

Music Improvisation Software: Theory and Practice



Introduction

The **HMC Intelligent Music Software** project develops and implements open-source programs to educate musicians in the art of improvisation: the simultaneous listening, composition, and performance of music. These ideas are developed and demonstrated in a vehicle called **Impro-Visor** (Improvisation Advisor).

Research This Summer

The following areas were our focal points:

- Further development of improvisation theory based upon **transformational grammars**.
- Automated generation of **guide-tone lines** and their use as a basis for transformation.
- Improvisation based on successive sub-division (“**fractal**” methods).
- **Theme weaving**, meaning the construction of improvised solos that contain specified themes.
- **Active trading**, wherein the software trades melodies with the player and reacts to what he/she plays.
- **Real-time audio input**, which enables the program to input melody played on an acoustic instrument in real-time.
- **Chord voicing** algorithms, which enables backing tracks that sound harmonically appealing.

The screenshot displays the Impro-Visor software interface. The top window shows a 12-Bar Blues lead sheet with a style of 'swing'. The lead sheet includes chord progressions: F13, Bb13, Bo7, F13, Cm9, F13b9, Bb13, Bo7, F13, D7#5#9, Gm9, C13b9, F13, D7#5#9, Gm9, and C13b9. Below the lead sheet is an 'Active Trading - Impro-Visor' dialog box. The dialog box has a 'TradeMode' section with 'User First' selected. It also shows 'Mode: Modify and Rectify', 'Transform File: BillEvans', and 'Grammar: CharlieParker'. There are sliders for 'Processing time (in beats)' (0.5), 'Volume of Response' (80%), and 'Tempo (Beats/Minute)' (132.0). A 'Length of Trade (bars)' field is set to 2, and there is a 'Loop' checkbox checked. A 'Start Trading' button is visible.

Active-Trading Illustration: The musician starts by playing two measures. Impro-Visor responds with two measures, by transforming what the user just played. This process continues until the user decides to stop trading. Shown is the result of four such trading cycles.

Results

Mikayla Konst and **Carli Lessard** developed an algorithm for creating a variety of guide-tone lines, and for transforming the lines into improvisations. Guide-tone lines, which outline the harmonic progression, are used by improvisation teachers to coach harmonically-based solo creation.

Carli Lessard developed an algorithm for “fractal” improvisation, that is, improvisation by successive sub-division of any melodic line.

Mikayla Konst developed an improvisation method based on statistics of intervals obtained from solo transcriptions, as the basis for a Markov chain.

Amelia Sheppard created new versions of Theme Weaver, which enables Impro-Visor to improvise or create custom solos that exploit specified themes.

Daniel Scanteianu and **Errick Jackson** developed a new algorithm and interface for specifying “fluid” chord voicings.

References

Please see <https://www.cs.hmc.edu/~keller/jazz/improvisor> (or just Google “impro-visor”) for papers and download information.

More Results

David Siah and **Zach Kondak** developed a stand-alone interface that converts monophonic audio signals into MIDI (musical instrument digital interface) signals, enabling Impro-Visor to have real-time audio input.

Zach Kondak and **Mikayla Konst** developed active trading, which allows Impro-Visor to respond in real-time to MIDI or audio input from the user.

David Siah began laying a foundation for translation of percussion patterns from audio into Impro-Visor’s symbolic notation for style patterns.

Interns **Nathan Kim** and **Baunnee Martinez** developed several new features on the feature request list and fixed bugs in Impro-Visor.

Most contributions will be integrated into the forthcoming **release 8.0 of Impro-Visor**, and will be the basis of research papers to be submitted.

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