A Nutshell Guide to Annotating Recorded Piano Performances on the Web with CosmoNote

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ABSTRACT

CosmoNote is a web-based citizen science tool for annotating expressive musical structures created by performers during piano performances. For this demonstration, we describe the annotation process in CosmoNote that allows citizen scientists to find and mark these expressive musical structures.

1. INTRODUCTION

In the course of performing scripted music, a pianist will use expressive variations in tempo and loudness that go beyond the score to communicate emphasis or structure through a performance. Understanding how performers create these structures is the key to comprehending how performers think about the piece and how they convey this thinking to listeners. However, it can be difficult to discern these structures with automated analysis and so, to find these structures in performed piano music, we have created CosmoNote [1], a citizen science annotation tool that asks participants to lend their ears to finding and marking these structures. For this demonstration, we provide an overview of the CosmoNote annotation process for our citizen scientist participants.

2. THE ANNOTATION PROCESS

The following subsections describe the process for creating annotations in CosmoNote, from creating an account to navigating collections of recorded performances to listening to, visualizing, and annotating these performances.

2.1 Creating an Account

To begin the annotation process, participants must first create a CosmoNote account which requires an e-mail address and a password. Account creation is done from the CosmoNote start page[1]. In addition, participants must be at least 18 years old and agree to the user agreement which can be read in full by clicking the link provided. Note that the account and the data associated with that account sit on a secure, remote server.

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[1] https://cosmonote.ircam.fr/

2.2 Selecting a Collection

When participants create an account or log in with an existing account, they will see a list of collections like that shown in Figure 1. After reading the descriptions and deciding which collection they wish to explore, they then click on that collection to start navigating its set of recorded performances.
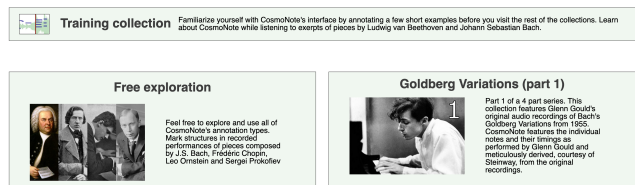

Figure 1: A list of collections: training, free exploration, and Glenn Gould's recording of Bach's Goldberg Variations
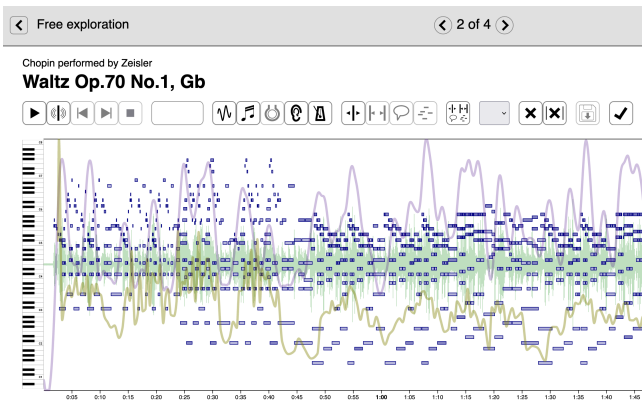

Figure 2: The CosmoNote performance page including navigation, information, controls, and visuals

2.3 Navigating the Recorded Performances

Once a participant has selected a collection, they will be shown the recorded performances for that collection, one performance per page, starting with the first one. Figure 2 shows the second performance in the Free Exploration collection. Participants can navigate through the collection with the backward and forward buttons at the top of the page while information about each recorded performance is displayed below the navigation as shown at the top of Figure 2.

2.4 Listening to the Recorded Performances

When a participant wants to listen to the audio for a performance they can start with the controls shown in Figure 3. The audio playback can be paused or stopped at any time during playback and, while audio is playing, participants can click on any time point in the corresponding visuals (as described in the next section) and playback will stop and start again from the time point selected.
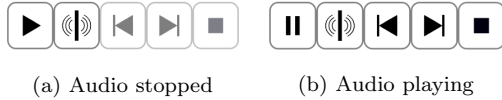

(a) Audio stopped   (b) Audio playing

Figure 3: CosmoNote's audio controls

2.5 Visualizing the Recorded Performances

CosmoNote shows musical data visually via superimposed information layers showing waveforms, note and pedal data, and via curves based on extracted feature data. The features include loudness, tempo, and harmonic tension with each type of visual data shown in a distinct layer. Each visual layer can be turned on and off individually with the controls shown in Figure 4a to allow for focus or comparison among the different layers. Figure 4b shows, superimposed, the waveform and note layers along with loudness and tempo curve layers.

(a) Visual controls for music data and extracted features: audio, notes, pedals, loudness, and tempo
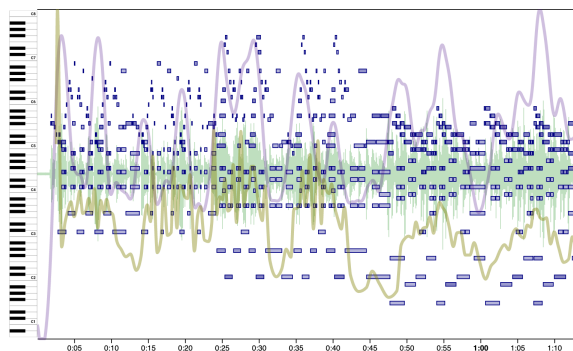
(b) Tempo and loudness overlaid on waveform and notes

Figure 4: CosmoNote visual layers and their controls

2.6 Annotating the Recorded Performances

For annotating performances, CosmoNote offers four types of annotations: boundaries, regions, comments, and note groups.

2.6.1 Boundaries

Boundaries represent time points that separate a musical performances into segments of musical ideas. Boundaries have four different strength levels that are indicated visually via opacity and the thickness of lines with both increasing as the level increases.

(a) CosmoNote annotation controls: boundaries, regions, comments, note groups, show/hide annotations, boundary strength, delete selected, delete all, and save
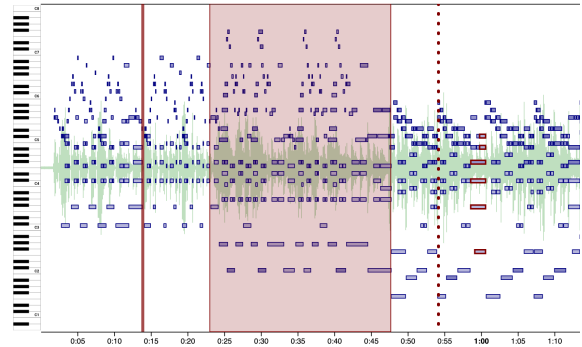
(b) CosmoNote annotations: examples of (left-to-right) a boundary, a region, a comment, and a note group

Figure 5: CosmoNote annotations and their controls

2.6.2 Regions

Regions delineate entire segments or areas of interest in a performance. Their function overlaps with that of boundaries but regions encompass all of the notes between two boundaries rather than just the boundaries themselves.

2.6.3 Comments

Comments enable annotators to mark elements of interest and to write some text about them. They are meant to provide a means to point at something of interest that is not captured by the other annotation types.

2.6.4 Note Groups

Note groups enable annotators to select a subset of the notes in a recorded performance to highlight those notes as belonging to some expressive structure. To select notes, an annotator drags a rectangle around the notes that they wish to select. Once a note group is created, notes can be individually added to or removed from the group.

3. TECHNICAL REQUIREMENTS

CosmoNote can be demonstrated either in person or online since it runs in any modern browser. However, with detailed visuals, CosmoNote works best on desktop browsers.

4. ACKNOWLEDGMENTS

5. REFERENCES

[1] L. Fyfe, D. Bedoya, C. Guichaoua, and E. Chew. Cosmonote: A web-based citizen science tool for annotating music performances. In *Proceedings of the International Web Audio Conference*, 2021.