

Machine Learning for the Inverse Control of FM Synthesis

ROSA GARZA

MENTORS: DR. EDGAR BERDAHL & ANDREW PFALZ

CCT REU 2017

LSU CENTER FOR COMPUTATION & TECHNOLOGY (CCT)



Frequency Modulation (FM) Synthesis

- Invented by John Chowning in 1967

$$y(t) = A * \sin(2\pi * cf * t + \frac{d}{mf} \sin(2\pi * mf * t))$$

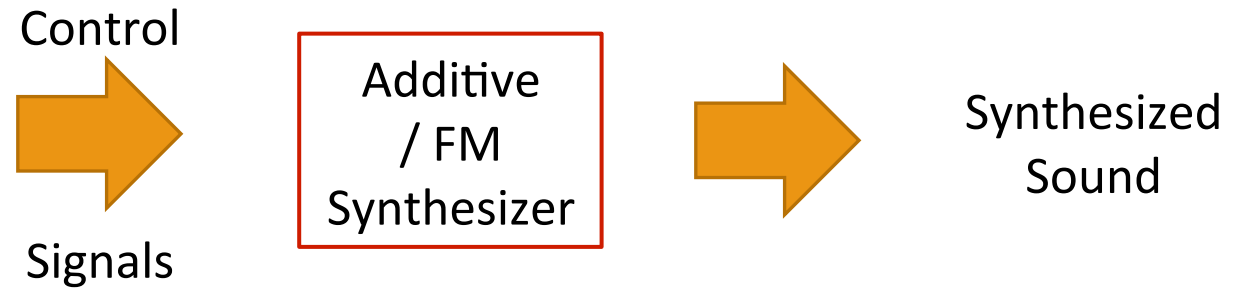
Control Signals:

- Carrier Frequency (CF)
- Depth (D)
- Modulation Frequency (MF)

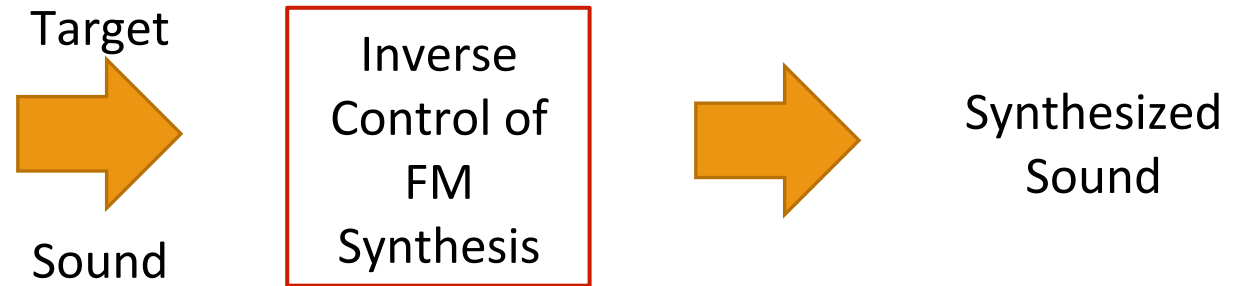
**t is an array of time*

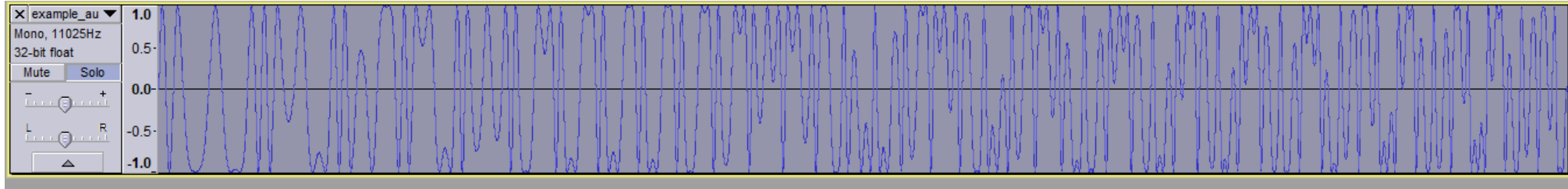
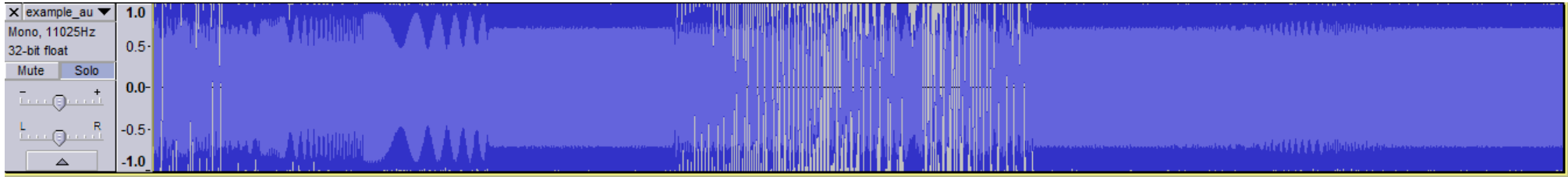


Current Sound Design Procedure

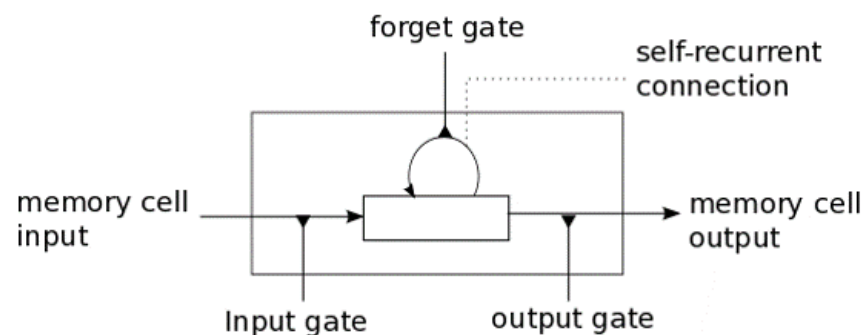


Research Goal





Long Short Term Memory (LSTM) Recurrent Neural Network (RNN)



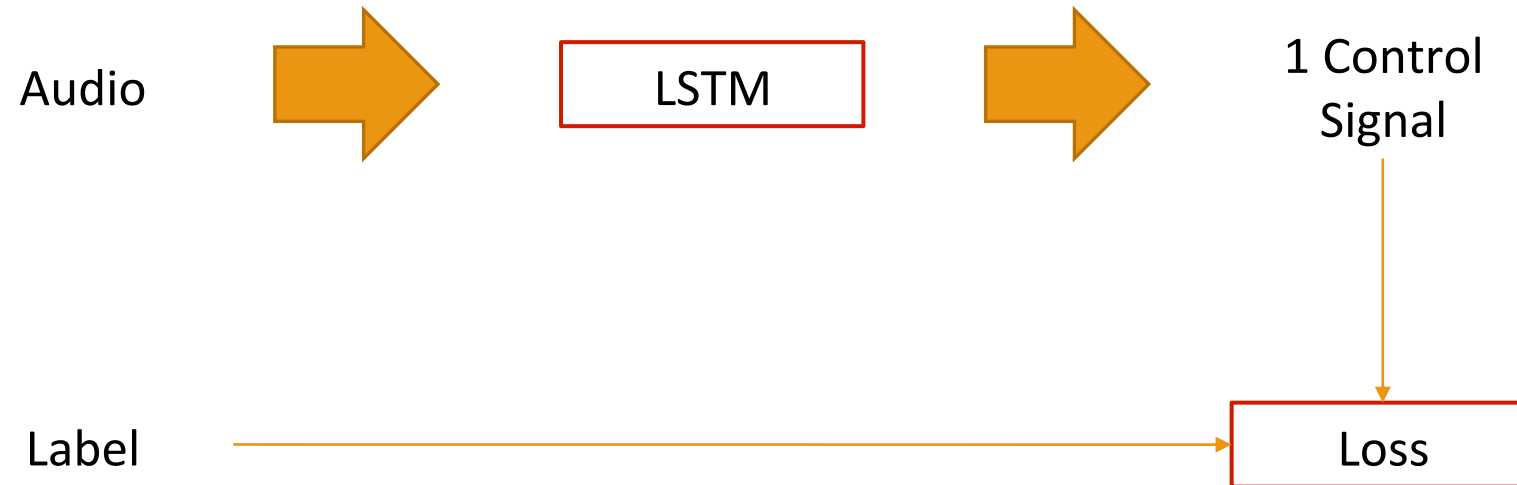
Hyperparameters:

- Learning Rate (1e-4 – 1e-7)
- Number of Unrollings (1,5,10,15,50,100)
- Epochs (1,5,20,100)
- Number of LSTM Layers

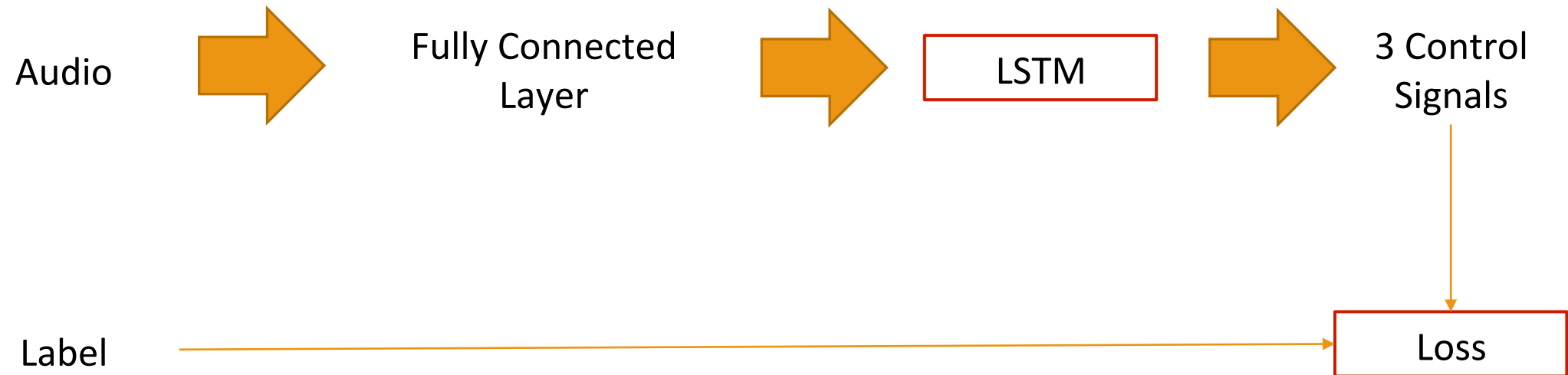
Calculating Loss: Mean Squared Error

- Goal: Low loss (close to 0)

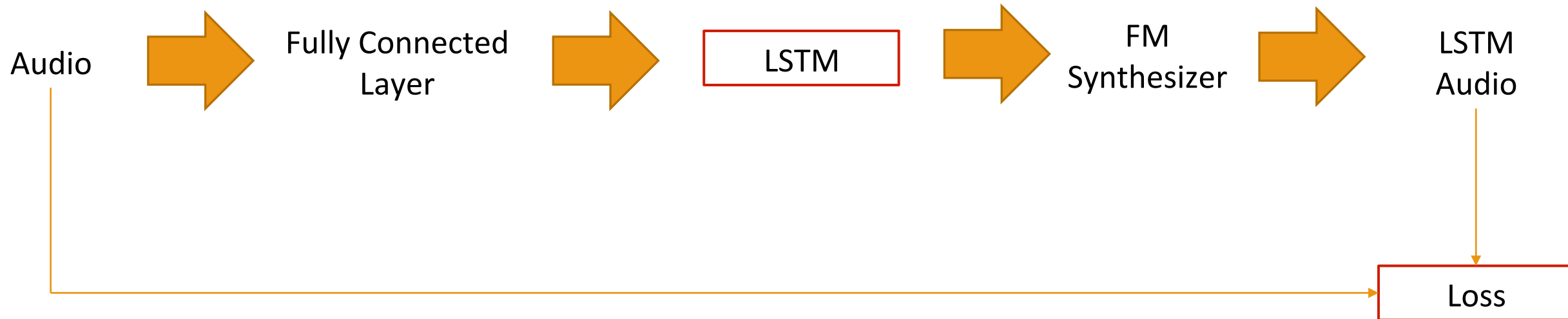
First Test



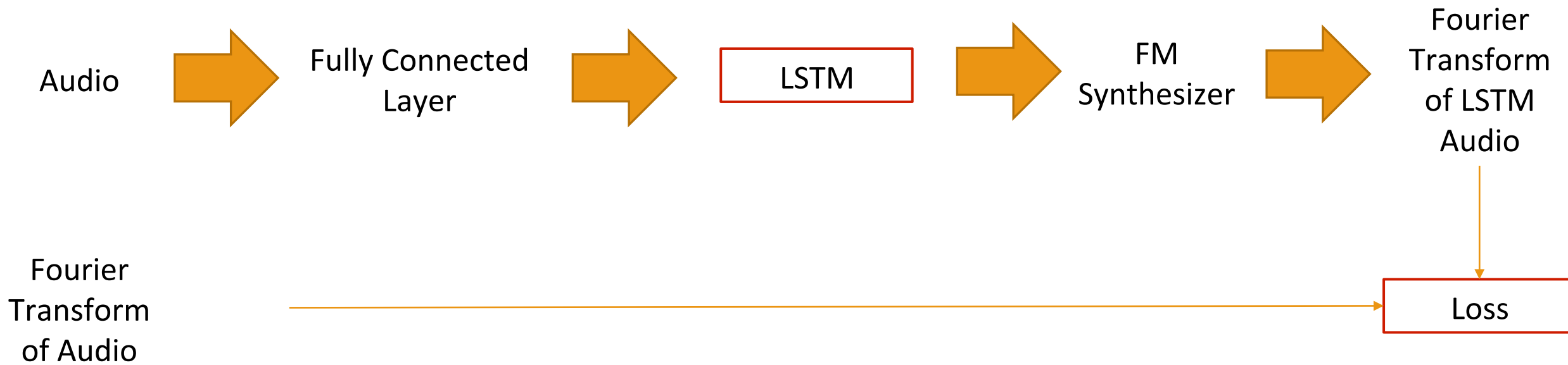
Second Test



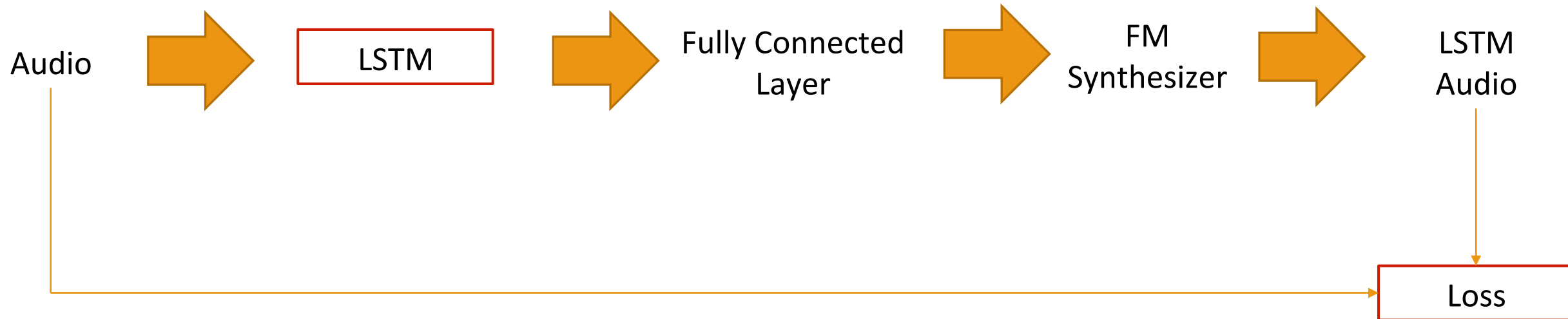
Third Test



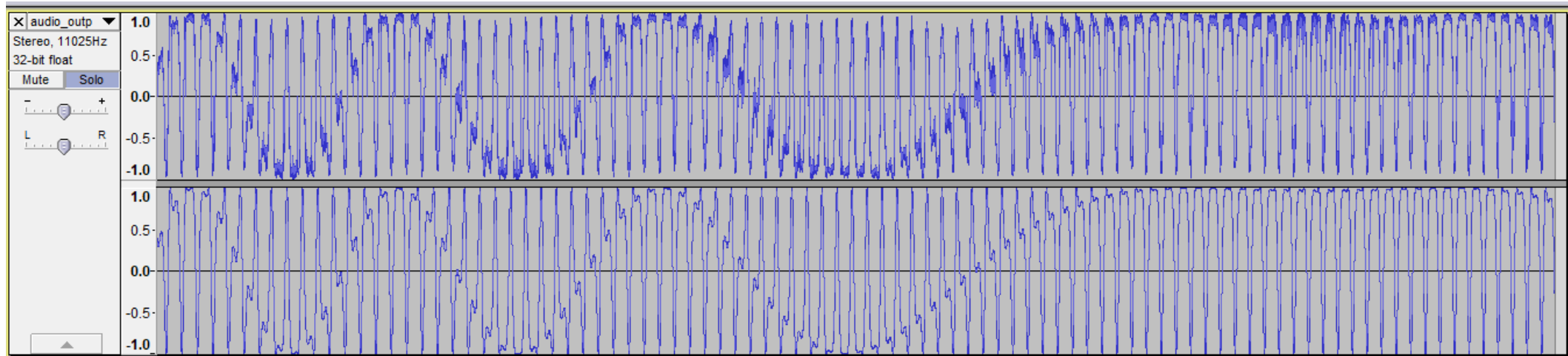
Small Edit to Third Test



Fourth Test



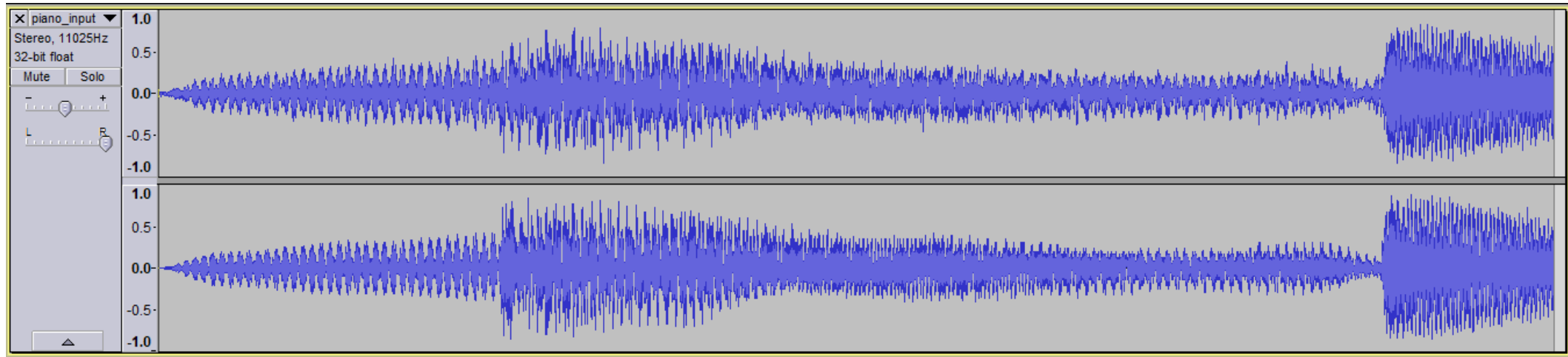
Most Recent Data



Seeing a loss of 0.002



Piano Input Data



Acknowledgements

Thank you to for this opportunity to be a part of the Center for Computation & Technology (CCT) at Louisiana State University (LSU) REU 2017.

Thank you to my graduate student, Andrew Pfalz, Dr. Berdahl, and Dr. Jesse Allison. Also to my family and friends for their support throughout my summer research experience.

This material is based upon work supported by the National Science Foundation under award OCI-1560410 with additional support from the CCT at LSU.



Center for
Computation & Technology

Questions?