

Data Collection Record

This document aims to provide a detailed guide on the sound-force data collection which was done as a part of a CIS 2 project. The project details were:

Name: Improve Content Validity of Virtual-Drilling Simulator

Group: 14

Semester: Spring 2023

Phantom Details:

This data set consisted of three phantoms. The phantoms were filled with mixtures of dental stone powder and water. The densities of the three phantoms were as follows:

PHANTOM	DESNITY (kg/m^3)
1	1084.065
2	1630.6
3	2100.3

The phantom design can be found on the project wiki page under “Other Resources and Project Files.”

Drilling:

Drilling was done using the Galen Robot. All recordings consisted of a single stroke of about 3.5 cm along the surface of the phantom. The RPM of the drill was kept constant at 80000. The orientation of the drill was kept constant during the entire motion of the drill.

Data Collection:

Sound data was collected by using a mic to record the audio. A Logitech Yeti X mic was used to record the audio.

1. The required phantom was secured onto the gamma sensor using bolts.
2. The force-sensing drill was secured onto the Galen robot.
3. The drill was moved to its initial position.
4. The Galen robot, drill sensor, and gamma sensor were run and rebased at the start position. The Galen robot was run in “Research” mode.
5. Recording of audio was started.

6. A rosbag containing the Galen robot, gamma sensor, and force-sensing drill was recorded.
7. Manually, the mic and the phantom were "tapped." This step was used to synchronize the data.
8. The script named "galen_crtk_move_cp_example.py" was run.
9. After the drilling stopped and the robot returned to its original position, the recordings were stopped.
10. Steps 3-9 were repeated for each recording.

Cleaning and Synchronizing Recorded Data:

The phantom and the microphone were tapped manually twice before each recording. These taps were reflected in the audio and force data which was used to synchronize the data. The peak of the first tap was used to synchronize the data.

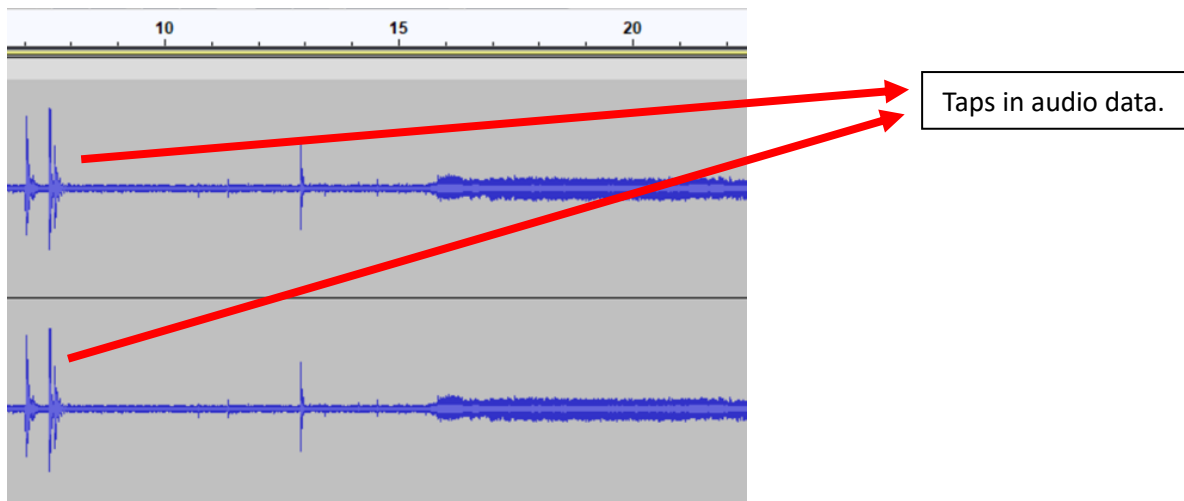


Figure 1: Taps visualized in audio data.

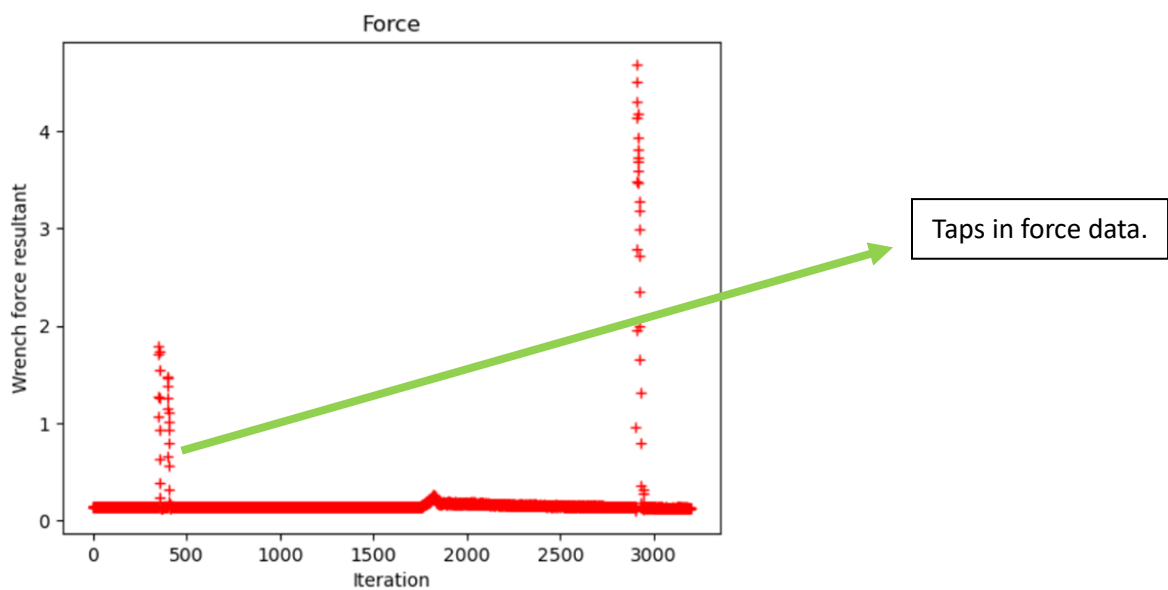


Figure 2: Taps visualized in force data.

Synched Data:

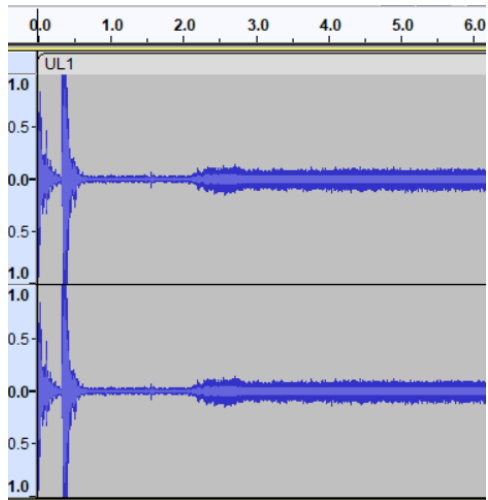


Figure 3: Synched-up audio data.

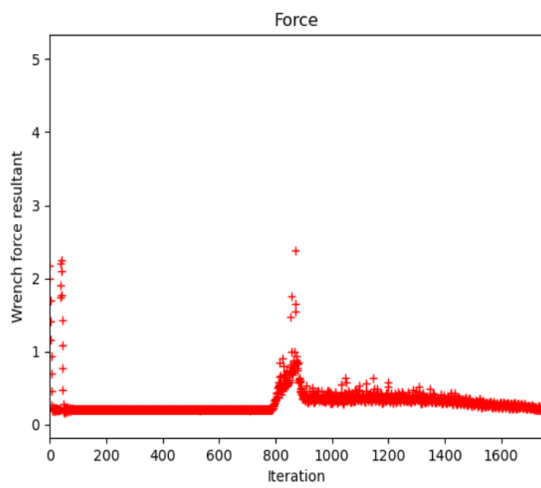


Figure 4: Synched-up force data.