Virtual Theremin

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A. Alavi, P. Roos, A. Theler

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The Theremin

Features

For each hand, we extracted the following:

- Palm position (x, y, z)
- Pinch gesture (p_0, p_1, p_2, p_3)
- Open/closed hand ($\alpha \in [0 \ldots 1]$)

Pinch Gestures

Two approaches

- Grabbing the images from Leap Motion and classifying the gestures
  - Template matching for tracking the hand
  - Linear SVM (Linear). Precision/recall only 70%
  - Synthesizing gestures using Blender (Unfinished)
- Leap Motion's SDK. Finger tip closest to the thumb and below a certain threshold. Precision/recall around 93%

Open / Closed Hand

Also via Leap SDK to detect level

- Average distance between fingers' tips and palm center
- No exact definition of open or closed hand, let alone a 50%- or 79%-open hand. Consequently, no way to measure the accuracy of any detection method

But there is a reasonable correlation between α and how close or open the hand is.

The Basic Theremin

- `leftHand.y` $\rightarrow$ Amplitude/Volume
- `rightHand.z` $\rightarrow$ Frequency

$\rightarrow$ A playable instrument.

Findings

- Precision of Leap Sensor is limited. E.g. it's not possible to accurately play a vibrato.
- Linear frequency mapping is easier to play.
- Leap has difficulties with tracking fingers under the hand palm.
- Users adapt.

Improvements Of The Instrument

For the right hand:

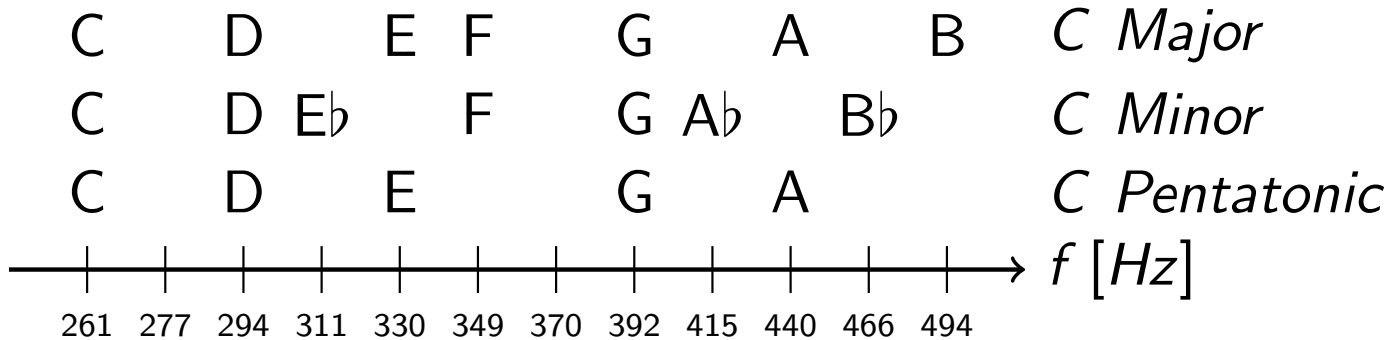
- Pinch gestures (p_0, p_1, p_2, p_3) control different waveforms (sinus, triangle, sawtooth and square).
- Open/closed hand (α) controlls the intensity of a vibrato.

For the left hand:

- Pinch gestures activate frequency discretization (playing aid).
- Open/closed hand controls the intensity of a tremolo effect (Amplitude Modulation).

Frequency Discretization - Music Scale

Rounding frequency to a music scale (chromatic, diatonic like major or minor, pentatonic).



→ change music scale with a pinch of a finger...

Thanks for your attention!