Optical Music Recognition and its Applications

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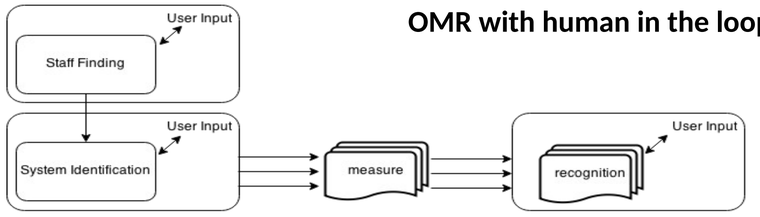
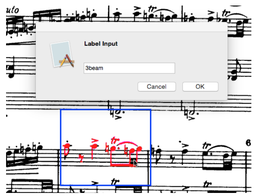
Overview

1, Optical Music Recognition (OMR) is aimed to convert printed score image to machine-readable format, that is, extracting musical information from score images.
2, Our system consists of staff finding, measure identification, instrumentation recognition, symbol recognition, rhythm interpretation, automatic notation, human-assisted re-recognition, … and there are many more possibilities in the future!

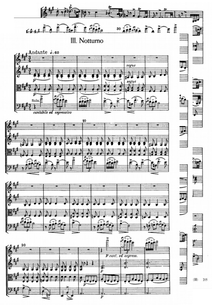


OMR with human in the loop



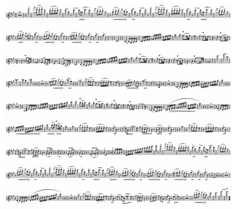
Automatic Notation, Score-to-parts, and Transposition

1, Represent recognized symbols as bag-of-primitives
2, Construct the connected graph for primitives in each *part*
3, Formulate automatic notation as a convex optimization problem on the primitive graph, perform the inference with Newton's method

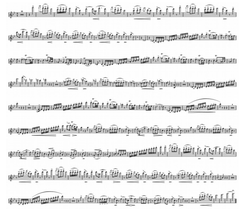


Source files of **the third movment, Notturno, of Alexander Borodin's second String Quartet**

Primitive graph of the first line from the fist **violin** part



Automatically notated **violin** part



Automatically transposed **violin** part

Orchestral Instrumentation Recognition

Assumptions:

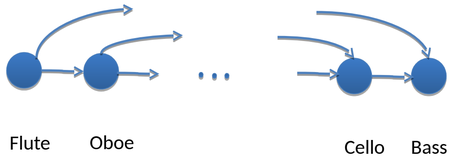
1. The order of the instruments is fixed within the same score.
2. The places of the instrumentation texts are either on the left of the staff line or between two staff lines.

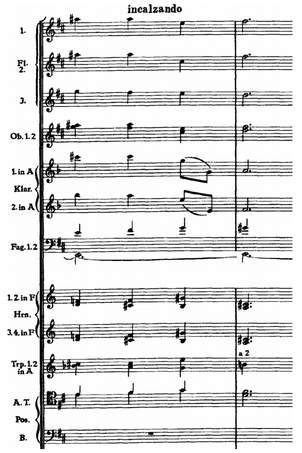
Information from the user:

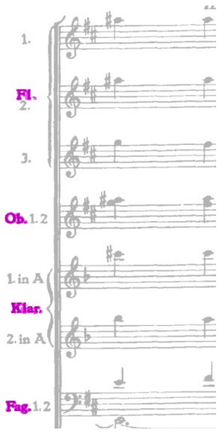
1. The names and the order of the instruments.
2. The possible patterns for each instrument. (the number of staves it can occupy and the corresponding location of the texts)

Method:

1. Calculate the likelihood score for an instrument with certain pattern appearing at certain place.
2. Use Dynamic Programming method to calculate the best configuration of the instrumentation.







Iteratively generating adaptable characters templates:

Step 1: Collect original templates from other scores.
Step 2: Use the current set of templates and do the recogniti
Step 3: Collect the templates from current recognition result
Step 4: Train the new set of templates.
Step 5: Go to Step 2.

Rhythm Interpretation

Problem:

Given recognized symbols from OMR, we want to be able to play back the music. Therefore we want to interpret rhythm or to understand the onset time and duration of every note.

Difficulties:

1. Multiple voices.
2. Omitted tuplet symbols
3. Voice spanning between different measures
4. Irregular beaming

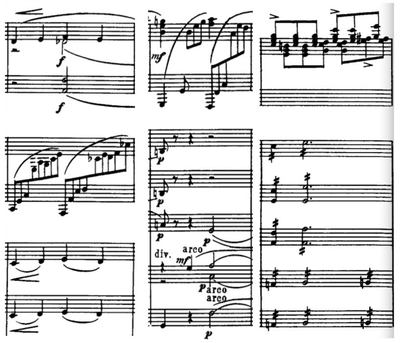


Figure1. Examples of measures of difficult rhythm from Rachmaninoff Piano Concerto No.2. All 3 system measures are in metric of 4/4.

To build to rhythm graph

1, Each note, rest and bar line is treated as a ***vertex***.
2, Vertices can be connected by either a ***voice ledge*** or ***coincidence edge***.
3. Each edge is assigned a score according to music rules. We seek the ***graph*** with maximum score.

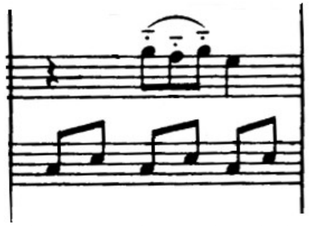
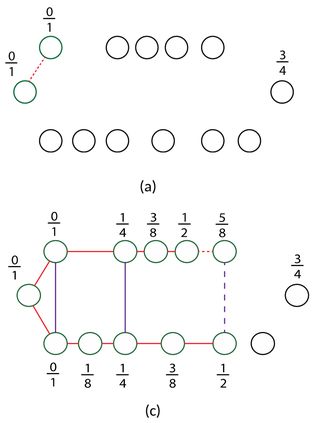


Figure2. An example measure in metric 3/4 .



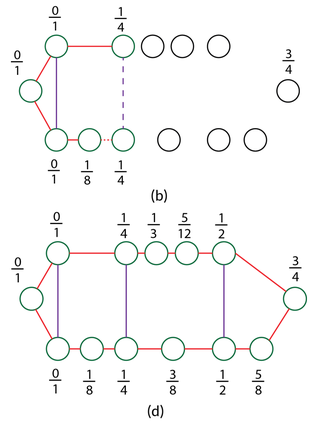


Figure3. Illustration of procedures to build a rhythm graph for the example measure in Figure 2.