

# MATCHING MUSICAL THEMES BASED ON NOISY OCR AND OMR INPUT

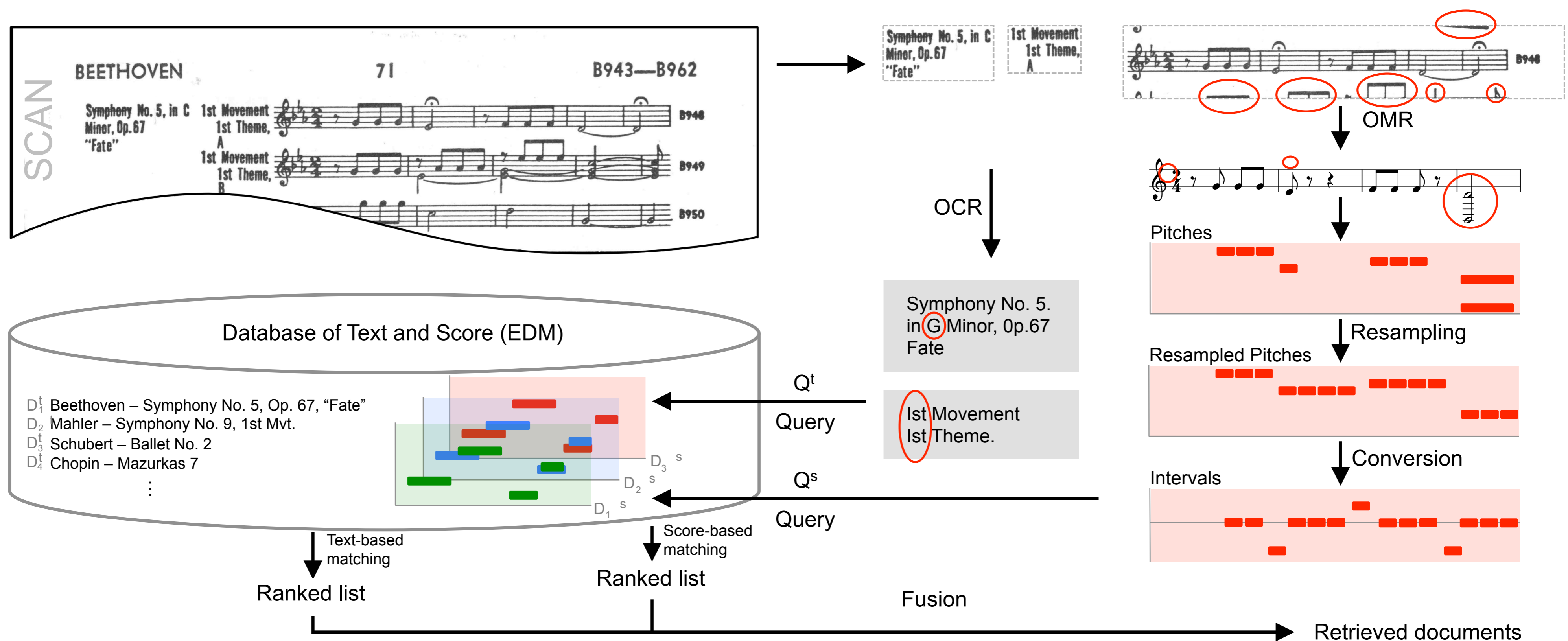
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## Abstract

In the year 1948, Barlow and Morgenstern published the book “A Dictionary of Musical Themes” [1], which contains 9803 important musical themes from the Western classical music literature. In this paper, we deal with the problem of automatically matching these themes to other digitally available sources [2]. To this end, we introduce a processing pipeline that automatically extracts from the scanned pages of the printed book textual metadata using Optical Character Recognition (OCR) as well as symbolic note information using Optical Music Recognition (OMR).

As one main contribution, we adjust alignment techniques for matching musical themes based on the OCR and OMR input. In particular, we show how the matching quality can be substantially improved by fusing the OCR- and OMR-based matching results.

## Processing Pipeline



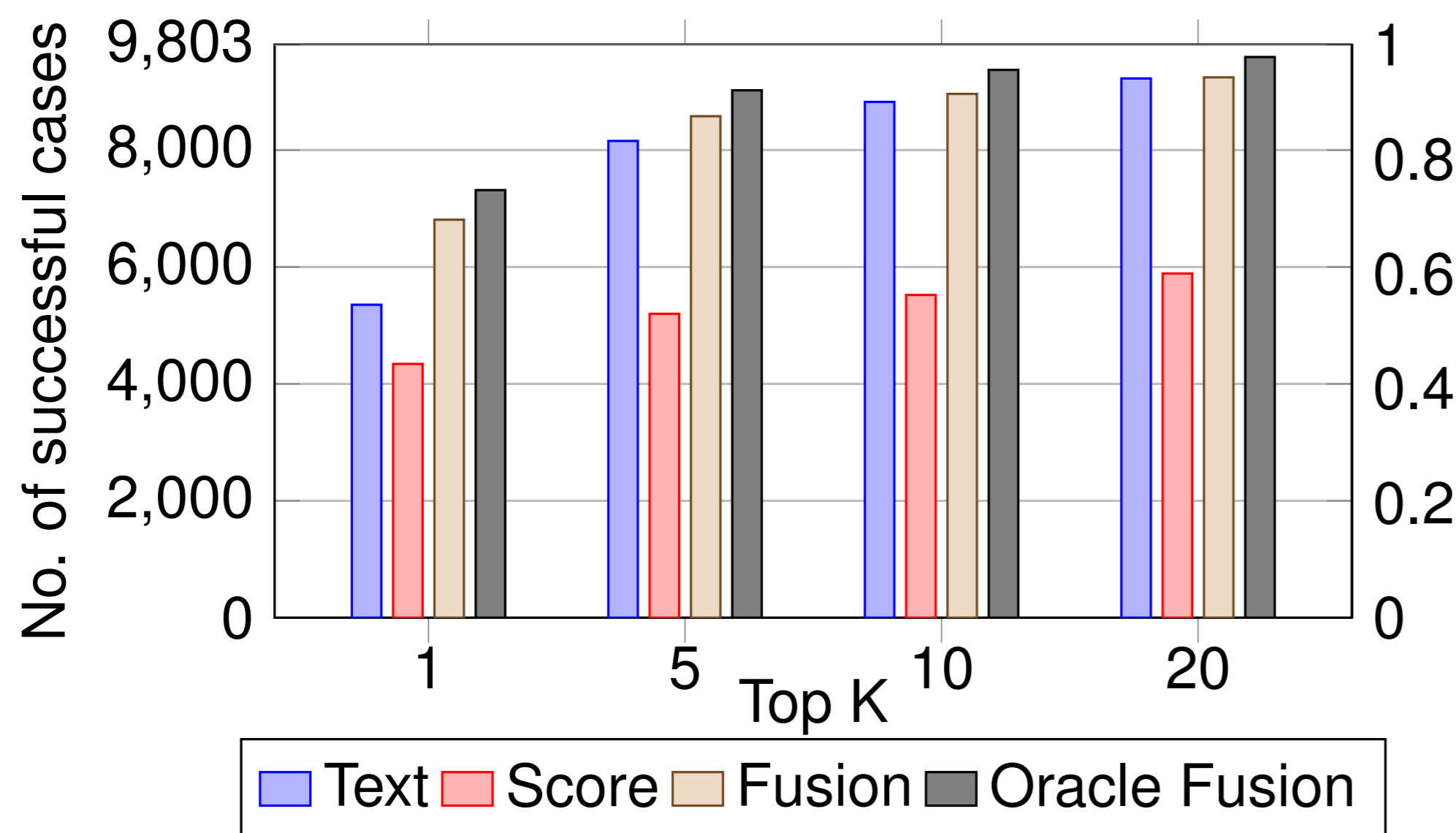
## Case Study

- **Queries:** 9803 musical themes as images [1]
  - OMR: Audiveris [3]
  - OCR: Tesseract [4]
- **Database:** 9803 musical themes from EDM [2]
- **Goal:** Identify the musical themes in the EDM database.
- **Evaluation measure:** Mean rank + Top-K match

## Results

Procedure	OCR	OMR	Fusion	Oracle Fusion
Mean Rank	7.04	1186.26	6.24	3.34
Mean Rank (capped*)	3.64	9.63	2.96	2.24

\*) Capped: Mean ranks are computed by replacing the ranks above K = 20 to the value 21.



- Text-based matching delivers good results.
- Fusion combines results from text- and score-based matching.
  - Main fusion idea: Score should refine the ranked list from the text-based matching.
- Oracle Fusion indicates upper limit.

## OCR Examples

Scenes from Childhood, Op. 15, Pft. From Foreign Lands	Scenes from Childhood. On. 15. Pft. From Foreign laods	Concerto No.1, in A Minor, Vn. & Orch. 1st Movement (Same as No. 7, G Minor, Piano Concerto)	toncerto No.1, in . Alinor.Vo. & Orch. Ist Movement 5 (Same as No. 7.6 Minor, Piano Concerto)	Sonata No. 8, in G Minor, Op. 13, Pft. "Pathétique"	No OCR output
Träumerei	Trfiumerei			1st Movement Intro	Ist Hmment Intrn

## OMR Examples

Scan:		
Output:		
Ex. 1: Schumann - Op. 15-07	Ex. 2: Bach - BWV 1041	Ex. 3: Beethoven - Op. 13

## Literature

- [1] Harold Barlow and Sam Morgenstern, "A Dictionary of Musical Themes," Crown Publishers, Inc., revised edition third printing edition, 1975.
- [2] Jacob T. Schwartz and Diana Schwartz, "The electronic dictionary of musical themes," Website <http://www.multimedialibrary.com/barlow/>
- [3] Hervé Bitteur, "Audiveris - open music scanner," Website <https://audiveris.kenai.com>
- [4] Ray Smith, "An overview of the tesseract ocr engine," in ICDAR, 2007, vol. 7, pp. 629-633.

## Acknowledgments

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