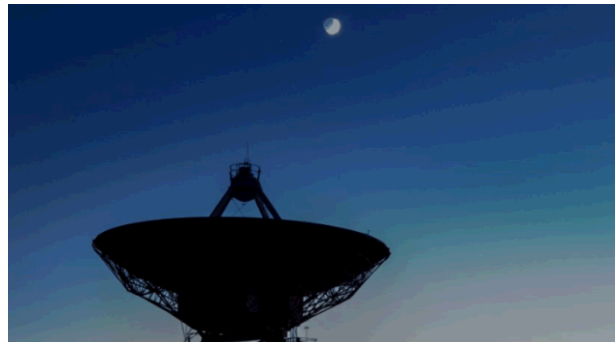




SAND2017-8753C



Seismic Event Discrimination with a Spectro-Temporal Neural Network

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Seismic Event Discrimination

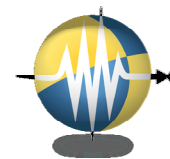


- Objective:
 - Given a seismogram, create a model to differentiate earthquake and non-earthquake events
 - Use inspiration from state-of-the-art speech recognition
 - DeepSpeech, DeepSpeech2
 - Utilize Keras / Tensorflow for neural network training and testing
 - Prepare seismic data using ObsPy and NumPy

Seismic Data Source



- Events cataloged by the University of Utah Seismograph Stations
- Seismograms recorded a 3-channel station FLU
 - Use only the z-channel
- Data is sampled at 100 Hz
- 6-second Event seismograms extracted
 - 1 second prior to arrival time
 - 5 seconds after arrival time

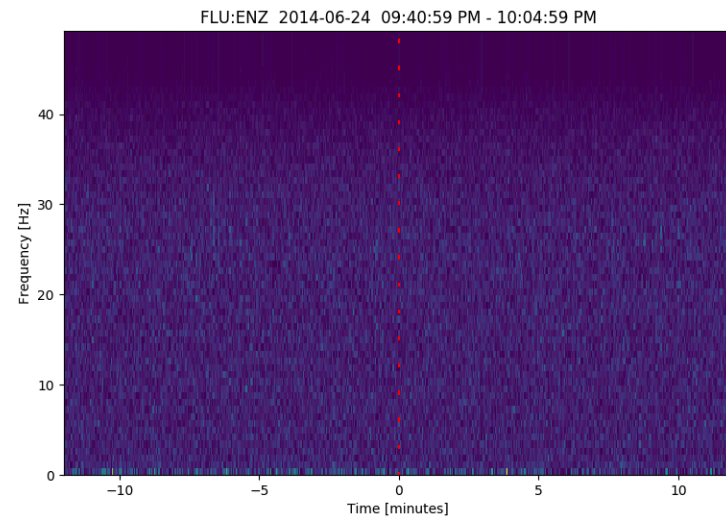
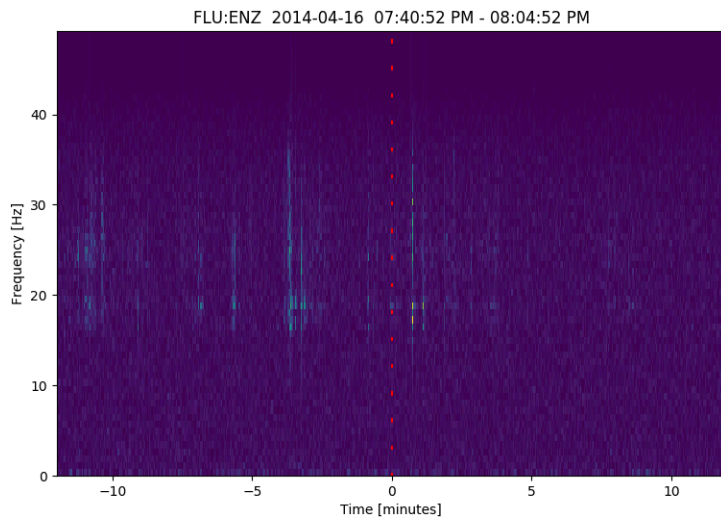
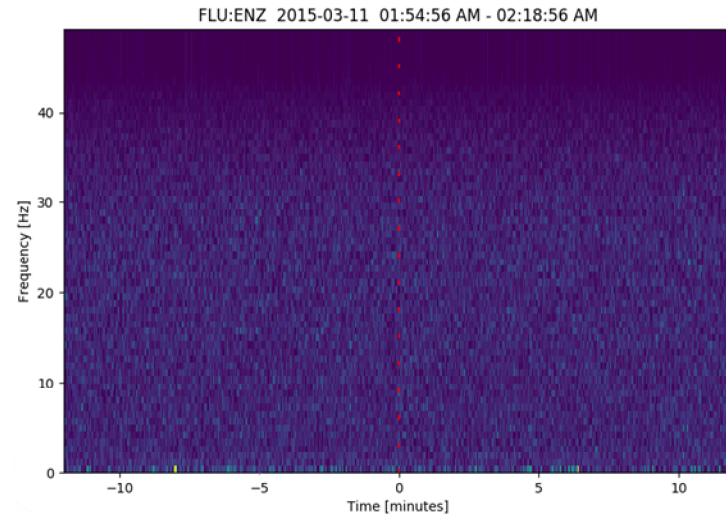
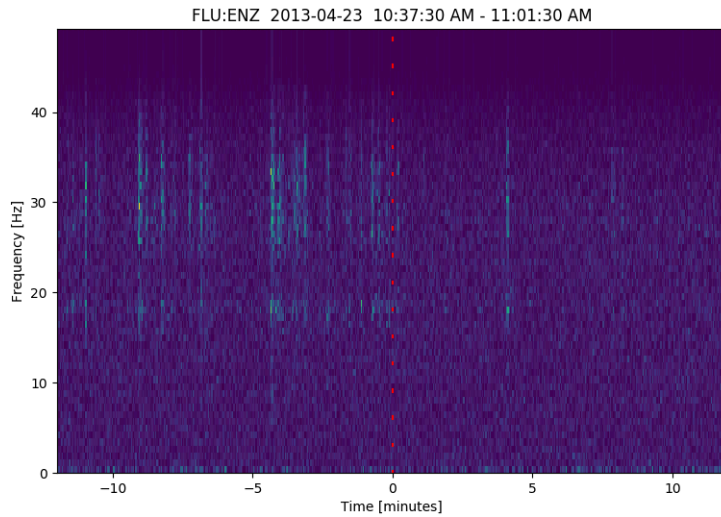


ObsPy
A Python Framework for Seismology

Seismic Data Pre-processing



- Compute Power Spectrograms from the event seismograms



Neural Network Model



- Deep Speech 2

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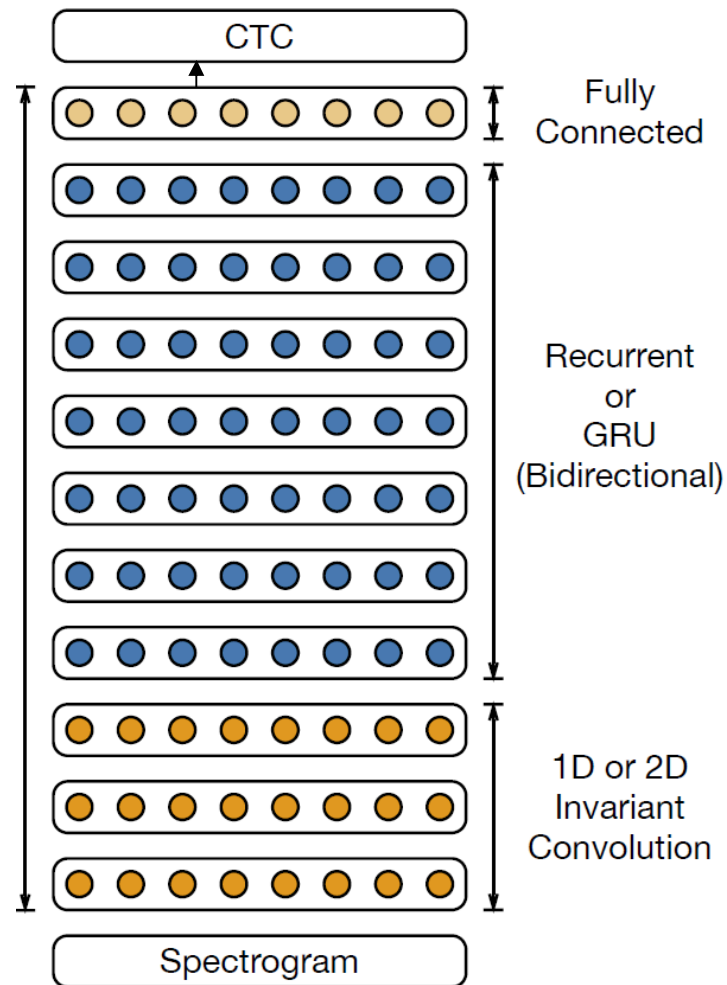
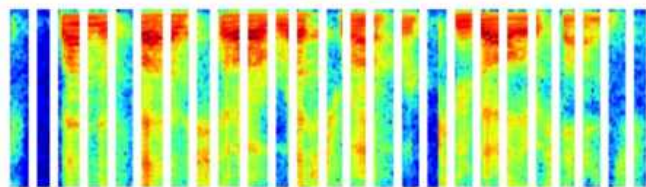
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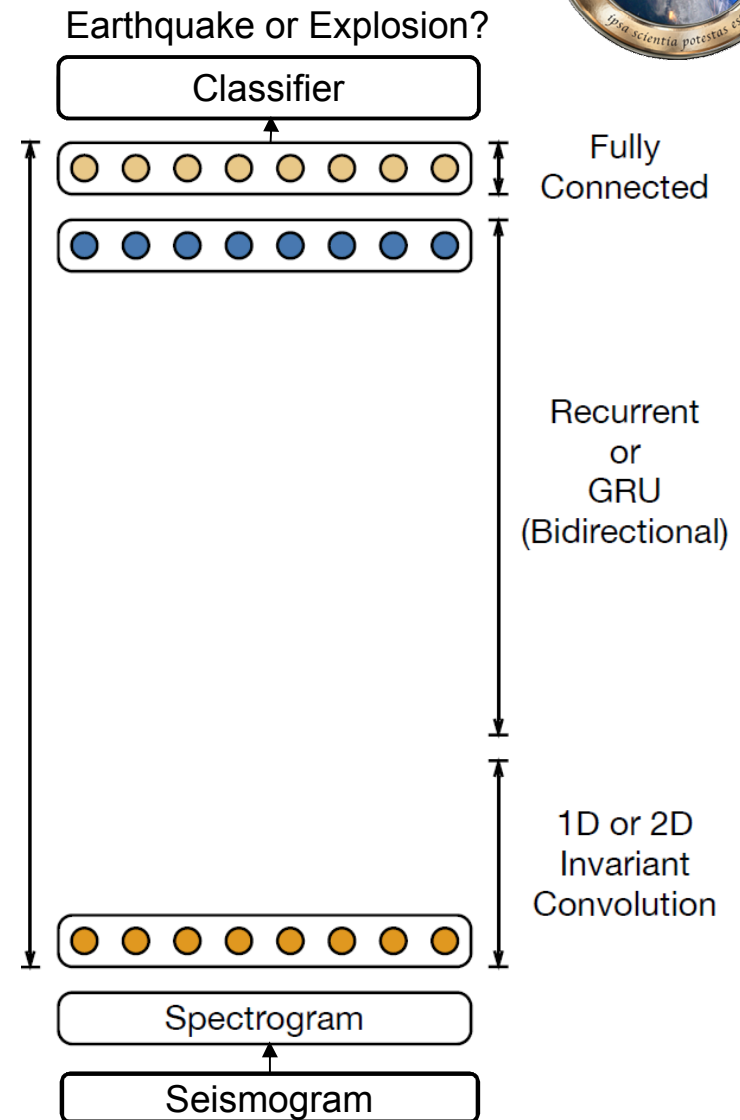
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Neural Network Model



- DeepSpeech2 used many layers to classify text from a speech (acoustic) signal
- We are simply performing binary event discrimination
 - Do not necessarily need a duplicates of each type of layer
 - We also have very few samples, so we need to be very careful with overfitting



Results



- 75%+ classification accuracy on held-out test set
 - Many tiny (imperceptible to the eye) events
- Plans to train a single classifier on a network of 100s of seismic stations