TiLiA – TimeLineAnnotator

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Summary

'TiLiA' (**TimeLine Annotator**) is an open-source, cross-platform network of tools and resources designed to facilitate real-time creating, displaying and interacting with timeline-style annotations of audio, video and musical scores. Developed in Python with the PyQt UI framework, TiLiA is available primarily as a desktop Graphical User Interface (GUI),supported by a Command Line Interface (CLI) as well as a free and open online platform where users may upload, view and query existing analyses.

Statement of need

Visual analyses of music have proven to be an enduringly popular, effective, and versatile tool for conveying a variety of musical ideas. [1] As the famous adage goes: 'a picture is worth a thousand words'. These analytical images are primarily connected to the *analysis* rather than the *music*, thus making them readily useful not only for the already visual sources of notated music, but also for the much broader range of musical styles and repertoires that are transmitted without the use of notation.

Whatever potential a *static* image has, an *interactive* one offers considerably more. Formal analysis is one of the clearest beneficiaries of the visual summary of music. Form can be hard to parse (especially in real-time) but is often easy to understand in relatively simple, at-a-glance summaries.

Save for a few exceptions (Gotham & Ireland, 2019), musical scholarship has not yet made the leap into this technological space with any degree of decisiveness or consistency. Even most visually minded music analyses are consigned to static images embedded in print (or in e-copies at best) and not subject to the expectations for *fair*, open-source data sharing that are now *de rigueur* in other fields. Still among the more computationally inclined communities, there has been little progress made on the coordination of standards and corpora for formal analysis.

In today's digital age, we have come to expect certain basic interactive features across visual interfaces, such as **resizing** content to fit the window, keyboard shortcuts, undo/redo functionality, and so on. Musical contexts extend this with additional expectations, such as **real-time synchronisation** (a.k.a., audio or score following). Any tool that aims to win over users effectively must present analytical ideas naturally and intuitively, with minimal friction in the user interface.

While one *can* appropriate tools (which primary purpose is editing scores or audio) for creating

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[1]See Isaacson (2023) for a survey of this long history.

36 visual analyses, [2] [3] the current range of tools dedicated to the task typically offer limited
37 functionality and their uptake by the wider community haws been minimal. [4]

38 In response to these challenges (user-friendly design, interoperable formats, real-time interac-
39 tivity …), we present 'TiLiA': a timeline annotator for all.

40 Specifications

41 TiLiA consists of an organisation of digital tools, primarily of its open-source desktop application
42 and command-line interface, but also of a supporting online platform, which we plan to make
43 open-source in the future. The desktop application is developed in Python using the PyQt
44 binding for the Qt UI framework. Automated testing is done with `pytest`, and partially-
45 automated deployment is available via GitHub Actions. The code base is loosely organized
46 around a Model-View-Controller (MVC) pattern, which allows both the CLI and the GUI
47 to benefit from the same backend logic. We provide object-oriented base classes such as
48 `Timeline`, `TimelineUI` and `TimelineComponent` as a means to promote extensibility and
49 support an evergrowing range of annotation needs.

50 TiLiA is designed to facilitate the *creation* of analyses — particularly where this requires
51 complex alignment with audio/video sources — and the (conversion and) *import* of analyses
52 of external origin through CSV files. This effort thus connects TiLiA to wider datasets and
53 scholarship, while also expanding its functionality. The tilia-dcml repository demonstrates how
54 the TiLiA CLI might be used to visualise data from an external corpus of musical analyses.
55 The CLI can also *export* timelines created in TiLiA to a JSON file suitable for processing by
56 other software.

57 The desktop application

58 The main part of TiLiA is a cross-platform *What-You-See-Is-What-You-Get* GUI (Figure 1),
59 designed to feel intuitive to anyone who has worked with audiovisual editing software. A
60 TiLiA analysis consists of timelines, each containing annotations that can be aligned to an
61 audio, video, YouTube stream or musical score. Each *timeline type* is designed to support
62 conventional formal annotations, with the affordance to work with a variety of other analytical
63 styles. These timelines each contain one or more *component types* (e.g., markers for marker
64 timelines), each with different *properties* to convey information including comments, colour
65 and labels.

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[2] The music notation software *Sibelius*, for instance, has offered a timeline since c.2019 with bar numbers and rudimentary checkpoints for changes to time and key signatures, presumably because they are possible indicators of section breaks. Peebles (Peebles, 2013) discusses how to use an audio editor (*Audacity*) in a similar way to the tools discussed here.

[3] Additionally, websites like *Edirom Online* (Röwenstrunk, 2014), *Listen Here!* (Weigl et al., 2023) and *mei-friend* (Goebl & Weigl, 2024) support the digital annotation of scores, not specific to analysis.

[4] Yorgason's *Audio Timeliner* (Yorgason, 2018), based on the original *Variations Audio Timeliner* (Notess & Swan, 2004), is notable for capturing the needs of its users with its simple design. *Dezrann* (Giraud et al., 2018) is another noteworthy, actively maintained website that allows the alignment of score data on top of annotation.
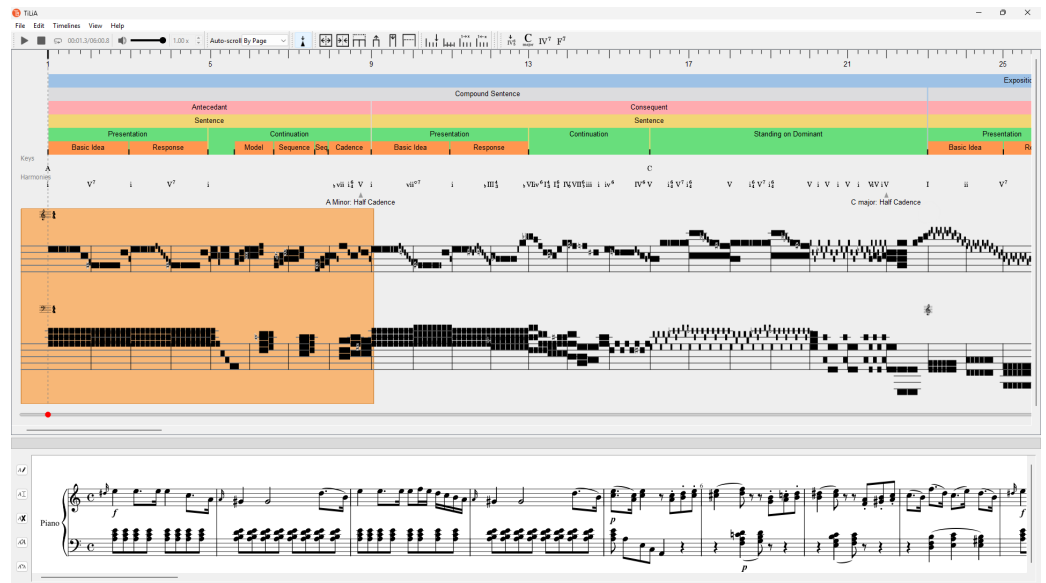
Figure 1: Excerpt of a TiLiA analysis on the desktop application.

Currently, there are six types of timelines:

- **Audiowave timelines**, for displaying amplitude graphs
- **Harmony timelines**, for displaying properly formatted chord symbols and roman numeral analysis
- **Hierarchy timelines**, for representing hierarchical structures
- **Marker timelines**, for highlighting discrete timepoints
- **PDF timelines**, for synchronising PDF documents with playback
- **Score timeline**, for synchronising a to-scale and synchronized "piano roll" notation as well as conventional musical notation from digital scores with playback

Command-line interface

In addition to the desktop GUI and the web app, a **command line interface** allows the automation of file and timeline creation and edition, media loading and external data importing. Sequences of commands can be loaded by the CLI from scripts written in plain text files, enabling programmatic conversion from various data formats to TiLiA files.

```
metadata set-media-length 120
timelines add hierarchy --name "Form"
timelines add marker --name "Formal closures"
timelines add hierarchy --name "Harmonic segments"
timelines add beat --name "Measures" --beat-pattern 1
timelines add marker --name "Harmony"
timelines add marker --name "Harm. functions"
timelines add marker --name "Keys"

load-media <path to audio> --scale-timelines yes
metadata set title "Title"
save --overwrite <path to TiLiA file>
```

Online platform

The TiLiA desktop application is supported by an online platform that lets users store, share, visualise and even query existing analyses. Registration is free and is only required for uploading

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content. This reflects a goal of TiLiA to support not only the modernised creation and storage of analyses, but also to support the still-rare practice of analytical *collaboration* and structured *searches* on the corpora; both which benefit from network effects facilitated by the lowered entry barrier.

References

Giraud, M., Groult, R., & Leguy, E. (2018). Dezrann, a Web Framework to Share Music Analysis. In S. Bhagwati & J. Bresson (Eds.), *Proceedings of the International Conference on Technologies for Music Notation and Representation – TENOR'18* (pp. 104–110). Concordia University. ISBN: 978-1-5251-0551-7

Goebl, W., & Weigl, D. M. (2024). Mei-friend: An interactive web-based editor for digital music encodings. *Journal of Open Source Software*, *9*(98), 6002. https://doi.org/10.21105/joss.06002

Gotham, M. R. H., & Ireland, M. (2019). Taking Form: A Representation Standard, Conversion Code, and Example Corpora for Recording, Visualizing, and Studying Analyses of Musical Form. In A. Flexer, G. Peeters, J. Urbano, & A. Volk (Eds.), *Proceedings of the 20th International Society for Music Information Retrieval Conference, ISMIR 2019, Delft, The Netherlands, November 4-8, 2019* (pp. 693–699). http://archives.ismir.net/ismir2019/paper/000084.pdf

Isaacson, E. (2023). *Visualizing Music*. Indiana University Press. https://www.barnesandnoble.com/w/visualizing-music-eric-isaacson/1140906228?ean=9780253064738

Notess, M., & Swan, M. (2004). Timeliner: Building a learning tool into a digital music library. In L. Cantoni & C. McLoughlin (Eds.), *Proceedings of EdMedia + innovate learning 2004* (pp. 603–609). Association for the Advancement of Computing in Education (AACE). https://www.learntechlib.org/p/12995

Peebles, C. (2013). Using Audacity to Participate in Active Musical Listening. *Engaging Students: Essays in Music Pedagogy*. http://flipcamp.org/engagingstudents/peebles.html

Röwenstrunk, D. (2014). *Markieren, Codieren, Annotieren – Arbeiten an und mit digitalen Musikeditionen mit Edirom und MEI*.

Weigl, D. M., VanderHart, C., Rammler, D., Pescoller, M., & Goebl, W. (2023). Listen here! A web-native digital musicology environment for machine-assisted close listening. *Proceedings of the 10th International Conference on Digital Libraries for Musicology*, 109–118. https://doi.org/10.1145/3625135.3625144

Yorgason, B. (2018). Teaching with Timelines. *Engaging Students*, *6*. http://flipcamp.org/engagingstudents6/essays/yorgason.html