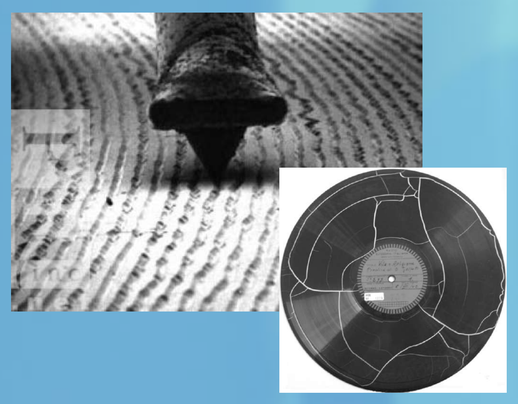
ALTERNATIVE DIGITIZATION APPROACH FOR STEREO PHONOGRAPH RECORDS USING OPTICAL AUDIO RECONSTRUCTION

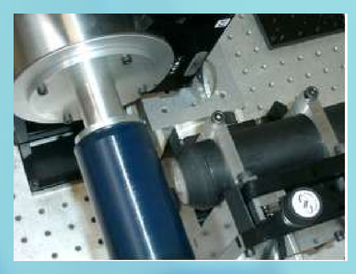
Beinan Li, Simon de Leon, Ichiro Fujinaga
Music Technology Area, Schulich School of Music, McGill University, and CIRMMT, Montreal, Canada

Motivation

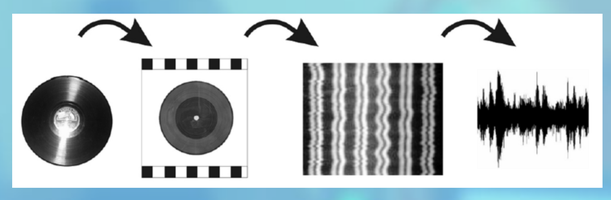


Optical Audio Reconstruction:
the only way to digitize
broken phonograph records

Related Work



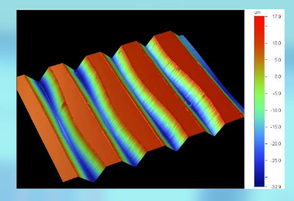
Lawrence Berkeley National Laboratory:
Wax cylinder, **Mono**
Confocal microscope



University of Fribourg:
78rpm, **Mono**
Microfilm, Scanner

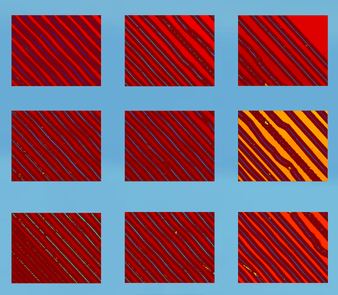
Our Approach

McGill Image to Audio Conversion (MItAC):
White-light Interferometer,
Vertical resolution: 1nm
Lateral resolution: 0.1μm



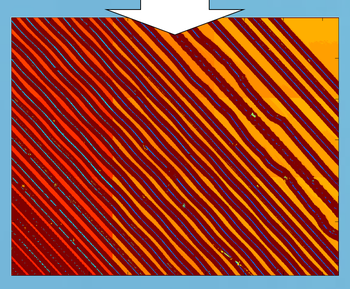
Digitization for both Mono Records and Stereo LPs:
Scan 3D info of disc grooves

Method

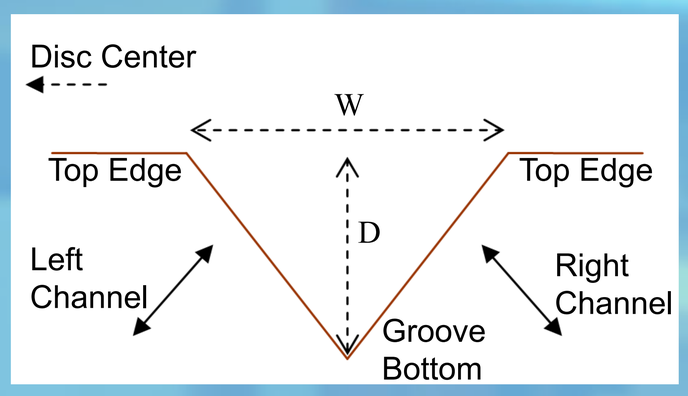


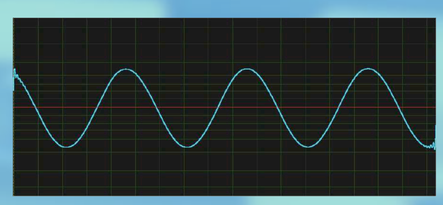
Scan the large disc area with multiple small Fields of View (FOV: 640x480)

Stitching



Groove recognition:
Connected Component Analysis

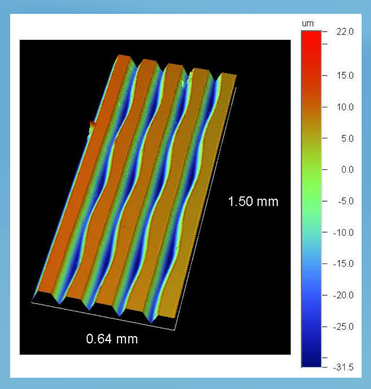




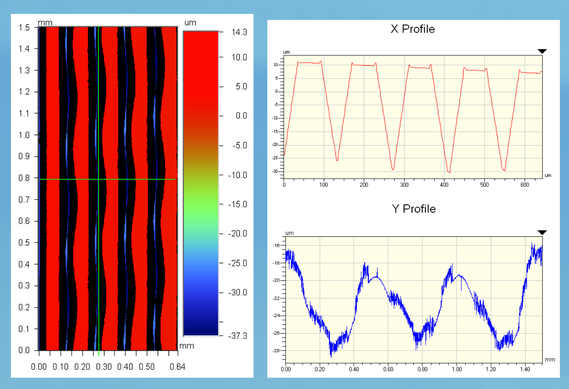
Sound Signal

Numerically differentiate the displacement:
The stylus velocity.
Polynomial fit and linear interpolation:
Fill missing data.

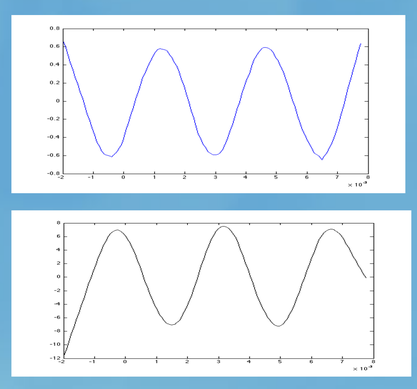
Results



The 3D contour view



The 2D contour and the cross-section views



The lateral and the vertical velocity of the stylus

The stereo signal:
Right channel: a 1kHz sine wave
Left channel: silence
Three FOV-sized stitched frames

Discussions & Future Work

	Time to scan one side	Storage space (GB)	Pixel size (μm)	Sampling rate (kHz)
10x Mag.	10 days	173	1.0	147.8
100x Mag.	3 years	17,156	0.1	1490

Future work:

- Experiments on various records, including broken ones
- Image restoration to improve reconstructed audio quality

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