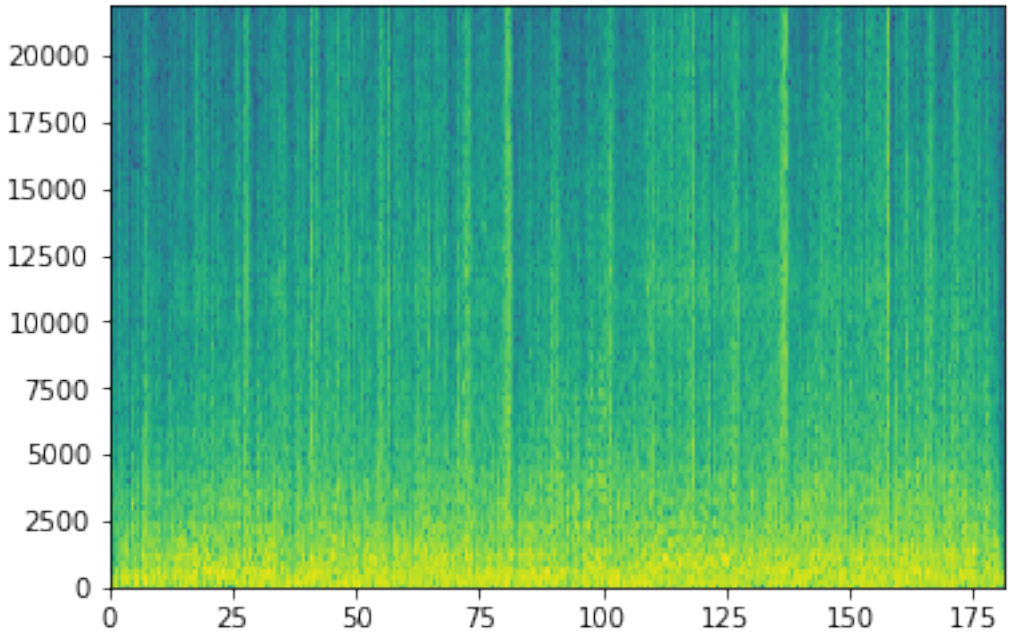
basic

March 24, 2019

```
In [167]: from matplotlib import pyplot as plt
          import numpy as np
          from keras.datasets import mnist
          from keras.models import Sequential
          from keras.layers import Dense, Activation, Flatten, MaxPooling1D, UpSampling1D
          from keras.layers.convolutional import Conv1D, Conv2D
          import medleydb as mdb
          from scipy import signal
          from scipy.io import wavfile
```

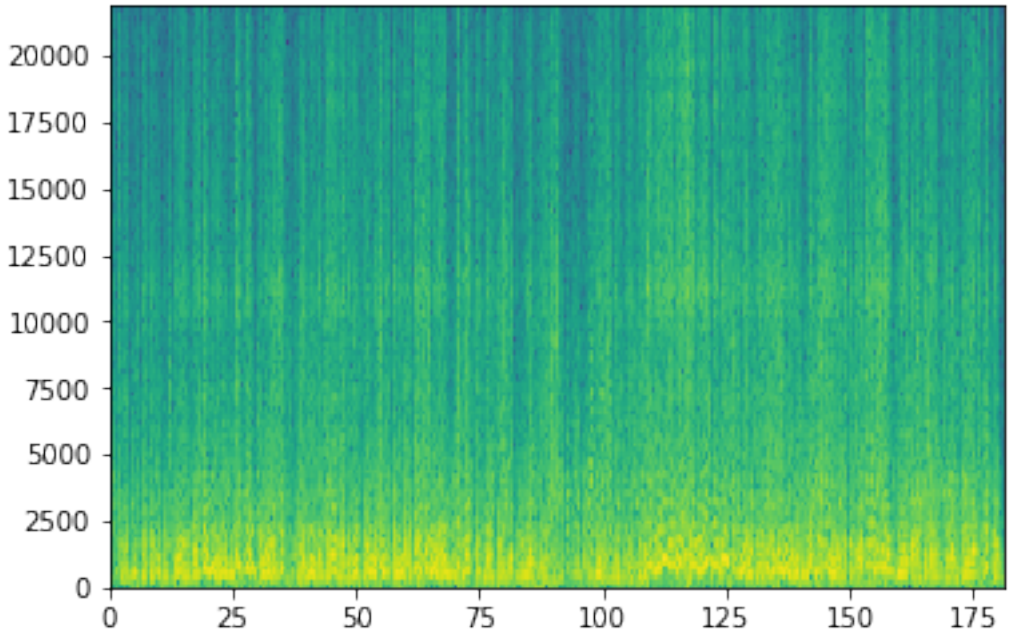
1 Load the mix

```
In [168]: multitracks = mdb.load_multitracks(["Phoenix_ColliersDaughter"])

In [169]: mix = next(multitracks)

In [170]: sample_rate, mix_audio = wavfile.read(mix.mix_path)
          mix_audio = mix_audio.mean(1)
          mix_audio = mix_audio[sample_rate*8:int(-sample_rate*1.5)]

In [171]: samples_per_period = 256
          overlap = int(samples_per_period/2)

In [172]: freqs, times, s_mix = signal.stft(mix_audio, fs=sample_rate, nfft=samples_per_period
                                            noverlap=overlap, nperseg=samples_per_perio

          freqs = freqs[:-1]
          s_mix = s_mix[:-1,:]

In [173]: plt.pcolormesh(times, freqs, 20*np.log10(np.abs(s_mix)))

Out[173]: <matplotlib.collections.QuadMesh at 0x2068d20bdd8>
```



2 Load the Flute

```
In [174]: flutes = mdb.get_files_for_instrument("flute", [mix])

In [175]: flute = next(flutes)

In [176]: sample_rate, flute_audio = wavfile.read(flute)
          flute_audio = flute_audio.mean(1)
          flute_audio = flute_audio[sample_rate*8:int(-sample_rate*1.5)]

In [177]: freqs, times, s_flute = signal.stft(flute_audio, fs=sample_rate, nfft=samples_per_pe
                                                noverlap=overlap, nperseg=samples_per_per

          freqs = freqs[:-1]
          s_flute = s_flute[:-1,:]

In [178]: plt.pcolormesh(times, freqs, 20*np.log10(np.abs(s_flute)))

Out[178]: <matplotlib.collections.QuadMesh at 0x2068d2afb38>
```

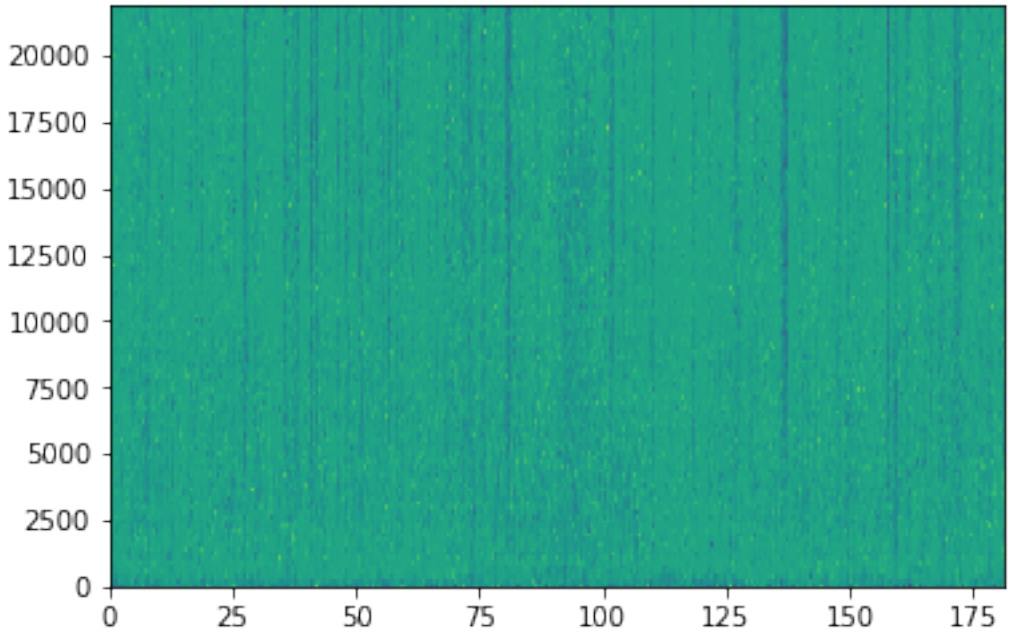


2.1 Create a mask for the flute

```
In [206]: mask_flute = s_flute / (s_flute + s_mix + 1e-9)
```

```
In [207]: plt.pcolormesh(times, freqs, 20*np.log10(np.abs(mask_flute)))
```

```
Out[207]: <matplotlib.collections.QuadMesh at 0x206910336a0>
```



3 Prepare the training data

In [179]:
```
#s_mix_train = s_mix.reshape(*s_mix.T.shape, 1)
#s_mix_train.shape
```

In [180]:
```
num_test  = int((sample_rate * 10)/samples_per_period)
num_train = s_mix.shape[1] - num_test
print(num_train, num_test)
```

```
60694 1722
```

In [208]:
```
mix_train = s_mix.T[:num_train,:,np.newaxis]
mix_train = np.concatenate((mix_train.real, mix_train.imag), axis=-1)
mix_train.shape
```

Out[208]:
```
(60694, 128, 2)
```

In [209]:
```
flute_train = mask_flute.T[:num_train,:,np.newaxis]
flute_train = np.concatenate((flute_train.real, flute_train.imag), axis=-1)
flute_train.shape
```

Out[209]:
```
(60694, 128, 2)
```

In [210]:
```
mix_test = s_mix.T[-num_test:,:,np.newaxis]
mix_test = np.concatenate((mix_test.real, mix_test.imag), axis=-1)
mix_test.shape
```

Out[210]:
```
(1722, 128, 2)
```

In [211]:
```
flute_test = mask_flute.T[-num_test:,:,np.newaxis]
flute_test = np.concatenate((flute_test.real, flute_test.imag), axis=-1)
flute_test.shape
```

Out[211]:
```
(1722, 128, 2)
```

In [212]:
```
model = Sequential()

model.add(Conv1D(10, 2, padding="same", input_shape=mix_train.shape[1:], activation='

model.add(Conv1D(2, 2, padding="same",  name="Conv1D_2"))

model.summary()
```

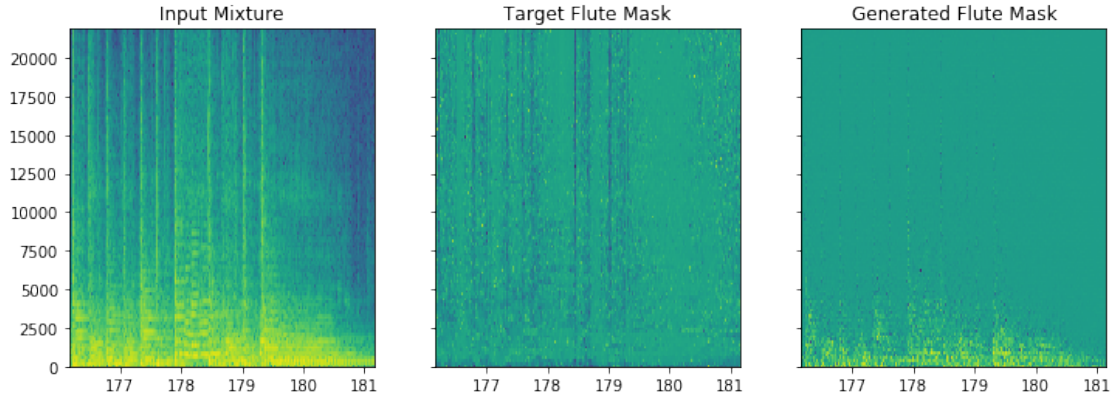
```
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
Conv1D_1 (Conv1D)            (None, 128, 10)           50
_________________________________________________________________
Conv1D_2 (Conv1D)            (None, 128, 2)            42
=================================================================
Total params: 92
Trainable params: 92
Non-trainable params: 0
_________________________________________________________________
```

```
In [213]: model.compile('adam', loss='mean_squared_error', metrics=['accuracy'])

In [214]: history = model.fit(mix_train, flute_train, batch_size=200, epochs=10)

Epoch 1/10
60694/60694 [==============================] - 18s 291us/step - loss: 181.5723 - acc: 0.5518
Epoch 2/10
60694/60694 [==============================] - 4s 62us/step - loss: 19.7310 - acc: 0.7052
Epoch 3/10
60694/60694 [==============================] - 4s 61us/step - loss: 10.5840 - acc: 0.7290
Epoch 4/10
60694/60694 [==============================] - 4s 62us/step - loss: 7.6092 - acc: 0.7471
Epoch 5/10
60694/60694 [==============================] - 4s 61us/step - loss: 6.1970 - acc: 0.7606
Epoch 6/10
60694/60694 [==============================] - 4s 66us/step - loss: 5.4173 - acc: 0.7697
Epoch 7/10
60694/60694 [==============================] - 4s 70us/step - loss: 4.9606 - acc: 0.7765
Epoch 8/10
60694/60694 [==============================] - 4s 68us/step - loss: 4.6810 - acc: 0.7815
Epoch 9/10
60694/60694 [==============================] - 4s 71us/step - loss: 4.4985 - acc: 0.7854
Epoch 10/10
60694/60694 [==============================] - 4s 65us/step - loss: 4.3767 - acc: 0.7887
```

```
In [215]: results = model.evaluate(mix_test, flute_test)

          print(model.metrics_names)
          print(results)

1722/1722 [==============================] - 0s 158us/step
['loss', 'acc']
[0.6745871293697069, 0.7976009001853712]
```

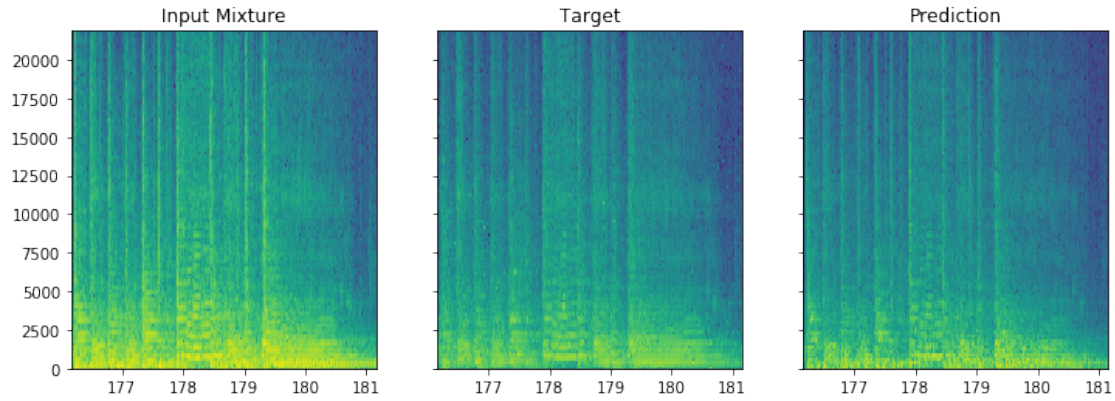
4 Results

```
In [228]: mask_prediction = model.predict(mix_test)
          mask_prediction.shape

Out[228]: (1722, 128, 2)

In [229]: mask_prediction = np.sqrt((mask_prediction**2).sum(-1)).T

In [230]: fig, (ax1, ax2, ax3) = plt.subplots(1,3,sharey=True,figsize=(12, 4))

          ax1.set_title("Input Mixture")
          ax2.set_title("Target Flute Mask")
          ax3.set_title("Generated Flute Mask")

          ax1.pcolormesh(times[-num_test:], freqs, 20*np.log10(np.abs(s_mix[:,-num_test:])))
          ax2.pcolormesh(times[-num_test:], freqs, 20*np.log10(np.abs(mask_flute[:,-num_test:])
          ax3.pcolormesh(times[-num_test:], freqs, 20*np.log10(mask_prediction))

Out[230]: <matplotlib.collections.QuadMesh at 0x20694908d68>
```




```
In [233]: target = s_mix[:,-num_test:] * mask_flute[:,-num_test:]

In [232]: prediction = s_mix[:,-num_test:] * mask_prediction

In [235]: fig, (ax1, ax2, ax3) = plt.subplots(1, 3, sharey=True, figsize=(12, 4))

          ax1.set_title("Input Mixture")
          ax2.set_title("Target")
          ax3.set_title("Prediction")

          ax1.pcolormesh(times[-num_test:], freqs, 20*np.log10(np.abs(s_mix[:,-num_test:])))
          ax2.pcolormesh(times[-num_test:], freqs, 20*np.log10(np.abs(target)))
          ax3.pcolormesh(times[-num_test:], freqs, 20*np.log10(np.abs(prediction)))
```

```
Out[235]: <matplotlib.collections.QuadMesh at 0x206b7010550>
```



4.1 Let's hear it

```
In [266]: _, predicted_audio = signal.istft(prediction, fs=sample_rate)

In [267]: wavfile.write("basic_model_flute_prediction.wav", sample_rate, predicted_audio.astype

In [268]: _, target_audio = signal.istft(target, fs=sample_rate)

In [269]: wavfile.write("basic_model_flute_target.wav", sample_rate, target_audio.astype(np.int

In [270]: _, mix_audio = signal.istft(s_mix[:,-num_test:], fs=sample_rate)

In [271]: wavfile.write("basic_model_original.wav", sample_rate, mix_audio.astype(np.int16))

In [ ]:
```