

# Projecting Finger Placement onto the Fretboard



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**Demo**

# Outline

- **Related Work**
- **Architecture**
- **Finding the Fretboard**
- **Projection**
- **Results**
- **Outlook**

# Related Work

- LEDs embedded in piano keys [Casio] or in fretboard [Optek Fretlight]
- Miniature data projectors as versatile HCI devices [Raskar]
- Tracking the fingering for training or transcription [Burns, Wang, Paleari, etc.]
  - markers attached
  - or camera mounted on neck
  - or not real-time

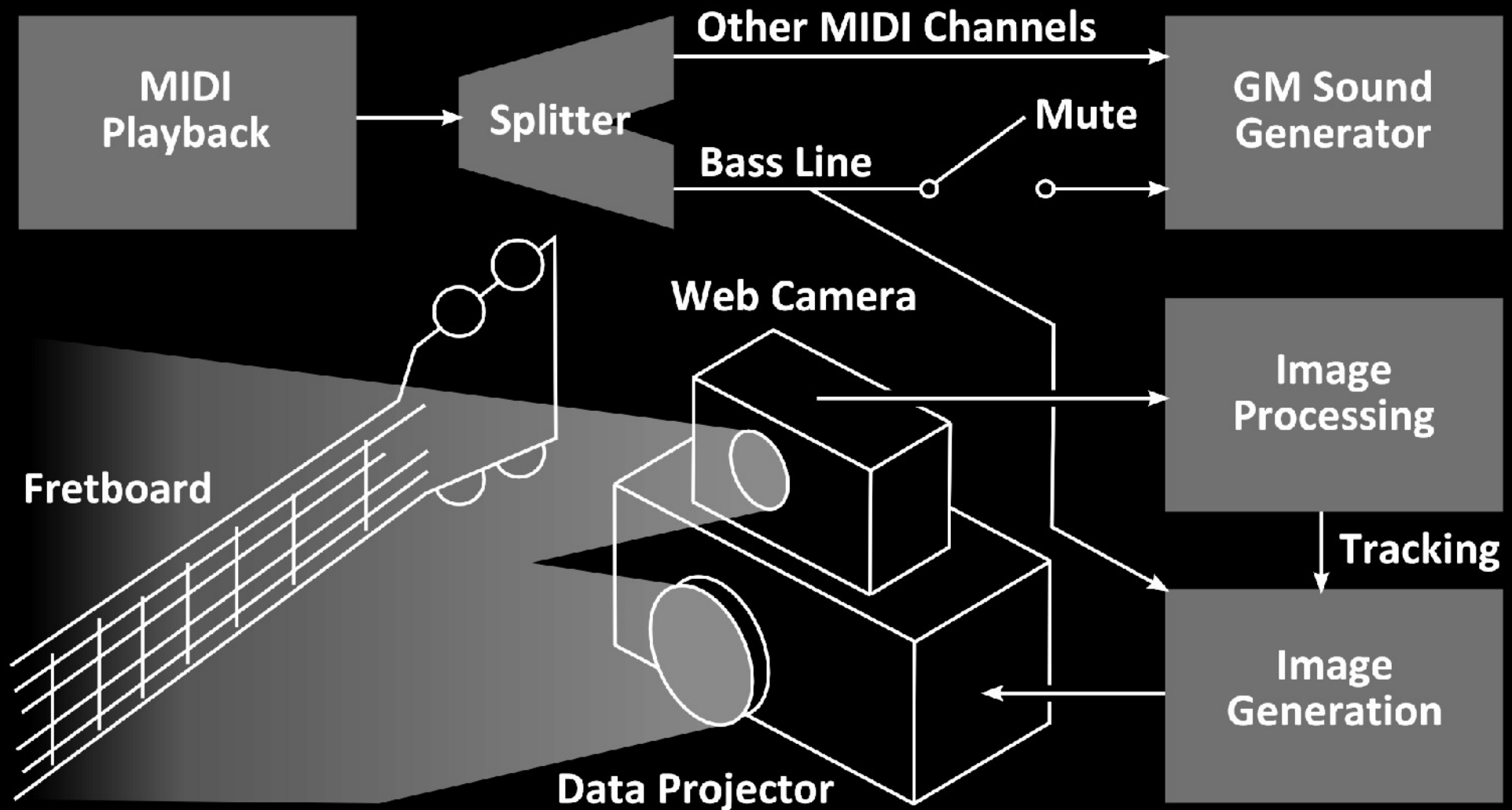
# System Architecture 1/3

## Miniature data projector

- On close distance bright enough and sharp
- Camera placement close → low parallax error



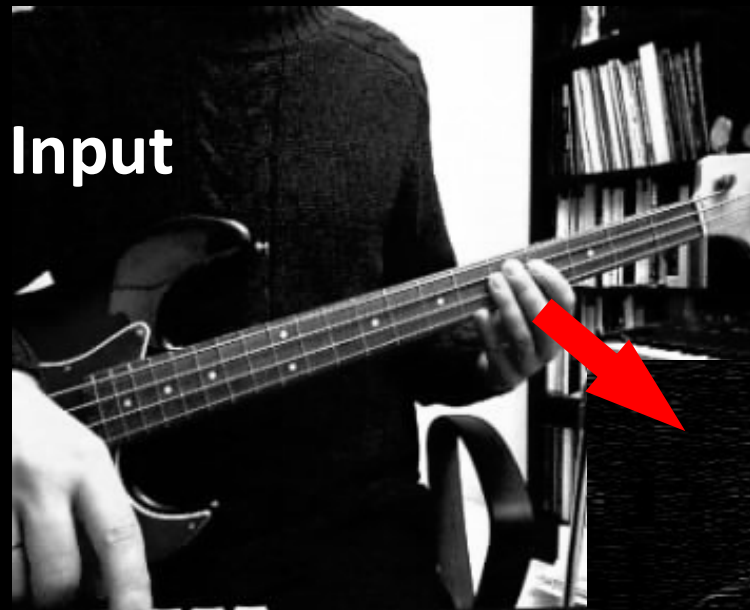
# System Architecture 2/3



# System Architecture 3/3

- No attached optical markers
- Interactive speed
- Robustness:  
do not literally  
“track” the fretboard
- Smooth the projected image’s  
motion from frame to frame

# Finding the Fretboard 1/3

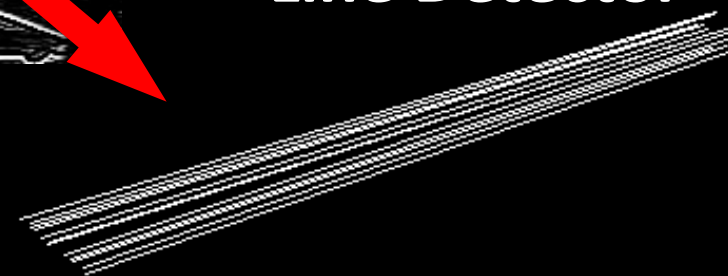


**Finding the Strings**



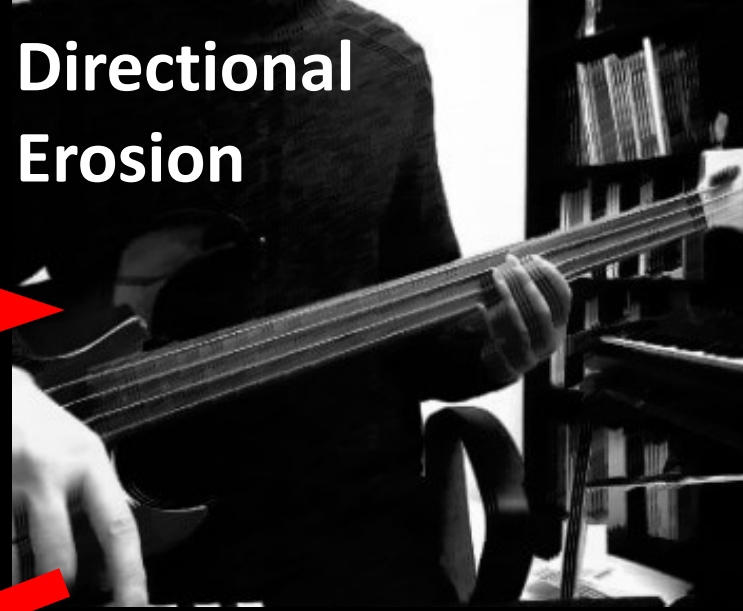
**Directional Filter**

**Constrained  
Line Detector**



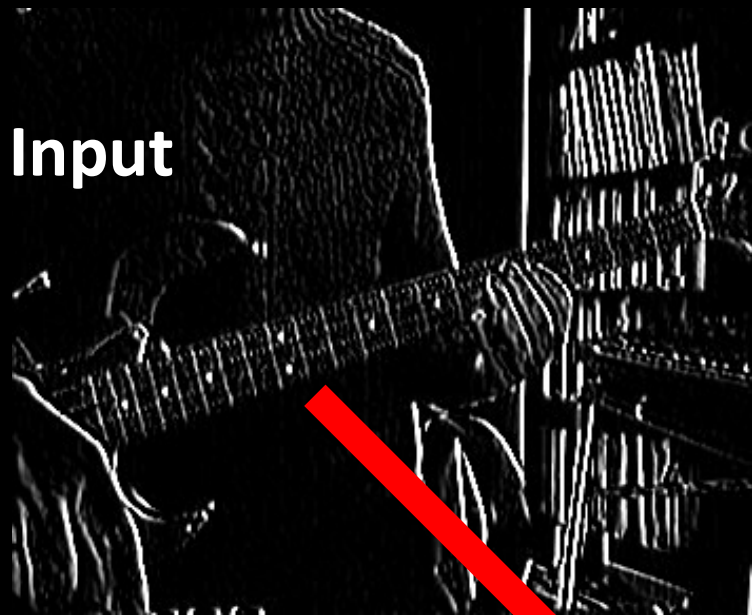


# Finding the Fretboard 2/3



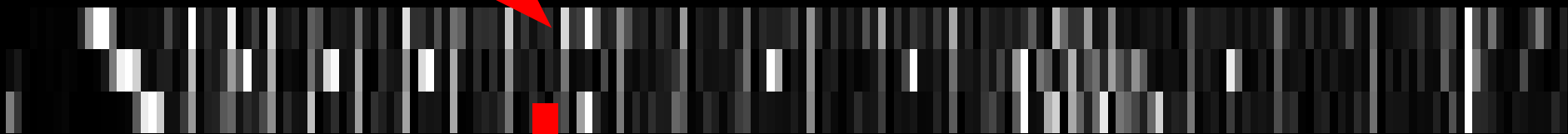
Extracting the Frets

# Finding the Fretboard 3/3



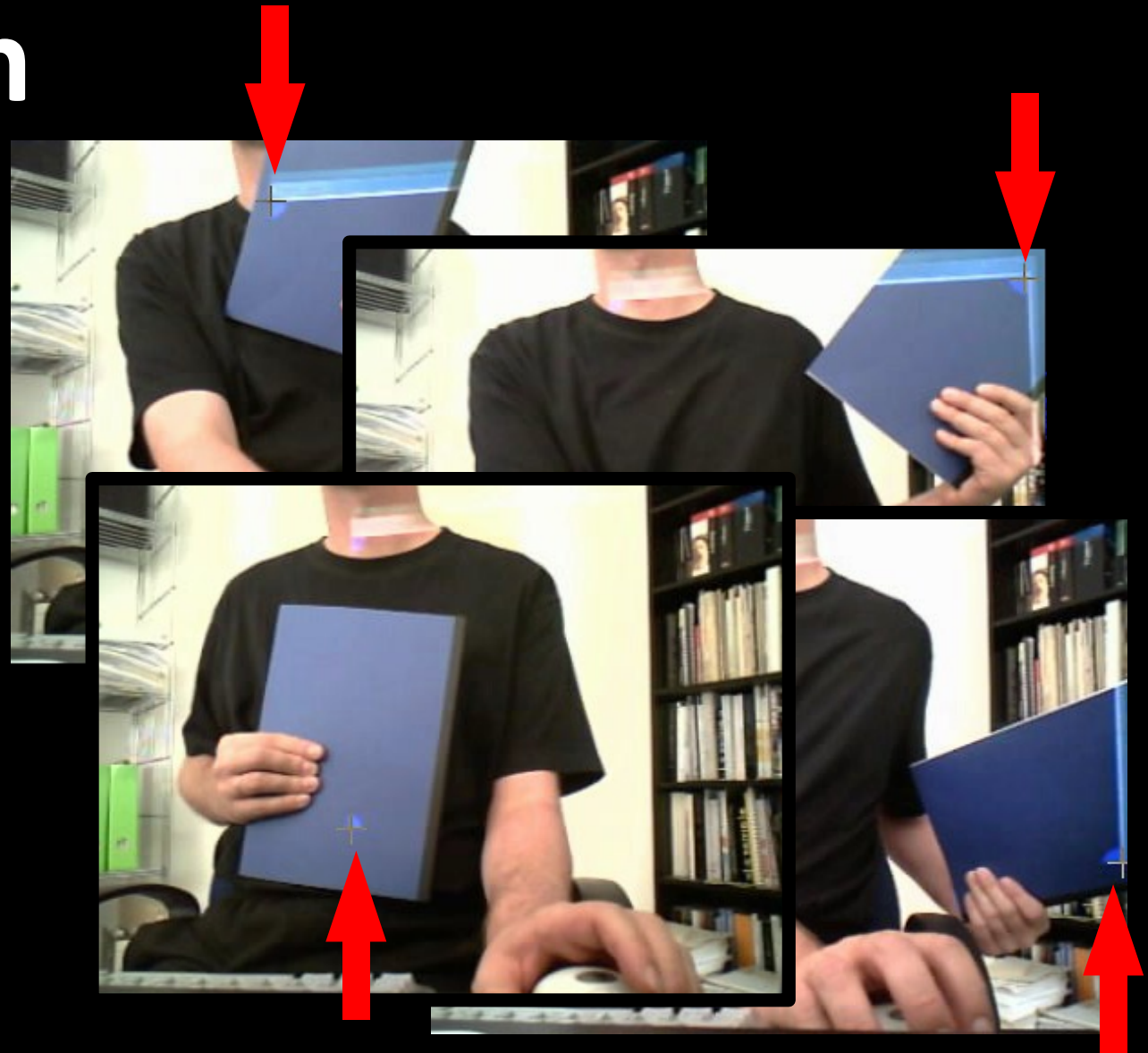
## Finding the Frets

Rectification:  
200 x 3 Pixels



# Projection

- Calibration



- Homography:  
Projector and camera may point in different directions if optical centers remain close

# Results

- **10 fps with low-end PC**
- **100 lumens are perfect**
- **Image processing issues**
  - **No striped shirts allowed**
  - **No glossy reflections allowed**
- **Problems with standard webcams**
  - **Low sensitivity → long shutter time → motion blur**
  - **Large latency effectively limits spatial resolution**
- **Project notes not on time but in advance?**

# Outlook

- **Karaoke-style projection?**
- **Experiments with learners**
- **Adapt to “expensive” musical instruments such as cello and harp;  
benefit: no damage to instrument**
- **Mobile version  
with built-in camera of mobile phone**



# Questions?

