ALTERNATIVE DIGITIZATION APPROACH FOR STEREO PHONOGRAPH RECORDS USING OPTICAL AUDIO RECONSTRUCTION

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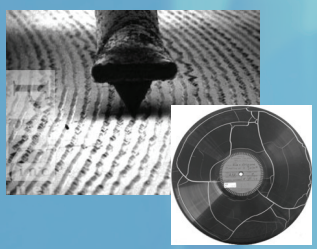
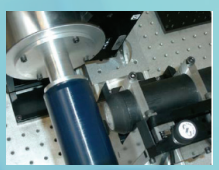
Motivation

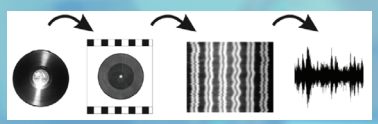


Optical Audio Reconstruction:
the only way to digitize
broken phonograph records

Related Work

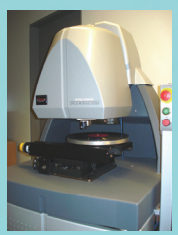


Lawrence Berkeley National Laboratory:
Wax cylinder, **Mono**
Confocal microscope

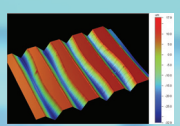


University of Fribourg:
78rpm, **Mono**
Microfilm, Scanner

Our Approach

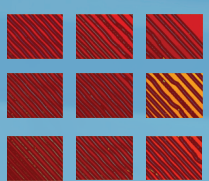


McGill Image to Audio Conversion (MItAC):
White-light Interferometer,
Vertical resolution: 1nm
Lateral resolution: 0.1μm



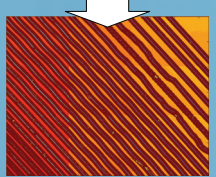
Digitization for both Mono Records and Stereo LPs:
Scan 3D info of disc grooves

Method

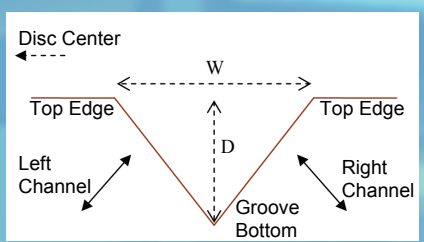


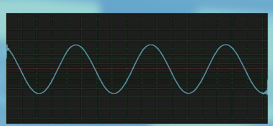
Scan the large disc area with multiple small Fields of View (FOV: 640x480)

Stitching



Groove recognition:
Connected Component Analysis

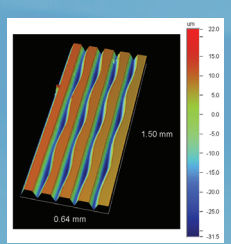




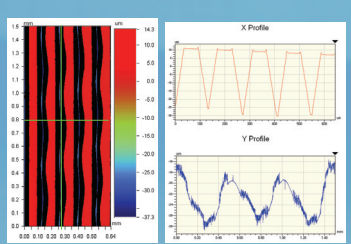
Sound Signal

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

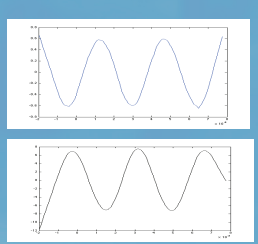
Results



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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