

On Digitization of Documents with Script Presentable Content

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Abstract

The paper is dedicated to details of the digitization of printed documents that include formalized script presentable content, in connection with the revitalization of the cultural heritage. We discuss the process and the necessary software by an example of music, as the recognition of scores is a solved task.

Keywords: information technologies, digitization of heterogeneous content, script presentable content, optical music recognition.

1 Introduction

We met a need for optical recognition of heterogeneous content at the revitalization of the printed cultural heritage.

The whole bunch of connected problems and challenges is presented in [1].

In the paper we'll discuss: widespread script presentations of music; the process of score digitization illustrated by an example; results of digitization and their possible use; organization and necessary support of work with heterogenous documents.

Review of OMR (Optical Music Recognition) software and details of its work can be found in a comprehensive survey [2].

2 Script presentation of music

Historically, content had been presented mainly as plain text with drawings. From other heterogeneous content elements, scores had been the earliest. The oldest interpreted record of a religious song (*Hurrian Hymn to Nikkal*) is dated back to 1400 B.C.¹, and it is in fact a script. Later, the graphical presentation of music was developed.

Modern script presentations of musical content emerged with computer music typesetting.

Exchange standards between music software are MIDI² and MusicXML³.

- MIDI is a standard industrial communication protocol for electronic musical instruments. Information is transmitted in the form of binary messages.
- MusicXML is an XML file with specific tags and attributes for music.

3 Process of score digitization

We will use the score of *The wedding waltz* by Eugen Doga. Stages of the process are: scan; image refinement; OMR; manual correction of the result in a music editor.

The scan should be performed in black-and-white, 300 DPI. We need BMP or TIFF without compression image format. This is dictated by SharpEye⁴ that is our recognizer. Other OMR programs may permit other formats. We applied afterscan image refinement tool Scan Tailor⁵. Fragment of such scanned image is in Tab. 1(A).

SharpEye can recognize several images at once in its batch mode. The result of recognition is opened for viewing as in Tab. 1(B). It

¹<http://urkesh.org/attach/duchesne-guillermin%201984%20the%20discovery%20of%20mesopotamian%20music.pdf>

²Musical Instrument Digital Interface; <https://www.midi.org/>

³<https://www.musicxml.com/>

⁴<http://www.visiv.co.uk/>

⁵<https://scantailor.org/>

may be immediately edited. However, dedicated music editors provide much more possibilities. To pass the recognition result to external music editor, we exported it into MusicXML.

There are several restrictions for SharpEye, for example, it recognizes only the Latin script. To correct possible recognition errors we opened the resulting XML file with Musescore⁶. We see in Tab. 1(C) that some details disappeared, for example, glissando and a badly printed note at the end of measure 9. Some mistakes are clearly audible at playing. Then the file was thoroughly checked visually and corrected. The score was also complemented with title and author name. See the fragment of final result in Tab. 1(D).

4 Result and its use

The obtained script presentation of the score has a lot of advantages and ways to use: compactness; generation of visual presentation with different decor and design; easiness of transposition and orchestration; editing (adding, deleting, and replacing notes); replacement of textual components into the score; search by diverse criteria; export in different graphical and script formats; playing; re-publishing; insertion of musical fragments, and other types of content, into the text of a heterogeneous document⁷; montage of music from fragments of different pieces, etc.

5 Conclusion

At present we haven't any possibility to combine formatted text and score in a uniform script. The heterogeneous document is assembled in the text processor by converting any other type of content into images that are inserted on document pages. This motivates the need in an integrated platform to work with heterogeneous texts [1].

⁶<https://musescore.org/en>

⁷An example mix of text, music, and math formulas:
https://math.ru/lib/files/pdf/Taneev_S_Podvizhnoy_kontrapunkt_strogo_pisma.pdf

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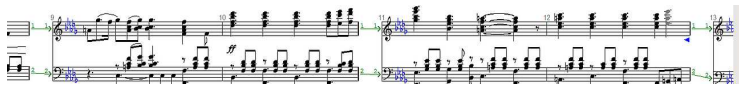
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Table 1. Score digitization in progress

A:
Scanned



B: Rec-
ognized



C:
Played
in editor



D: Cor-
rected

