

What Is Topical in Cultural Heritage: Content-based Retrieval Among Folksong Tunes (WITCHCRAFT)

Vooraanmelding CATCH 2005

1a Project Title

What Is Topical in Cultural Heritage: Content-based Retrieval Among Folksong Tunes

1b Project Acronym

WITCHCRAFT

1c Principal Investigator

dr. F. Wiering

2 Classification

3 – Personalisation through presentation

3 Composition of the research Team

1. *Research organisation:*

Utrecht University, Institute of Information and Computing Sciences (ICS):

- Center for Content and Knowledge Engineering (CKE): prof. dr. J van den Berg, dr. F Wiering
- Center for Geometry, Imaging and Virtual Environments (GIVE): dr. R.C. Veltkamp

2. *Cultural heritage organisations:*

- Meertens Instituut, KNAW (folksong recordings): prof. dr. L.P. Grijp
- Theater Instituut Nederland (printed theatre songs): drs. P.J. Post

4 Description of the Proposed Research

4a Scientific aspects

Music is known to every culture, and in each it plays a number of roles, for example in religious ceremonies, in entertainment, or as a sign of social identity. Music is therefore an important aspect of what UNESCO describes as the ‘intangible cultural heritage’ consisting of practices and expressions rather than objects. Access to the musical heritage has its own set of problems that have not been addressed as yet in the CATCH core projects.

Music’s most important manifestation, sound generated during performance, is volatile. It can be captured, though imperfectly, in two ways, as sound recording and as music notation. Worldwide, huge amounts of music have been recorded and notated in attempts to document and preserve traditional culture.

In the Netherlands, Ate Doornbosch created a collection of national importance for his famous radio programme *Onder de Groene Linde* (‘Under the Green Limetree’). Between 1957 and 1994, he has made field recordings of over 7000 songs. At the Meertens Instituut, an information system has been developed around this and other song collections, the *Nederlandse Liederbank* (‘Database of Dutch Songs’). The *Liederbank* contains song metadata such as first line, title, refrain, author, and keywords, but one cannot query the musical content itself. This is a serious lacuna because melody identification and comparison forms the basis of much musicological and ethnological research. We propose to make such search tasks possible by using automation techniques developed for *content-based* music information retrieval (MIR).

Music Information Retrieval (MIR) as a major research topic has emerged only recently. MIR research has produced numerous methods and tools, but few complete, usable working systems exist.¹ All of these only try to match low-level features extracted from audio data or music notation (mostly pitch only, see for example Themefinder²) and as a consequence produce output of limited perceptual relevance (Selfridge-Field 1998). The WITCHCRAFT project sets as its objective to develop a fully-functional content-based retrieval system for folksong melodies stored as audio and notation, building on the best practices of MIR research. More precisely, the project aim is the design, implementation and evaluation of a melody search engine that:

- is capable of handling large amounts of audio and notation data;
- retrieves ranked lists of melodies;
- matches relevant low-level and high-level musical features using similarity measure(s) that are based on music cognition and perception and reflect the musical characteristics of the repertoire;
- is usable for both specialists and the general public.

¹ For a survey of MIR systems see <http://www.mirsystems.info/>

² <http://www.themefinder.org>

This system's potential will be demonstrated by integrating it in the *Nederlandse Liederenbank* of the Meertens Instituut, and adding a selection of theatre songs from the Theater Instituut Nederland to test the strengths of the melody search engine in cross-repertoire research.

The principal issues to be addressed in the project are:

1. preparation of a realistic test corpus;
2. integration of notation and audio data;
3. selection of features and methods to use for the extraction;
4. designing similarity measures;
5. designing efficient matching algorithms;
6. modelling user tasks for both specialists and the general public and visualisation of the query interface and the search results interface;
7. evaluation by music specialists and general public end users.

The computer science part of the WITCHCRAFT project will be executed by the ICS. In the field of MIR, the ICS is the leading institute in the Netherlands. In its Orpheus project³, methods are being researched for searching large quantities of music notation using similarity measures such as the Earth Mover's Distance and Proportional Transportation Distance (Typke et al. 2003; Wiering 2004). The performance of these measures compares favourably to other similarity measures (Typke et al. 2004). ICS's recently started C-minor project (part of the BSIK-3 MultimediaN consortium) focuses on musical similarity measures that have cognitive relevance. Close collaboration with partners abroad such as the Institute for Psychoacoustics and Electronic Music (IPEM) of Ghent University⁴ will enable us to build on tools and techniques developed elsewhere in the WITCHCRAFT project.

4b Innovation

The proposed research is innovative for the following reasons:

- it aims at a complete, working system for melody retrieval;
- audio and notation will be integrated, using the state-of-the-art MAMI transcriber as starting-point for further research (De Mulder et al. 2003);
- knowledge from music perception and cognition will be used for designing similarity measures, based on high-level musical features, that can be finetuned for the repertoire;
- new methods are designed for adequate presentation of musical output;
- it will be evaluated by end users and domain experts, for which adequate evaluation methods will be created (Typke et al. 2005).

4c Relevance for cultural heritage

The Meertens Instituut feels that incorporating a melody search engine into the *Nederlandse Liederenbank* is an urgent matter. Access to the melodic content of recordings and notated music allows large-scale research into transmission, variation and popularity of folksongs that was previously unthinkable. To realise this potential,

³ <http://www.cs.uu.nl/centers/give/multimedia/music>

⁴ <http://ipem.ugent.be/>

they will initiate projects to digitise the entire content of complete song collections, for example of the newly-acquired collection of Harrie Franken (c. 15.000 songs). Research into the origin of folk melodies will be enhanced by including collections of popular music from the early 20th century such as the one of the Theater Instituut Nederland. An impact is also expected in Flanders, where the need for content-based access to the scattered folksong collections is similarly strongly felt. In general, we expect that this project will generate a stimulus for new digitisation projects of musical content, as these are only viable insofar as an effective mechanism exists for providing access to this content.

Melody is the most natural property for people to remember music by. Methods developed in the WITCHCRAFT project can therefore be generalised so that more tangible access to many repertoires within the world's musical heritage can be achieved.

5. Literature

- T. De Mulder, J.P. Martens, M. Lesaffre, M. Leman, B. De Baets, H. De Meyer (2003). An Auditory Model Based Transcriber of Vocal Queries, in: *Proceedings ISMIR 2003*, 246-247
- E. Selfridge-Field (1998). Conceptual and Representational Issues in Melodic Comparison. *Computing in Musicology* 11, 3-64
- R. Typke, C. Gianopoulos, R.C. Veltkamp, F. Wiering, R. van Oostrum (2003). Using Transportation Distances for Measuring Melodic Similarity. *Proceedings ISMIR 2003*, 107-114
- R. Typke, R.C. Veltkamp, F. Wiering (2004). Searching Polyphonic Music Using Transportation Distances. *Proceedings ACM Multimedia 2004*, 128-135
- R. Typke, M. den Hoed, J. de Nooijer, F. Wiering, R.C. Veltkamp (2005). A Ground Truth For Half A Million Musical Incipits, in *Proceedings of the Fifth Dutch-Belgian Information Retrieval Workshop*, 63-70
- F. Wiering, R. Typke, R.C. Veltkamp (2004). Transportation Distances in Music Notation Retrieval. *Computing in Musicology* 13, 113-128