Haute école d'ingénierie et d'architecture Fribourg
Hochschule für Technik und Architektur Freiburg

# Minutes

## Bachelor Thesis

## ML-for-NR

***Date:*** 05.28.2019
***Heure/time:*** 10.00 AM
***Lieu/place:*** Lawrence-Berkeley National Laboratory

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***Participants***: Ruffray Benoit (RB), Haber Carl (HC), Cornell Earl (CE), Nachman Benjamin (NB)

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### *Agenda :*

1. ***Project kickoff***

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### *Discussions* :

Explanations about the IRENE system, audio records, Weaver, and the current algorithm for audio reconstruction. Definition of the project steps.

This project is about shellac records. In this type of disc, the groove is carved in a way that it's not the position of the needle that matters, but its movement. A straight groove, even if decentered, won't produce sound.

The IRENE system takes pictures of a single line across the disc. The disc is played at the intended speed while the pictures are taken. This result in a high-resolution image of the complete groove. The picture is in grayscale, with white parts being flat, and black parts inclined.

This image is used to recreate the sound without having to touch the disc (so fragile audio supports are conserved). The current algorithm finds the edges of the groove, and uses them to determine a middle. This single point groove allows recreation of the carved soundwave. However, texture and scratches provoke minor errors, resulting in a high frequency-noise when generating the sound. A low-pass filter wouldn't be enough, as some noise is also wrongly generated at lower frequencies.

Weaver is the software used to manipulate the images and generate the sound. It's a collection of plugins used in a pipeline It's written in C#.

Imaged discs and their generated sound are available as dataset.

The goal of the project is to see if machine learning could improve the generated sound. NB proposed to follow these steps :

0. Learn how to use KERAS by implementing a small neural network for MNIST dataset.

1. Train and test a model on single frequency clean grooves, clean generated sound as ground-truth.

2. Train and test a model on single frequency noisy grooves, clean generated sound as ground-truth.

3. Train and test a model on actual disc images, noisy generated sound as ground-truth.

4. Train and test a model on actual disc images, clean sound as ground-truth (either from original tape or physical playback)

NB also suggested going to the machine learning workshop held at the University's Library on May 29th. He made his powerful computer available for training if needed.

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### *Decisions*

1. The project will follow the suggested steps.

### *Tâches à réaliser / Tasks:*

| *Tâches / Tasks* | *Qui/Who* | *Délai/Delay* |
|---|---|---|
| 1. Go to the ML workshop | RB | 05.29 |
| 2. Learn KERAS and implement a model. Train and test it | RB | 06.05 |

### *Points ouverts / Open points :*

Regular meeting with HC, CE and NB

Exact format of images

### *Date et lieu de la prochaine réunion / Date and place of next meeting :*

Nothing planned yet, as they are available most of the time.