

SETI @ IBMCloud Code Challenge

SETI = Search for Extra Terrestrial Intelligence

Task:

Build Signal Classification Model based on simulated E.T. signals (supervised machine-learning)

Background

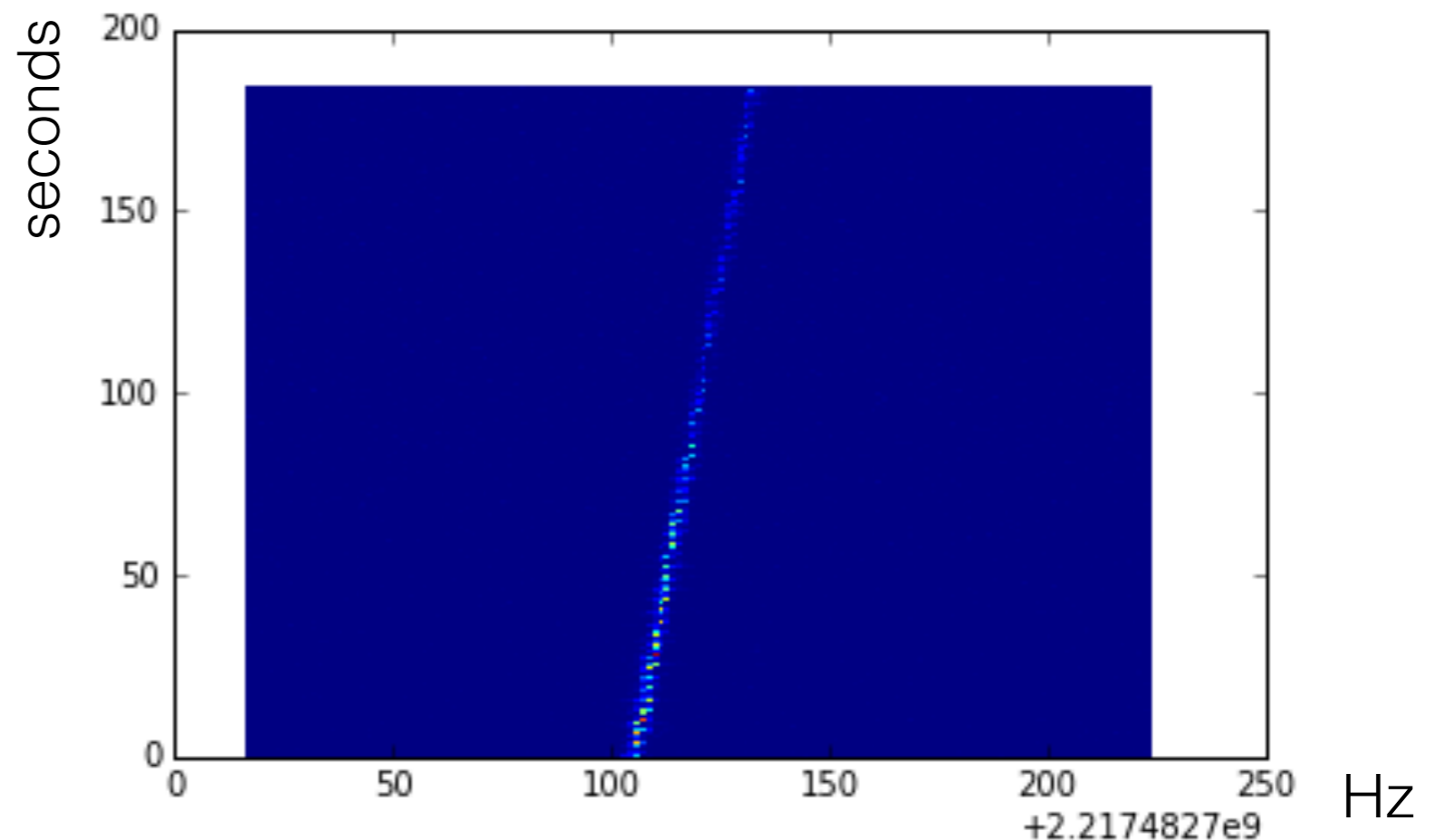
Available SETI data are ~100 second observations of radio signals, from a particular target in the sky (typically a star with known exoplanet)

The data are complex-valued time-series data.

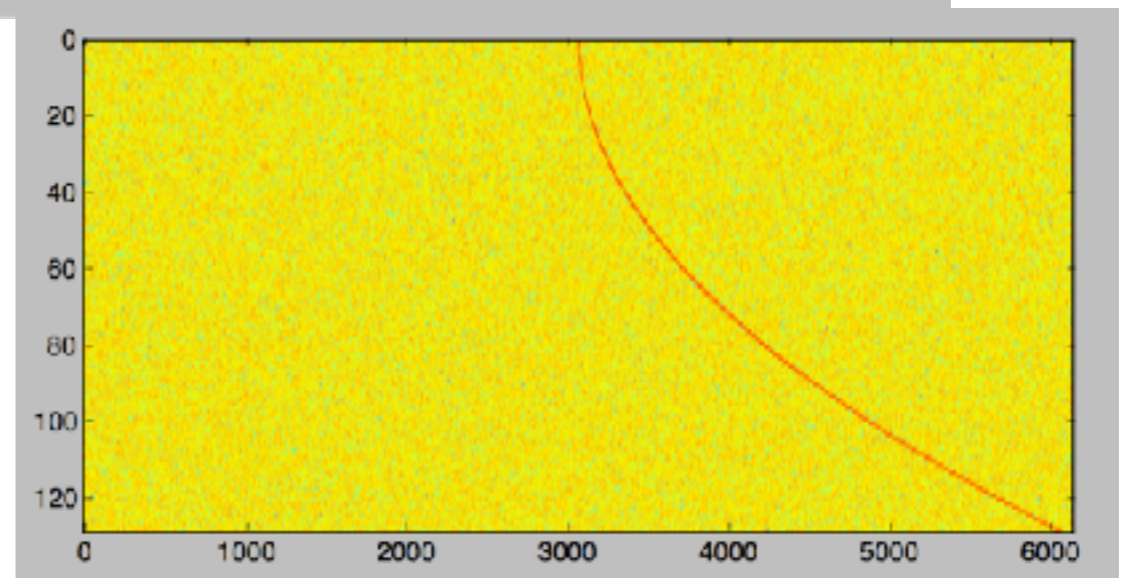
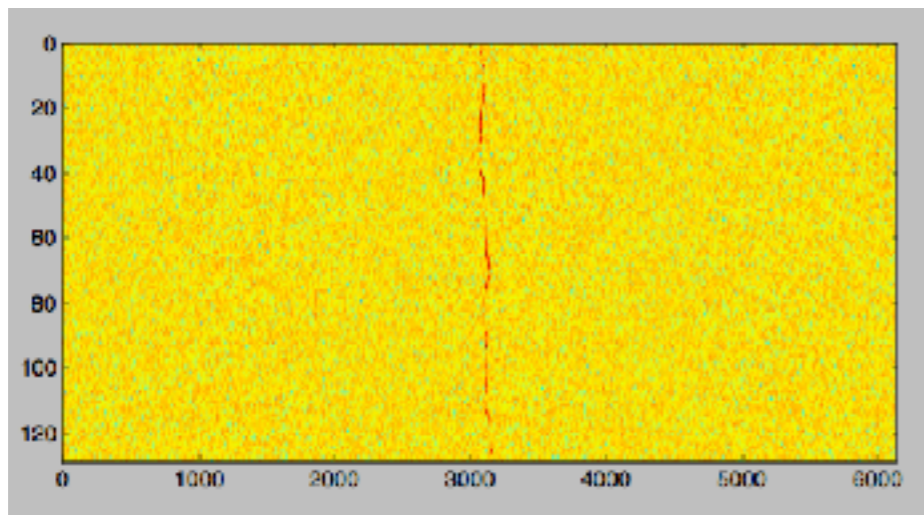
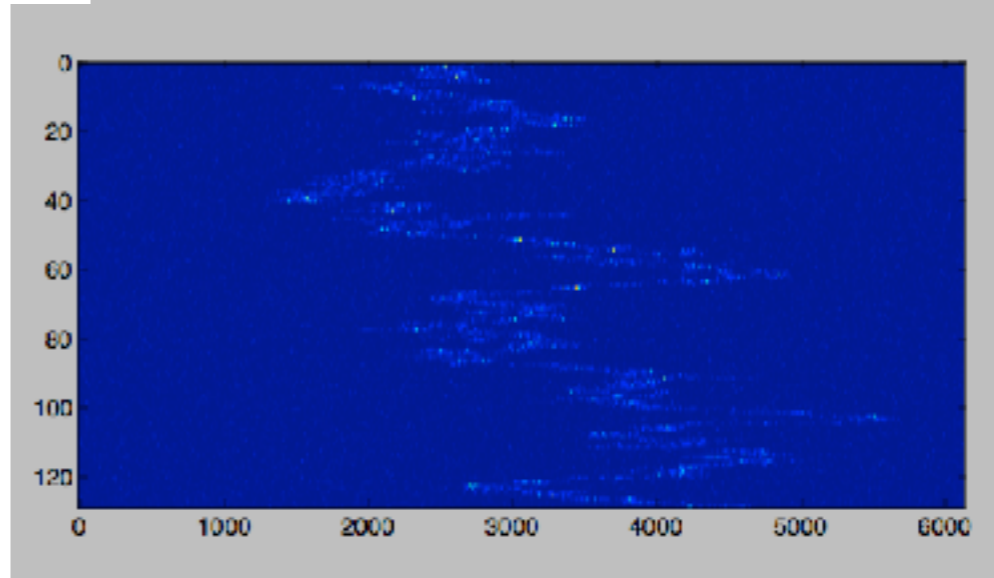
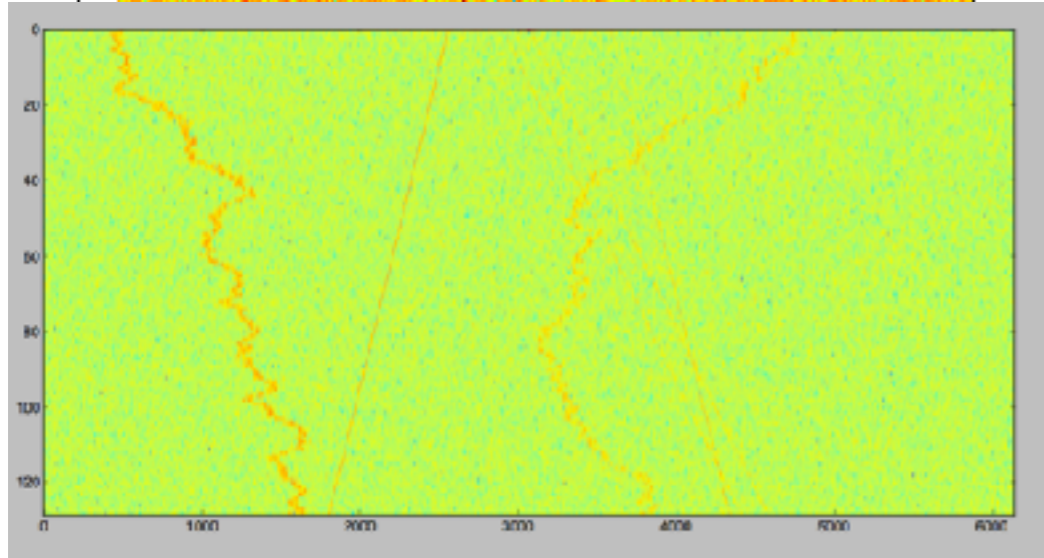
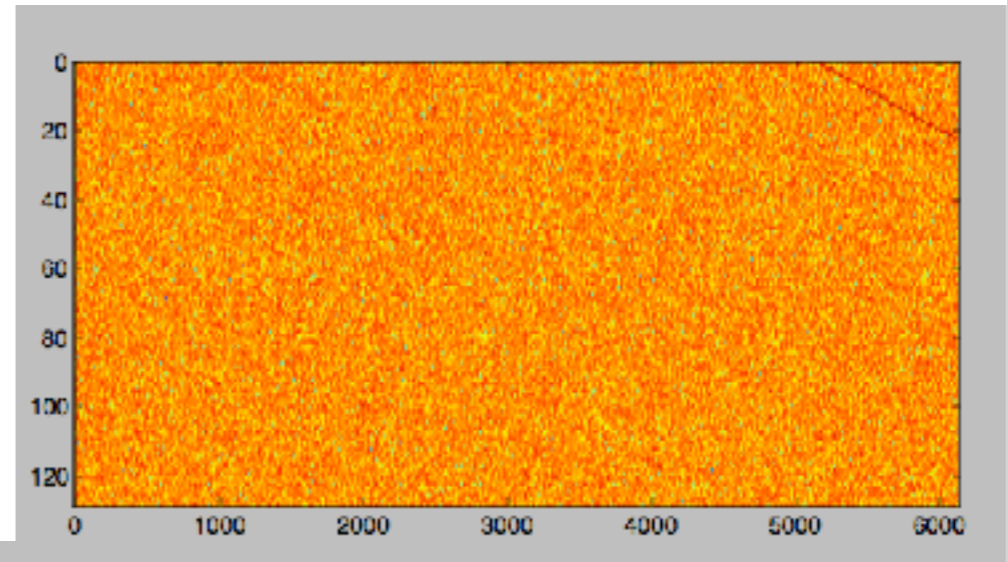
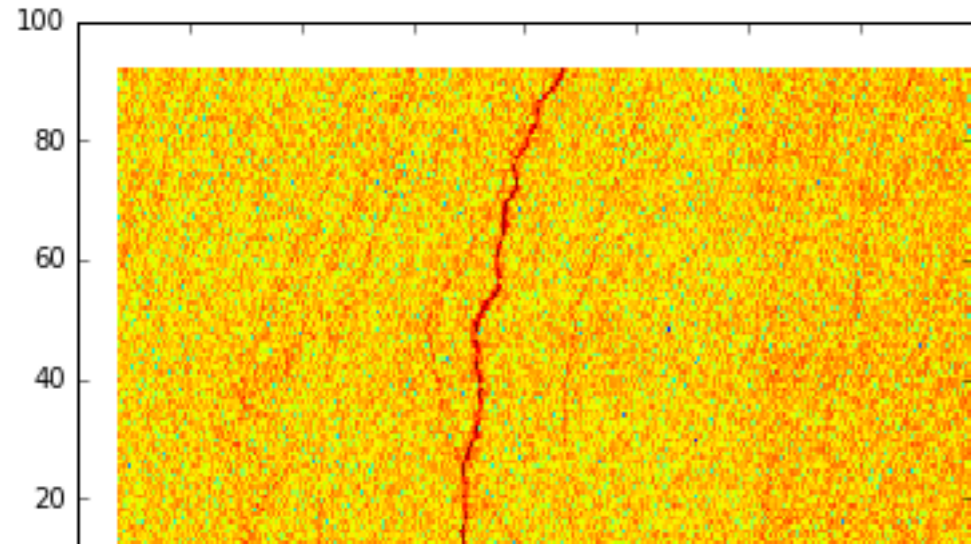
Typically they are analyzed as spectrograms: measurement of signal power across frequency range vs. time (color = Power)

Narrow-band signal
from ISEE3 satellite

Signal almost always
has a “drift” (aka “chirp”)



However, many signals are not-narrow band. SETI Inst. needs a good way to classify them (yellow/orange due to log scale).

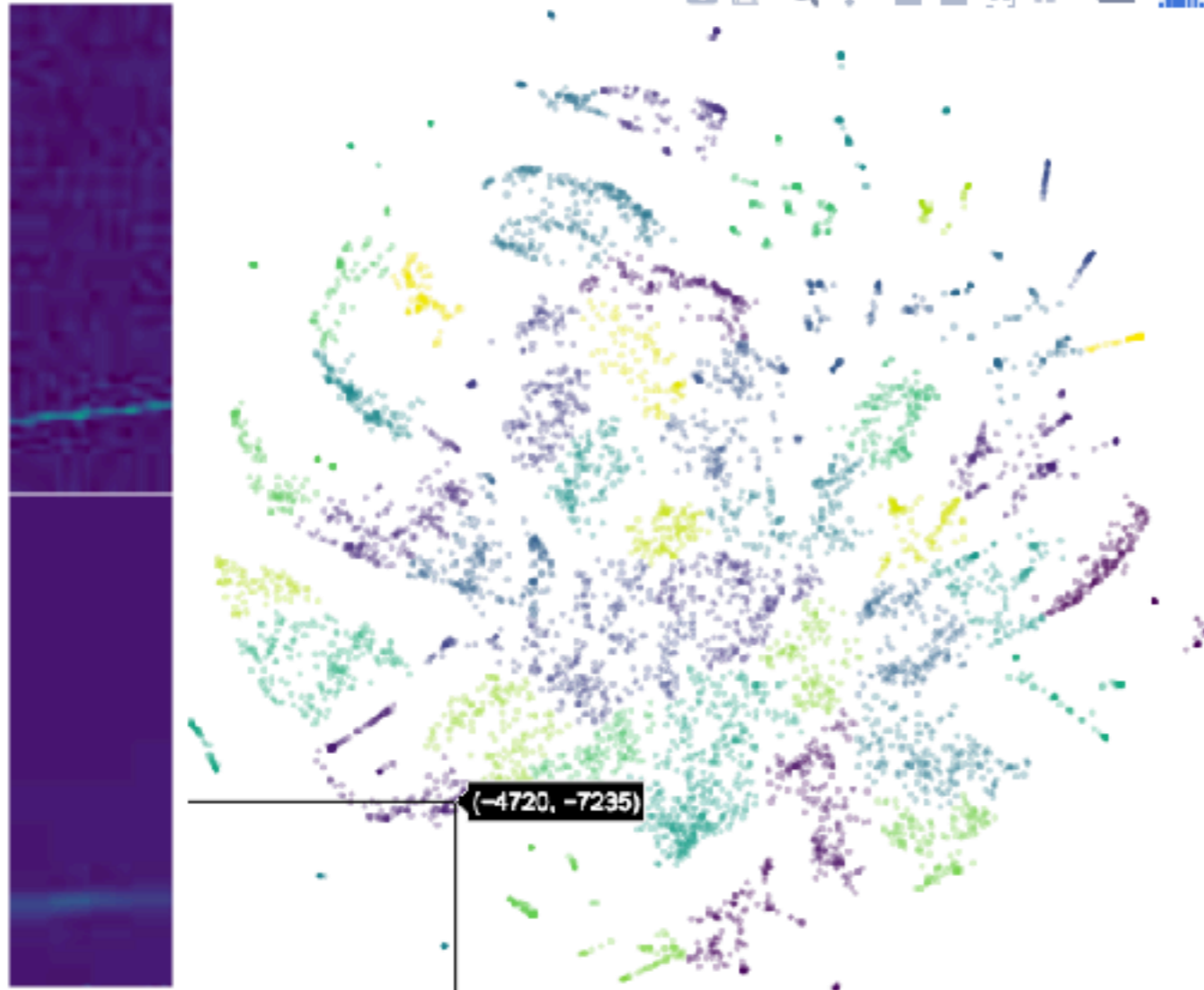


Previous Dimensionality reduction techniques have been attempted at classification of **unlabeled real data**

Display tSNE clustering and autoencoder reconstructions (top waterfall is original, bottom is reconstruction)

```
In [ ]: waterfall_recon_plots((Y[:3*49*49, 1]*1000).astype(np.int16), (-Y[:3*49*49, 0]*1000).astype(np.int16), Y_pred, 'testreconwaterfalls')
```

Out[]:



... plus other attempts. Mildly successful in grouping spectrograms (aka waterfall)

The Project

We are constructing a large database of simulated (and, thus, classified) signals that look roughly like a subset of the signals types that have been observed.

SETI Inst. is looking to the machine-learning community to assist in building a good classifier.

When data viewed as spectrogram, this is a kind of 2D visual recognition problem.

Other ideas: time-series data could also be decomposed differently (KLT transforms, or Wavelet decomposition)

For students, we can provide access to our IBM Spark cluster (~30 executor cluster) used for the SETI+IBM project. You will need to sign up for an IBM account.

Data will be provided in Openstack Swift Object Storage.

These data will be part of SETI Institute Code Challenge / Hackathon starting in ~May/June. But you will get first access.