Visualizing Chord Recognition Performance

Christopher Liscio, Blake Vanberlo, Aniruddhan Murali, Shuhui Zhu, & Dan Brown

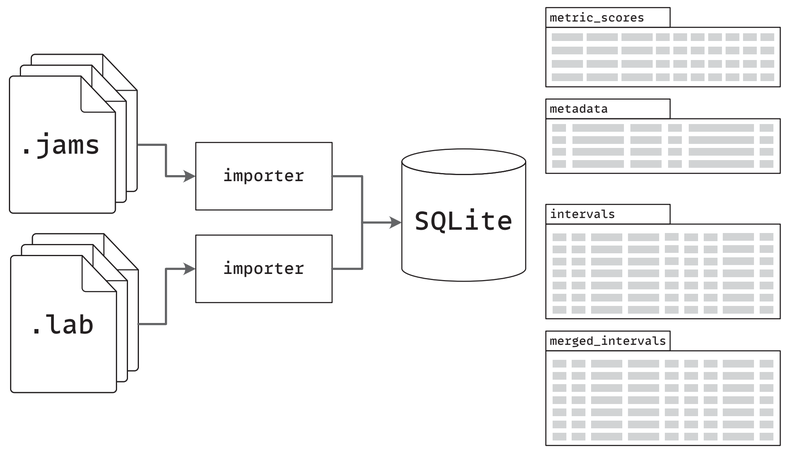
UNIVERSITY OF WATERLOO | DAVID R. CHERITON SCHOOL OF COMPUTER SCIENCE

clliscio@uwaterloo.ca, dan.brown@uwaterloo.ca

Abstract

We created a visualization tool that helps Automatic Chord Recognition (ACR) developers to characterize system performance across a test data set. Our system's design uses principles from the field of Information Visualization (InfoVis) to communicate accuracy more effectively than a table of mean metric scores. We share some of the insights we developed while building our tool, and hope our findings may help inform the design of figures used in future publications, and affect how future ACR system designers improve and present their systems.

System Input



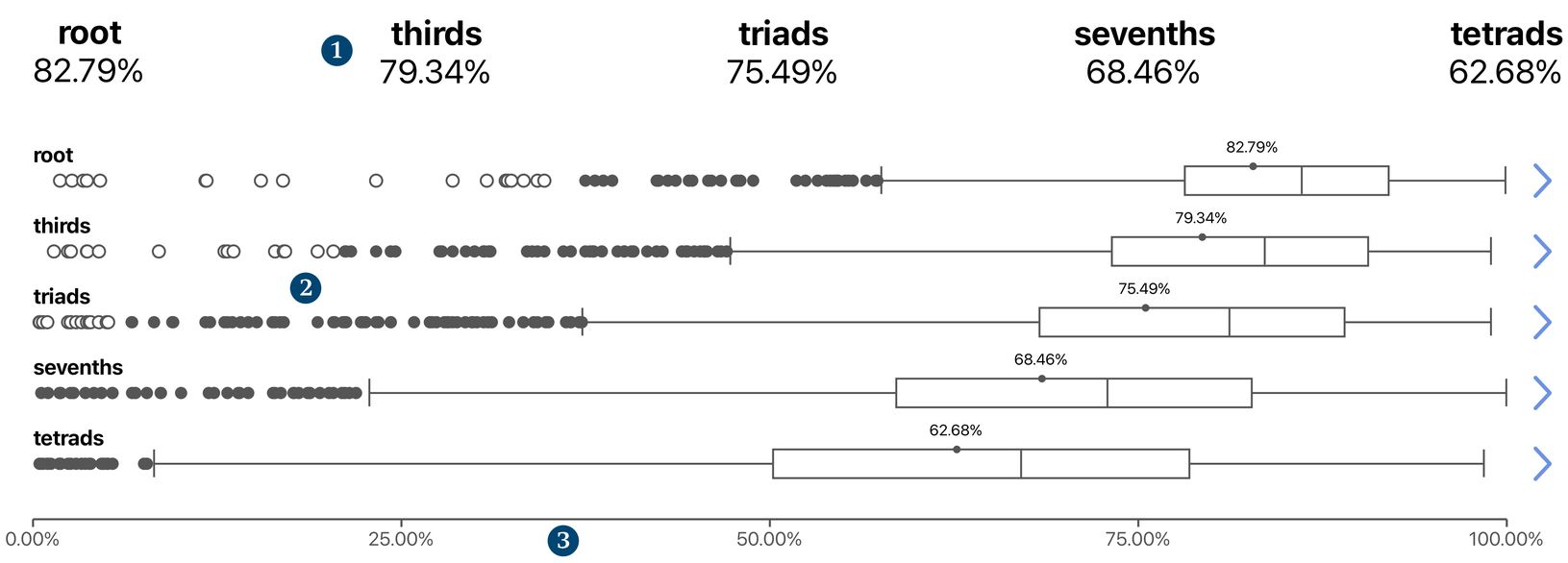
We import and process an ACR system's labeling on the test set to populate an SQLite database, which allows us to rapidly execute queries that gather data for our dataset-wide summary visualizations. For example, we have queries that gather suitable data for the Standard Metric Pictograms, and for our Metric Score Overviews.

This approach elides the excessive file system activity that would otherwise be required to traverse a large test set. As a result, we can achieve highly interactive visualizations in our system.

Metric Score Overviews

We follow the standard convention, and present overview scores (1) for a number of the standard metrics. However, instead of reporting only mean values, we use box plots with **explicitly-rendered outliers** (2) to better represent the distribution of scores across the entire test data set. Using a **common horizontal scale** (3), we can see a clear decline in performance as metrics become successively more discriminative.

We offer users a simple mechanism to further investigate problematic songs. Hovering the mouse over an outlier score, they can immediately see which song it came from. Clicking the outlier reveals a more detailed presentation of the differences between the system's estimates and the ground truth annotations.



Individual Song Results

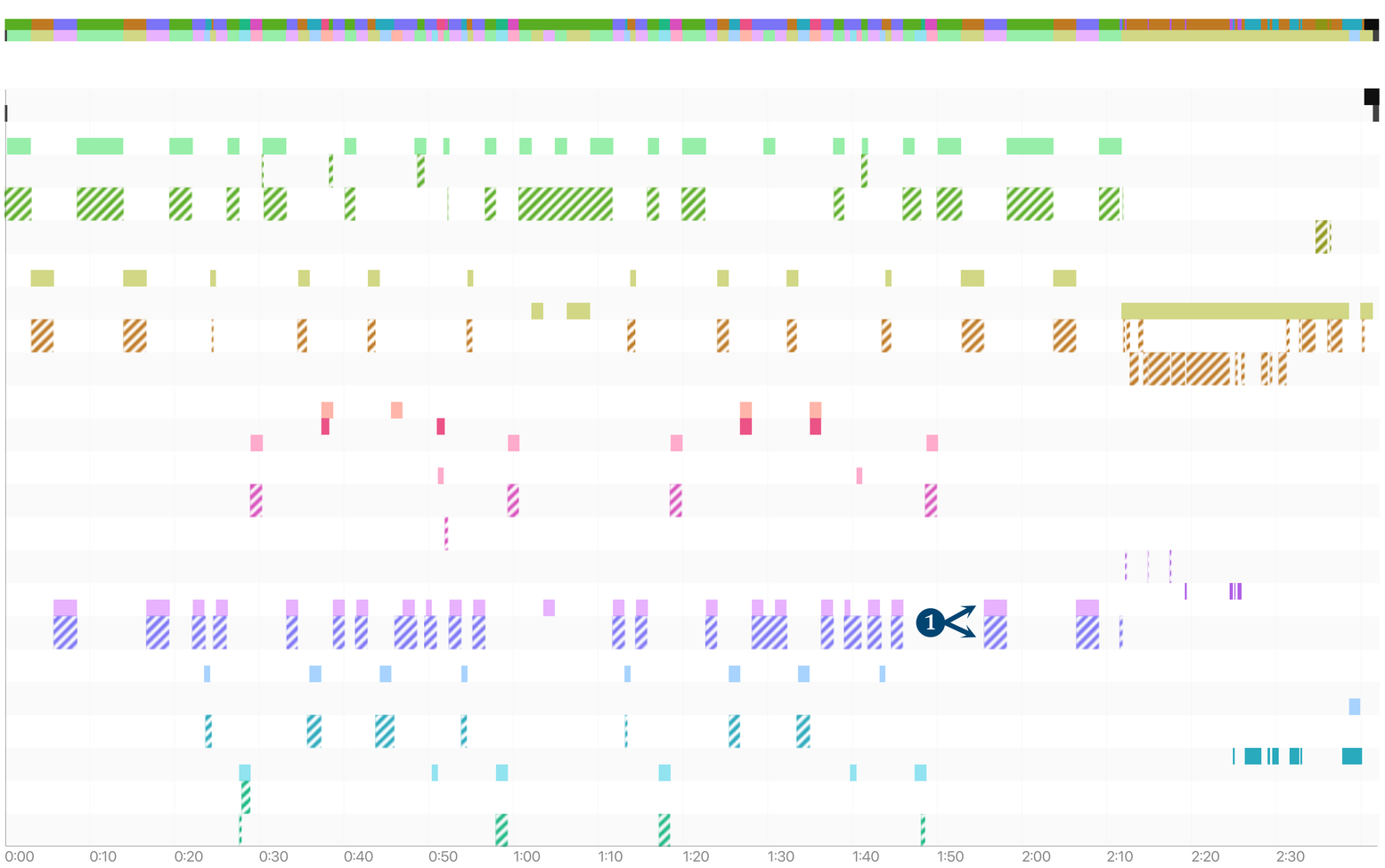
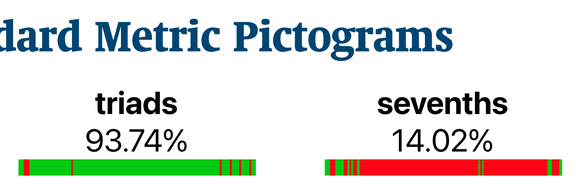


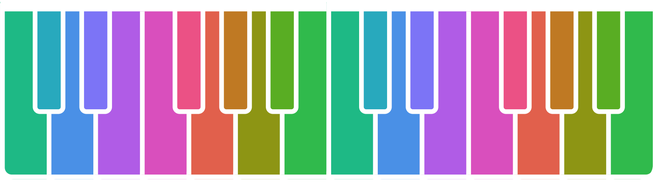
Figure 1. A cropped section of the song results screen, illustrating the **Timeline Browser** interface. Individual *lanes* are allocated to distinct chord labels, and distinct, striped fills emphasize chords that are not found in the ground truth vocabulary. The display is fully interactive, offering both horizontal zooming and panning.

Standard Metric Pictograms



We display a visual representation of the matching function's output below each metric score in the song results screen. At a glance, these pictograms convey both *goodness*, and matches across the song.

Root Note Coloring



Chord intervals are assigned colors based on their root note. We selected colors that maintain an **even perceptual distance** between adjacent pitch classes, and have **high contrast** against a white background.

Our coloring relates chords with the same root notes, and makes adjacent root notes look similar (Fig 1, (1)).

Chord Lanes

Intervals for each chord label occupy *lanes* that we divide vertically between the ground truth (bottom) and estimate (top) contributions (Fig. 2, (1)). This makes boundary differences evident, and clearly indicates when the ACR system's estimates agree with the ground truth.

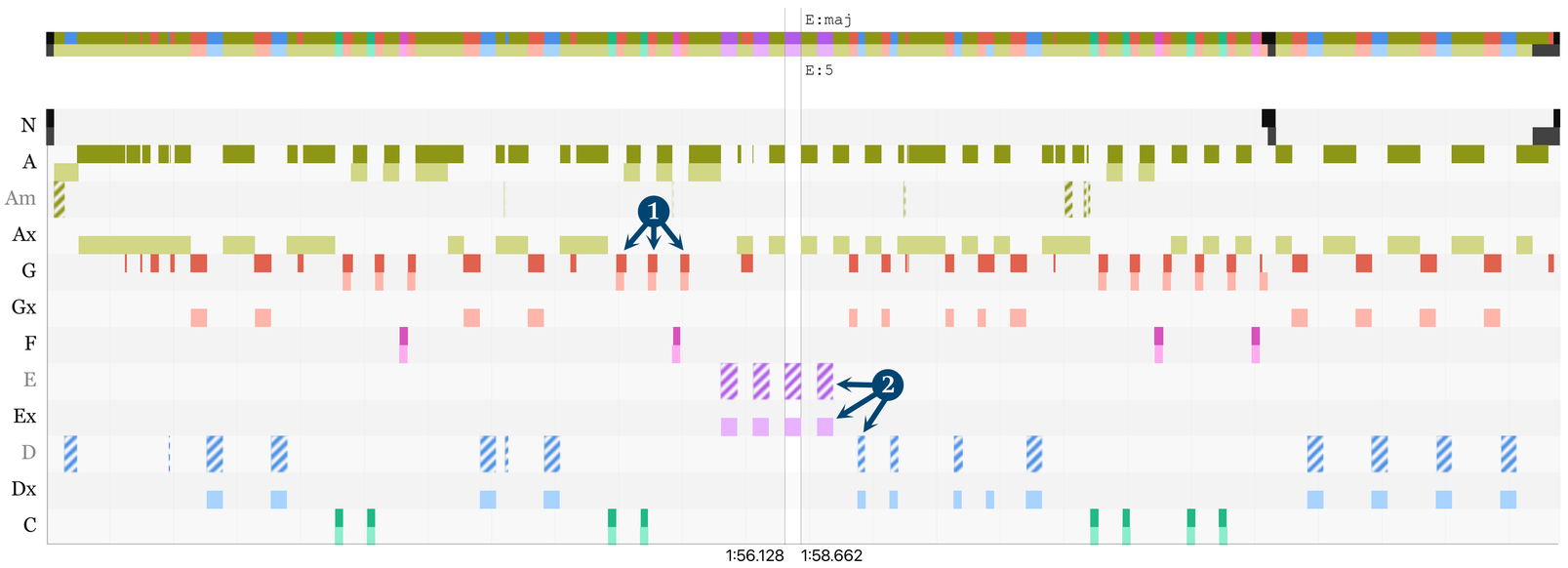


Figure 2. Interaction in the Timeline Browser interface. When the mouse cursor is hovered above a merged interval to highlight it, we reveal its underlying textual labels in the overview pictogram, and its bounds on the horizontal time axis.

Distinctive Errors

Predicted labels that do not appear in the ground truth vocabulary appear taller, with a striped fill pattern to stand out. However, our root note coloring strategy reduces this *visual severity* when appropriate. In Fig. 2, (2) we see the `E:maj`, `E:5`, and `D:maj` labels in close proximity. The `E:maj` is out-of-vocabulary, yet still appears related to the `E:maj`, and not the `D:maj`.