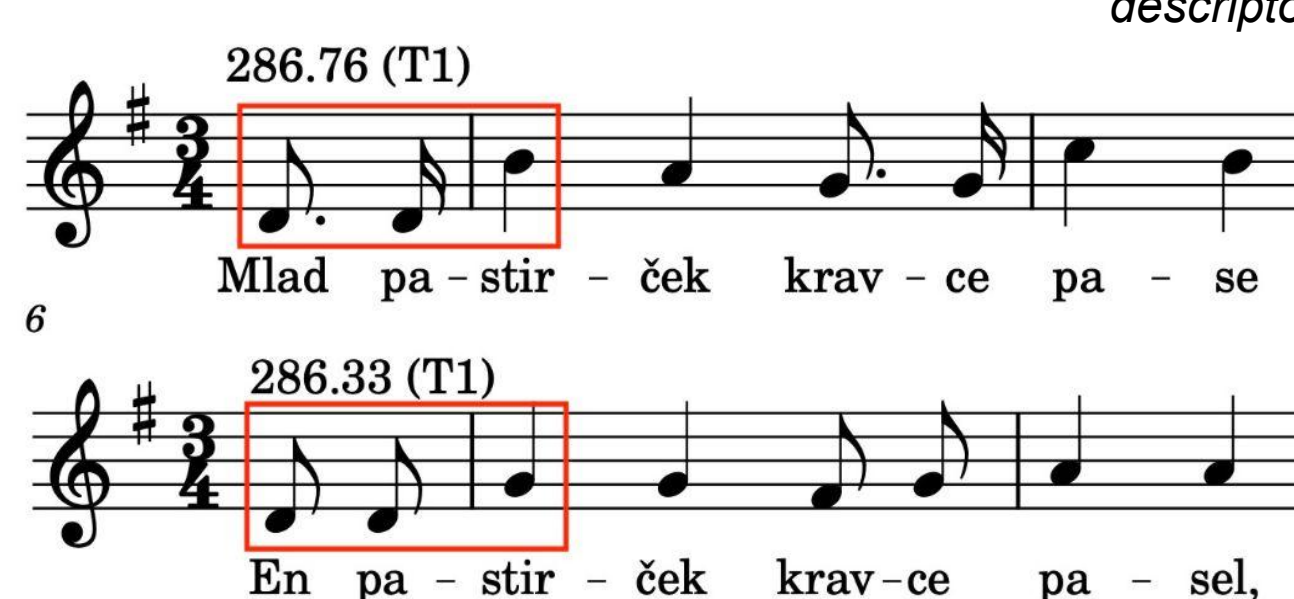


Figure 5: Two excerpts of variants of tune type 286, both of which belong to the same melodic subgroup T1.

References

- [1] D. Huron et al., 1996.
- [2] S. Gog, T. Beller, 2014.
- [3] Code available on algonus.fr/code.

The complete bibliography is available in the paper.