Demonstrating GuitarPie and TabCtrl: Audio-Based Pie Menu Interaction for Tablature Interface Control

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Abstract

Digital tablature interfaces are a de-facto standard for electric guitar hobbyists, featuring capabilities such as playing back tablatures with configurable individual instrument tracks (e.g., drums). Such interfaces are typically controlled via mouse and keyboard or via touch input. Hence, learners often need to switch back and fourth between playing the guitar and using the input device(s) for controlling the interface. In this demonstration, we showcase our audio-based pie menu technique called GuitarPie, which takes the guitar's audio signals as input for interface control. GuitarPie utilizes the grid-like structure of a fretboard for an intuitive spatial representation of audio-controlled operations. We demonstrate GuitarPie as an integral part of our tablature interface TabCtrl.

CCS Concepts

• **Human-centered computing** → **Sound-based input / output**; *Interaction techniques.*

Keywords

Electric guitar, Audio-based input, Guitar practice, Tablature

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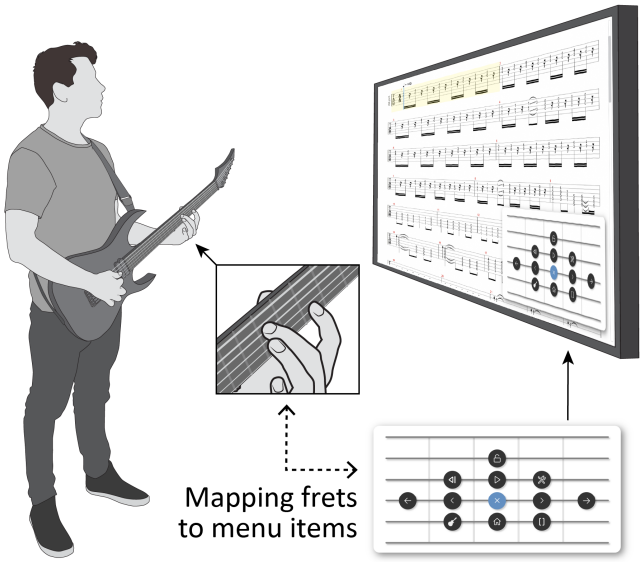

Figure 1: GuitarPie enables audio-based interface control by mapping menu items to locations on the fretboard around the first played note—akin to a pie menu. Our TabCtrl application (see screen) uses GuitarPie to enable tablature configuration and playback control without letting go of the guitar.

1 Introduction

The electric guitar has become a common instrument for hobbyists to pick up and learn, also due to increasing support via digital platforms and learning tools. For instance, digital tablature interfaces, such as *Guitar Pro* [9] and *Ultimate Guitar* [6], are a beginner-friendly alternative to sheet music. Besides displaying tablatures, such interfaces typically support playback of individual instrument tracks (e.g., drums) as well as various operations for configuring the UI and the playback. Examples for those operations are muting and unmuting individual audio tracks (e.g., playing back the drum track, while the guitar track is muted), jumping to a specific position, or choosing a different song. However, operating those interfaces while holding the guitar can be challenging [1]. Concretely, an electric guitar occupies both hands and affords an upright posture. Constantly switching between playing the guitar and operating a desktop PC or a small tablet can be disruptive and potentially pose limitations on the practicing setup (e.g., having to sit next to the

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device so that it can be accessed easily). Previous works improve the guitar practicing process by physically augmenting the guitar [7], the guitar pick [3], or other parts such as the guitar strap [1]. While such solutions could potentially also be used to control digital interfaces, they require additional hardware and modifications to the guitar or to the equipment, which reduces flexibility and can be a hindrance for a broader adoption.

In this demonstration, we present GuitarPie [4], which uses the audio signals from an unmodified electric guitar (Figure 1). GuitarPie represents audio-triggered operations visually as menu items on the grid-like guitar fretboard. At the same time, GuitarPie uses *relative* fret positions and can hence be used almost anywhere along the fretboard, similar to how conventional pie menus open around the current cursor position [2]. Consequently, instead of having to memorize specific note sequences for each operation [8, pg. 108], those sequences for triggering operations emerge implicitly through easy-to-visualize spatial relationships on the fretboard. We implemented a specific instance of GuitarPie in our tablature interface application **TabCtrl**. We demonstrate operations at different levels of granularity, ranging from starting playback to low-level operations, such as moving the playhead by a single bar, e.g., to mark regions. Taken together, GuitarPie enables seamless interface control during guitar practice without letting go of the guitar.

2 Demo Application

We demonstrate GuitarPie in a tablature interface control context. Specifically, GuitarPie is the main means of navigating and configuring guitar tablatures inside our TabCtrl application. In terms of look and functionalities, TabCtrl resembles a conventional tablature application (see the interface on the screen in Figure 1). However, as opposed to conventional tablature interfaces, crucial functionalities can be controlled via the electric guitar's audio signal—without switching to touch input or mouse and keyboard.

Our implementation consists of a backend (implemented in Python) and a frontend that runs inside a browser (implemented in JavaScript and CSS). In our backend, we primarily use *Basic Pitch* [10] to convert the incoming audio stream to MIDI notes, which we send to the frontend via websockets. In our frontend, we use *alphaTab* [5] to render, navigate, and configure the guitar tablatures.

When playing a note on the fourth string (D string in standard tuning), the main menu (Figure 2 top) appears in the lower-right corner of the screen (see lower-right part of screen in Figure 1). The horizontal and vertical lines in the menu represent the fretboard part around the played note. We refer to the location of the fourth string at the fret that opened the menu as the *center* (blue X-symbol in Figure 2 top). In the following, we describe the specific menu items and sub menus of our GuitarPie instance inside TabCtrl.

- **Close menu** (center). Playing the same fret that opened the menu closes it.
- **Play** (up). Starts playback at the current playhead position and closes the menu.
- **Stepwise navigation** (center row left and right). Playing a fret left and right relative to the center moves the playhead forward or backward by one bar, respectively. The two frets left or right move the playhead to the previous and next section, respectively.
- **Back to start** (up-left). Moves the playhead to the song's start.
- **Home menu** (down). Opens the *Song Selection*.
- **Lock** (two up, above menu). Closes the menu and disables it. This is for cases in which the learner wants to practice a part without playing it back. The menu can be enabled again via mouse / keyboard or by playing a pre-defined note sequence.

The remaining menu items open sub menus (Figure 2 s1–s3) with the played fret as the new center, similar to traversing hierarchies in marking menus.

- **Settings** (up-right). Opens the *Settings* sub menu (Figure 2 s1) with the following operations relative to the third string at the *Settings* fret.
  - **Toggle Count in** (up).

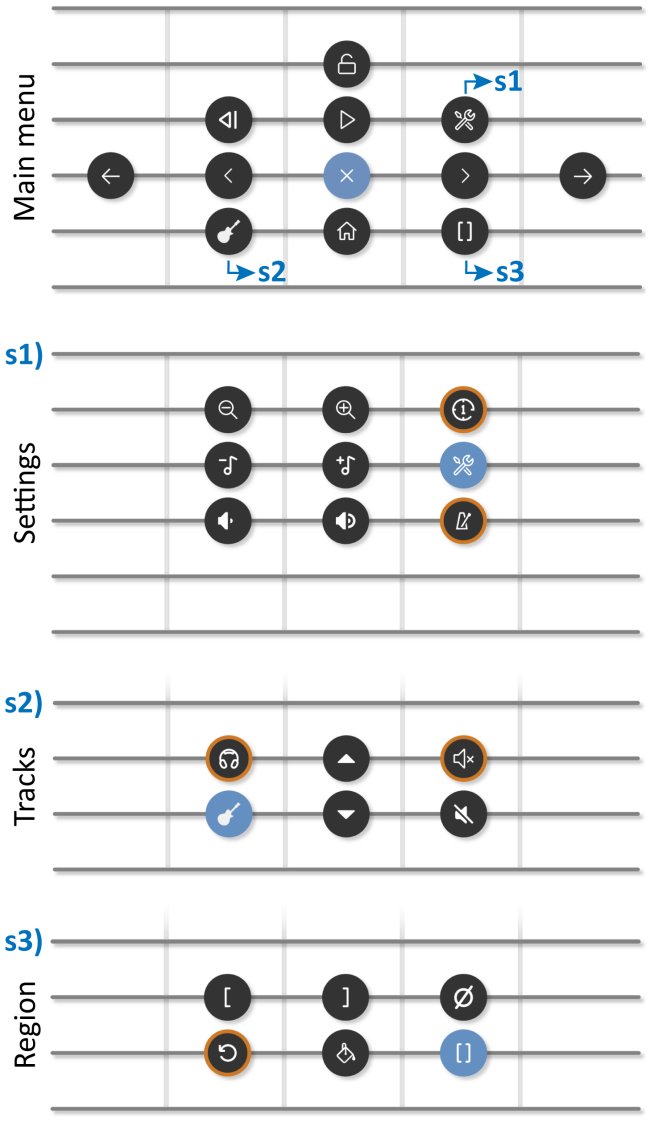

Figure 2: Menu structure of TabCtrl's GuitarPie instance. Hitting a note on the fourth string opens a hierarchical GuitarPie menu (top) with several operations and sub menus (s1–s3).

  - **Metronome on/off** (down).
  - **Zoom out/in** (up-left). Making the tablature smaller or larger.
  - **Tempo decrease/increase** (left).
  - **Volume down/up** (down-left).
- **Tracks** (down-left). Opens the *Tracks* sub menu (Figure 2 s2). Allows to switch tracks via up and down buttons (typically, tablature interfaces separate the guitar tracks, drum track, etc. of a song, with individual tablatures for each). Furthermore, tracks can be muted or set to solo playback.
- **Region** (down-right). Opens the *Region* sub menu (Figure 2 s3). Allows to mark the bar of the current playhead position as the beginning or end of a region, and for removing the region. This sub menu also contains a button for toggling looped playback. If looping is on, the region is looped when playing (or the whole song, if no region was specified). Otherwise, the playback ends at the end of the region or the song, respectively.

During playback, i.e., while using the guitar for practicing the song, GuitarPie is inactive. This avoids ambiguities with regards to practicing versus menu usage. Many functionalities such as settings are not required while playing. Hence, we strictly distinguish between playing the song and using the pie menu. There are various options for stopping playback [4, Section 4.2.2]. Per default, TabCtrl stops playback when the learner stops playing the song in non-silent parts of the active track (this option can be toggled).

3 Conclusion

In this demonstration, we showcase the GuitarPie technique, which uses audio signals from an electric guitar as input and spatially represents menu items corresponding to the grid-like layout of a guitar fretboard. Furthermore, we implemented a tablature interface called TabCtrl, which features a specific instance of our GuitarPie technique. Our technique and application support tablature interface control without having to let go of the electric guitar and without requiring physical augmentations of the guitar.

Acknowledgments

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