ISMIR Late-Breaking/Demo [Unrefereed]

TOOLS FOR SEMI-AUTOMATIC BOUNDING BOX ANNOTATION OF MUSICAL MEASURES IN SHEET MUSIC

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EXTENDED ABSTRACT

In this contribution, we introduce various tools that are useful in the context of score following applications, where measures are highlighted synchronously to audio playback [1,3]. Such applications require alignments between sheet music and audio representations [2]. Often, such alignments can be computed automatically in the case that the sheet music representations are given in some symbolically encoded music format. However, sheet music is often available only in the form of digitized scans. Recently, the potential of deep learning techniques has been explored to directly link pixel positions in scans of sheet music to time positions in audio recordings [1]. While being a promising research direction, such approaches still lack robustness and also require large amounts of annotated training data.

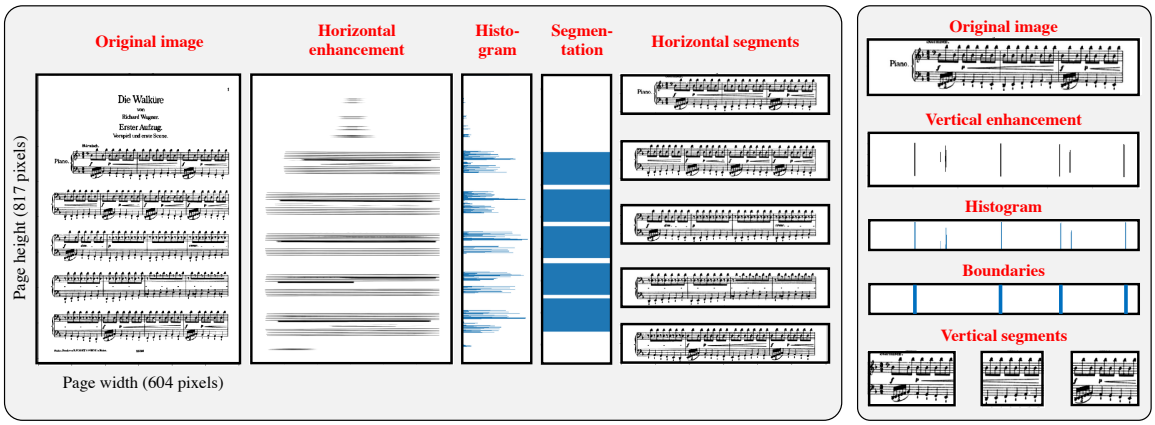

Figure 1. Two-stage segmentation approach for automatically detecting bounding boxes of sheet music measures. **Left:** Horizontal segmentation for detecting musical stave lines. **Right:** Vertical segmentation of musical stave lines for detecting measure boundaries.

In our contribution, we present tools for solving a subtask: the annotation of bounding boxes (given in pixels) of measure positions in digital scans of sheet music—a task that is extremely tedious when being done manually. First, we present an automated two-stage segmentation approach for detecting such bounding boxes, where we exploit strong heuristics on the specific structure of Western sheet music notation. (Figure 1). In the first stage, we detect stave lines using a filtering approach for enhancing horizontal structures. In the second stage, we detect measure boundaries using a filtering approach for enhancing vertical structures. In both stages, we further exploit the continuity properties of note lines and measure lines that are not shared by other horizontal or vertical structures (e.g., note stems). Second, we introduce an interactive interface that assists a user in annotating and correcting bounding boxes (Figure 2a). Among others, the tool provides

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automated functionalities for splitting, adding, deleting, merging, and manipulating bounding boxes. Third, we describe a web-based score following interface based on the `trackswitch.js` technology [4], which demonstrates the usefulness of the annotated bounding boxes (Figure 2b). Finally, we provide measure annotations for several hundred pages of sheet music including Beethoven piano sonatas, Schubert piano songs, piano transcripts of Wagner operas, and music from the Carus publishing house[1].

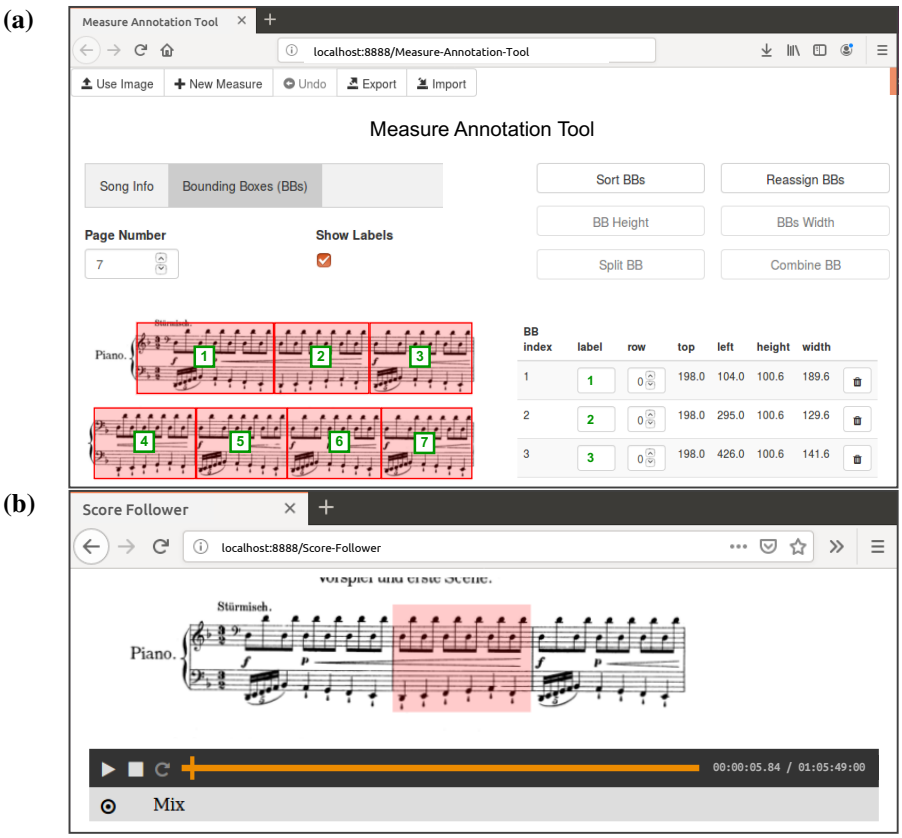

Figure 2. **(a)** Interactive user interface for bounding box annotation. **(b)** Interface for measure-wise score following.

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