Gesture centered and Physically inspired Spectral Synthesis

Applied to the violin

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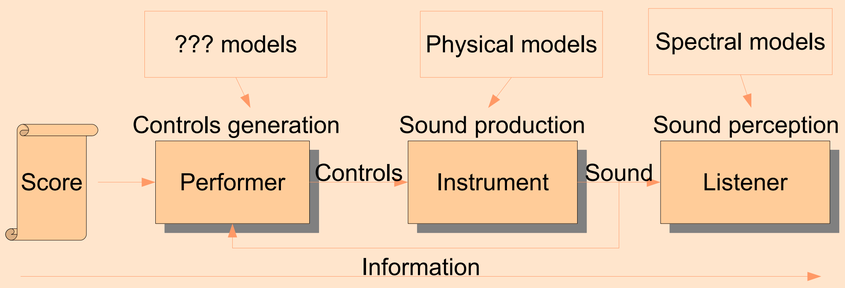
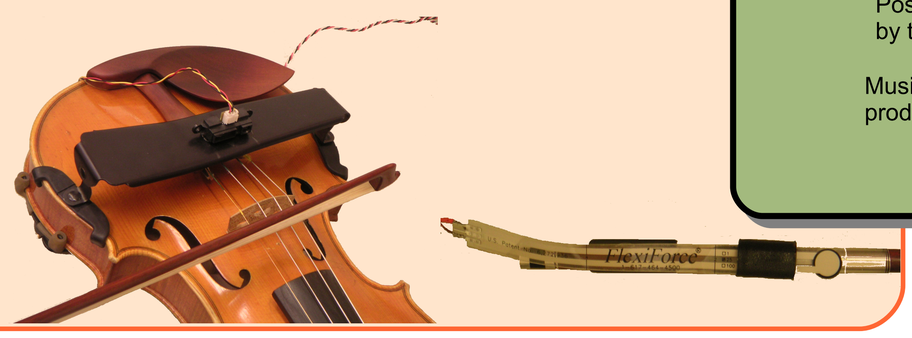
Musical instruments synthesis techniques can be roughly classified into Physical and Spectral models. Physical models try to model the instrument's sound production mechanism and Spectral models basically consist on spectral transformation and concatenation of recorded samples. Both focus on the sound of the instrument, but in general they forget about the gestural interaction between performer and instrument during a performance. This work presents a spectral model centered in performance control gestures, that has some characteristics inspired in physical models.

Gesture centered

- **Focused on Gestures.** Physical models are focused on sound production mechanisms and Spectral models on sound perception. This work addresses the synthesis by focusing on the performer and the control actions that makes during a performance.

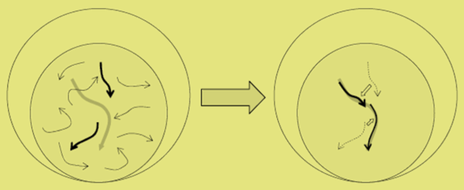


- Violin performance control actions: vibrato, fingering, bow force, bow velocity, bow-bridge distance, etc.
- We mean by *Gesture* a trajectory of those control actions that form a musically meaningful entity and can be isolated and concatenated with other gestures in order to form a musical phrase.
- **Gesture vs Note** as sample unit. A gesture consists of a group of notes, instead of single notes.
- Although gestures can be represented as score or sound samples, they are generated by physical actions. In order to analyze and identify gestures, **measurements of** those **physical control actions** are carried out.

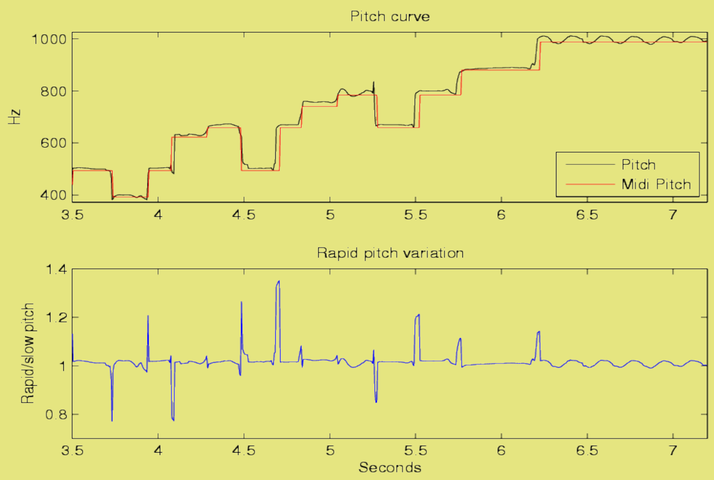


Spectral synthesis

- Generation of performance trajectories by spectral transformation and concatenation of gestures. The analysis and resynthesis of samples is SMS based.

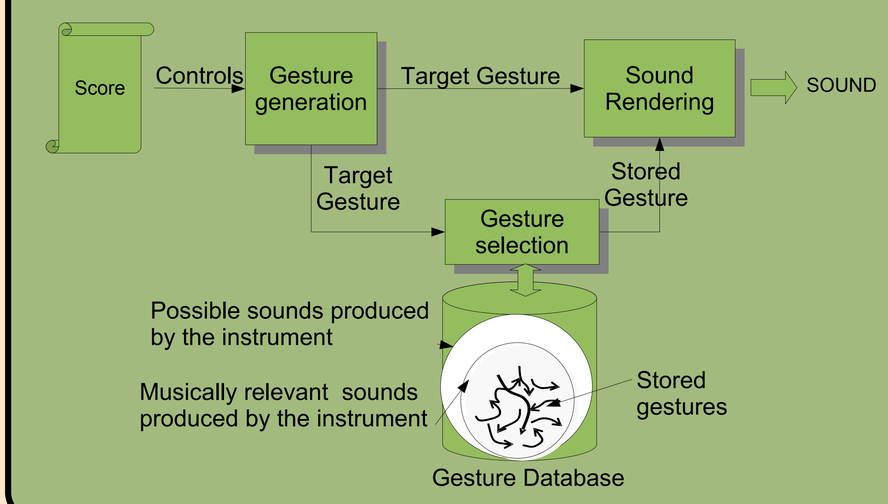


- Spectral data representation: temporal variation of features, decomposed into slowly+rapidly varying. We keep only the rapidly varying features. Next we show an example of slowly+rapidly varying pitch.



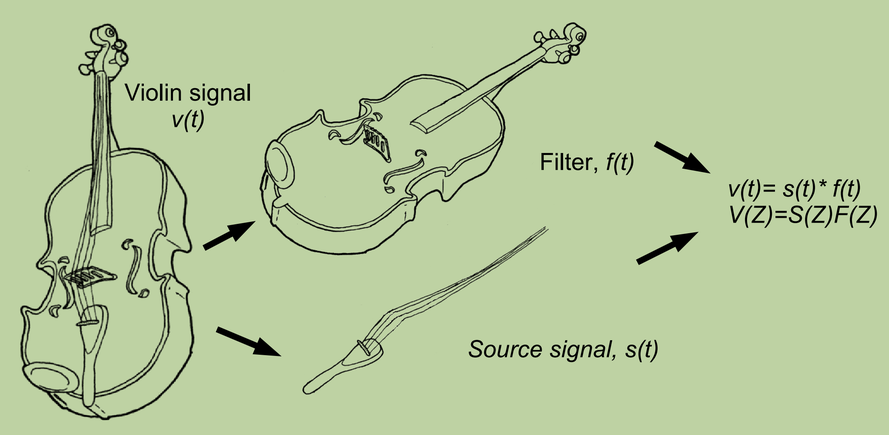
OVERVIEW

Key features:
- Spectral synthesis
- Gesture centered
- Physically inspired

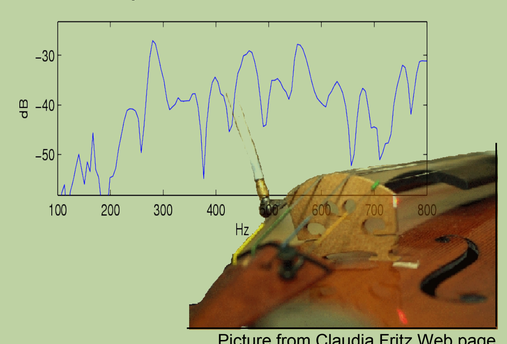


Physically inspired

- **Source-Radiator Separation**. Separation of the violin signal in two parts: *source signal* and reberberation of the sound box. Sample transformation and concatenation are of higher quality, and vibrato is easier to model when working directly with the *source signal*, beacuse the resonances of the sound box are eliminated.



- The sound box can be modelled as a filter by measuring the acoustic response of the violin body.
- The source can be obtained either by directly measuring it, or by deconvolution, given *v(t)* and *f(t)*: s*(t)=v(t)/f(t)*.



Picture from Claudia Fritz Web page

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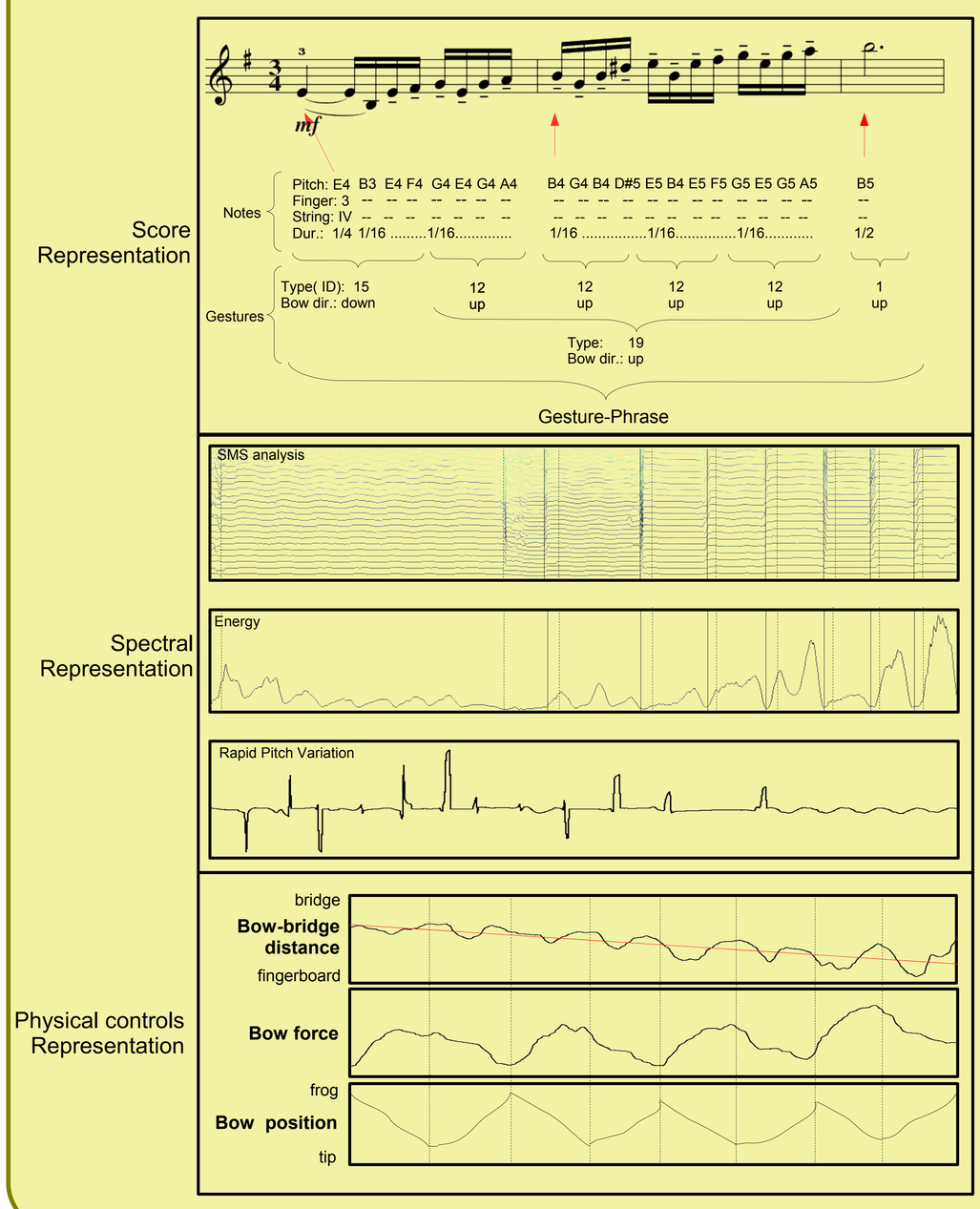
Database Representation



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