Link to the example Sound classification using Images, fastai

https://towardsdatascience.com/sound-classification-using-images-68d4770df426

```
from fastai import *
from fastai.vision import *
import numpy as np
import librosa as lr
```

solution to ERRORS

usr/local/lib/python3.6/dist-packages/torch/nn/functional.py:3000: UserWarning: The default behavior for interpolate/upsample with float scale_factor changed in 1.6.0 to align with other frameworks/libraries, and uses scale_factor directly, instead of relying on the computed output size. If you wish to keep the old behavior, please set recompute_scale_factor=True. See the documentation of nn.Upsample for details. warnings.warn("The default behavior for interpolate/upsample with float scale_factor changed "

seems that some issues with torch that is used in colab Forum 33 Try to install specific version of torch in your colab before run fastAI python code

!pip install "torch==1.4" "torchvision==0.5.0"

```
!pip install "torch==1.4" "torchvision==0.5.0"
```

```
Collecting torch==1.4
  Downloading https://files.pythonhosted.org/packages/24/19/4804aea17cd136f1705a5e98a
     |████████████████████████████████| 753.4MB 22kB/s
Collecting torchvision==0.5.0
  Downloading https://files.pythonhosted.org/packages/7e/90/6141bf41f5655c78e24f40f71
     |████████████████████████████████| 4.0MB 23.3MB/s
Requirement already satisfied: numpy in /usr/local/lib/python3.6/dist-packages (from
Requirement already satisfied: six in /usr/local/lib/python3.6/dist-packages (from to
Requirement already satisfied: pillow>=4.1.1 in /usr/local/lib/python3.6/dist-package
Installing collected packages: torch, torchvision
  Found existing installation: torch 1.6.0+cu101
    Uninstalling torch-1.6.0+cu101:
      Successfully uninstalled torch-1.6.0+cu101
  Found existing installation: torchvision 0.7.0+cu101
    Uninstalling torchvision-0.7.0+cu101:
      Successfully uninstalled torchvision-0.7.0+cu101
Successfully installed torch-1.4.0 torchvision-0.5.0
```

```
from google.colab import drive
drive.mount('/content/drive')
```

```
Drive already mounted at /content/drive; to attempt to forcibly remount, call drive.m
```

Display the audio file

```
import IPython
IPython.display.Audio("/content/drive/My Drive/1.wav")
```

0:00 / 0:05

another good reading resource

Audio Classification using FastAI and On-the-Fly Frequency Transforms

https://towardsdatascience.com/audio-classification-using-fastai-and-on-the-fly-frequency-transforms-4dbe1b540f89

We have 2 options to convert the audio files to spectrograms, matplotlib or librosa. We will go for the latter because it is easier to use and well known in the sound domain. Before we use it we just need to install a little dependency to ensure librosa works well

I installed librosa becauseI wanted to use it but it didnt work so I used wavfile later.

```
pip install librosa
```

Double-click (or enter) to edit

The below code is for single channel or mono audio so if i use it for gravel classification it gives the following errors *_ValueError:_ *only 1-dimensional arrays can be us

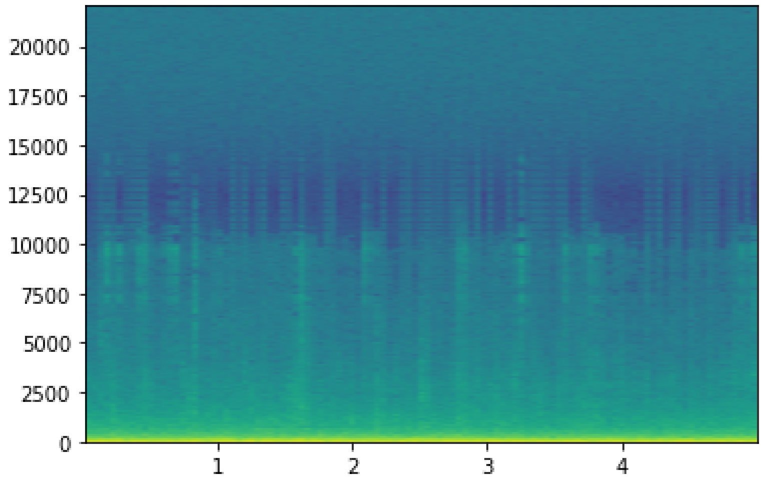
https://dsp.stackexchange.com/questions/10743/generating-spectrograms-in-python-with-less-noise

```
import pylab
from scipy.io import wavfile

fs, frames = wavfile.read("/content/drive/My Drive/gravel.wav")

channels = [
    np.array(frames[:, 0]),
    np.array(frames[:, 1])
]
```

```
# generate specgram
Pxx, freqs, t, plot = pylab.specgram(
    channels[0],
    NFFT=4096,
    Fs=44100,
    detrend=pylab.detrend_none,
    window=pylab.window_hanning,
    noverlap=int(4096 * 0.5))
```

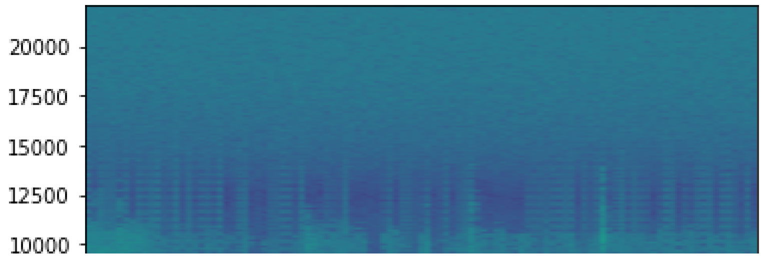


```
import pylab
from scipy.io import wavfile


fs, frames = wavfile.read("/content/drive/My Drive/nongravel.wav")

channels = [
    np.array(frames[:, 0]),
    np.array(frames[:, 1])
]

# generate specgram
Pxx, freqs, t, plot = pylab.specgram(
    channels[0],
    NFFT=4096,
    Fs=44100,
    detrend=pylab.detrend_none,
    window=pylab.window_hanning,
    noverlap=int(4096 * 0.5))
```



```
import wave, os, glob
import pylab
from scipy.io import wavfile
import matplotlib.pyplot as plt
import matplotlib



zero = []
path = '/content/drive/My Drive/audiofiles/gravel'
files = os.listdir(path)
gravel_counter= 0

for filename in glob.glob(os.path.join(path, '*.wav')):
    s = wave.open(filename, 'r')
    fs, frames = wavfile.read(filename)
    channels = [
         np.array(frames[:, 0]),
        np.array(frames[:, 1])
          ]

# generate specgram

    w = 10
    h = 7
    d = 70
    fig = plt.figure(figsize=(w, h), dpi=d)
    Pxx, freqs, t, plot = pylab.specgram(
    channels[0],
    NFFT=4096,
    Fs=44100,
    detrend=pylab.detrend_none,
    window=pylab.window_hanning,
    noverlap=int(4096 * 0.5))
   # print(filename)
#print(files)
    output_dir = "/content/drive/My Drive/Spectogram/Gravel"
#fig.savefig('{}/graph.png'.format(output_dir)) # old correct one
    #print(s)

    gravel_counter = gravel_counter + 1
    #print(gravel)
    gravel = "gravel" + str(gravel_counter) + ".png"
    #print(filename)
    filepath = os.path.join(output_dir, gravel)

    plt.savefig('/content/drive/My Drive/Spectogram/Gravel/' + gravel)
    plt.close()
    #print(filepath)
    #fig.savefig({}/filenamesave.format(output_dir))
#fig.savefig('{}/graph'+.png'.format(output_dir))
print("end")
```

```
end
```

For Non Gravel sounds

```
import wave, os, glob
import pylab
from scipy.io import wavfile
import matplotlib.pyplot as plt
import matplotlib


zero = []
path = '/content/drive/My Drive/audiofiles/non_gravel'
files = os.listdir(path)
ngravel_counter= 0

for filename in glob.glob(os.path.join(path, '*.wav')):
    s = wave.open(filename, 'r')
    fs, frames = wavfile.read(filename)
    channels = [
         np.array(frames[:, 0]),
        np.array(frames[:, 1])
          ]

# generate specgram

    w = 10
    h = 7
    d = 70
    fig = plt.figure(figsize=(w, h), dpi=d)
    Pxx, freqs, t, plot = pylab.specgram(
    channels[0],
    NFFT=4096,
    Fs=44100,
    detrend=pylab.detrend_none,
    window=pylab.window_hanning,
    noverlap=int(4096 * 0.5))

    output_dir = "/content/drive/My Drive/Spectogram/Non-gravel"


    ngravel_counter = ngravel_counter + 1

    ngravel = "Non-gravel" + str(ngravel_counter) + ".png"

    filepath = os.path.join(output_dir, gravel)

    plt.savefig('/content/drive/My Drive/Spectogram/Non-gravel/' + ngravel)
    plt.close()

print("end")
```

```
end
```

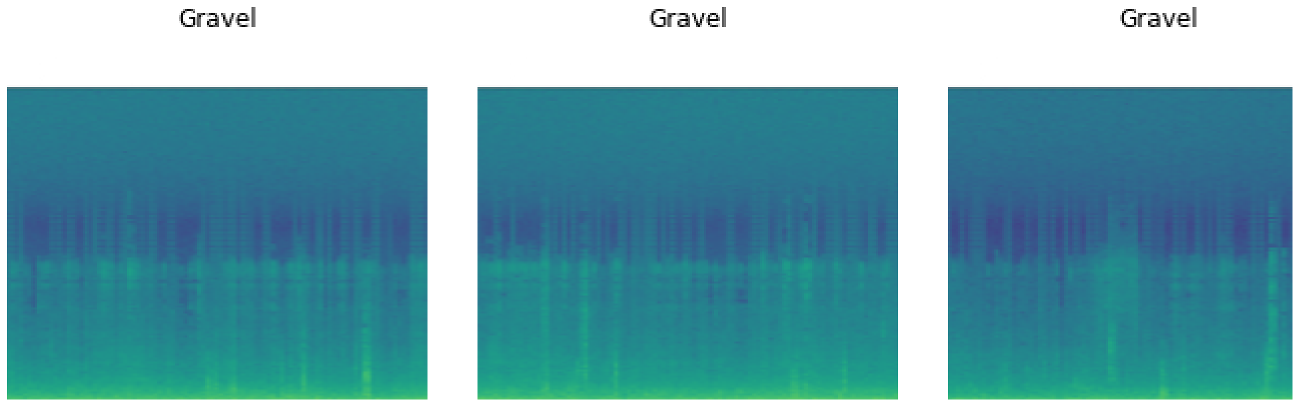
classification part

```
path = "/content/drive/My Drive/Spectogram";
```

```
path
```

```
'/content/drive/My Drive/Spectogram'
```

```
data = (ImageList.from_folder(path)
      .split_by_rand_pct()
      .label_from_folder()
      .transform([],size =224)
      .databunch())
data.show_batch(rows=3, figsize=(10,10))
```



```
data.normalize(imagenet_stats)
```

```
learn = cnn_learner(data, models.resnet34, metrics=[error_rate,accuracy])
```

```
Downloading: "https://download.pytorch.org/models/resnet34-333f7ec4.pth" to /root/.ca
100%                                        83.3M/83.3M [04:38<00:00, 313kB/s]
```

```
learn.model
```

```
learn.fit_one_cycle(10)
```

epoch	train_loss	valid_loss	error_rate	accuracy	time
0	1.292108	1.744478	0.340426	0.659574	00:16
1	1.195238	1.300250	0.340426	0.659574	00:07
2	0.927550	0.491724	0.212766	0.787234	00:06
3	0.735525	0.387641	0.170213	0.829787	00:06
4	0.607243	0.362773	0.234043	0.765957	00:06
5	0.501051	0.496762	0.191489	0.808511	00:06
6	0.422047	0.555415	0.170213	0.829787	00:06
7	0.369687	0.533067	0.148936	0.851064	00:06
8	0.323575	0.504000	0.106383	0.893617	00:06
9	0.286102	0.406760	0.127660	0.872340	00:06

```
learn.save('stage-1')
```

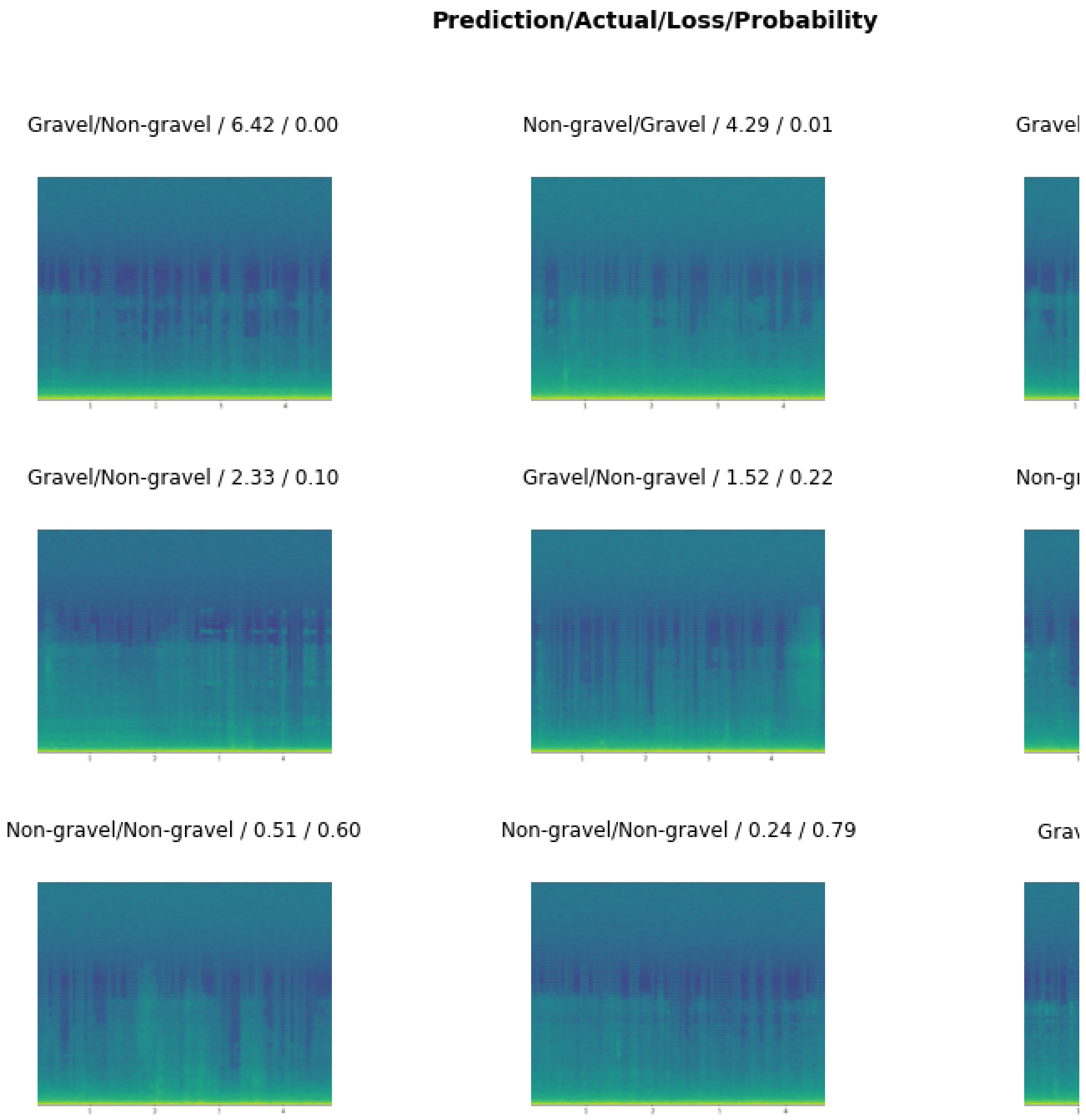
```
interp = ClassificationInterpretation.from_learner(learn)
```

```
losses,idxs = interp.top_losses()
```

```
len(data.valid_ds)==len(losses)==len(idxs)
```

```
    True
```

```
interp.plot_top_losses(9, figsize=(15,11))
```



```
interp.plot_confusion_matrix(figsize=(12,12), dpi=60)
```

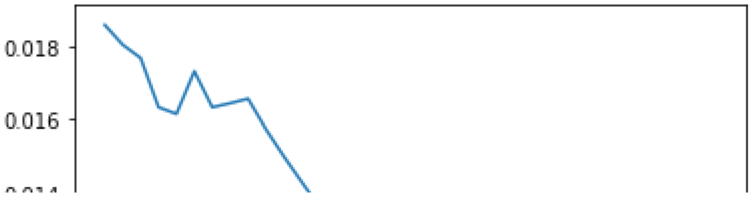
```
learn.unfreeze()
```

```
learn.lr_find()
```

48.00% [24/50 02:02<02:12]

epoch	train_loss	valid_loss	error_rate	accuracy	time
0	0.030606	#na#	00:05		
1	0.018546	#na#	00:05		
2	0.016112	#na#	00:05		
3	0.018568	#na#	00:04		
4	0.017463	#na#	00:05		
5	0.018049	#na#	00:05		
6	0.016334	#na#	00:05		
7	0.017323	#na#	00:04		
8	0.016446	#na#	00:04		
9	0.015740	#na#	00:05		
10	0.014294	#na#	00:05		
11	0.013444	#na#	00:05		
12	0.012502	#na#	00:04		
13	0.011407	#na#	00:04		
14	0.010519	#na#	00:05		
15	0.010183	#na#	00:05		
16	0.009732	#na#	00:05		
17	0.009065	#na#	00:05		
18	0.008474	#na#	00:05		
19	0.007895	#na#	00:05		
20	0.007943	#na#	00:05		
21	0.008245	#na#	00:05		
22	0.015109	#na#	00:05		
23	0.018493	#na#	00:05		

```
learn.recorder.plot()
```



```
learn.unfreeze()
learn.fit_one_cycle(10, max_lr=slice(1e-6,1e-5))
```

epoch	train_loss	valid_loss	error_rate	accuracy	time
0	0.027285	0.299077	0.085106	0.914894	00:07
1	0.036268	0.245371	0.127660	0.872340	00:07
2	0.028660	0.192131	0.063830	0.936170	00:07
3	0.027103	0.157950	0.063830	0.936170	00:07
4	0.022239	0.141795	0.042553	0.957447	00:07
5	0.020072	0.168879	0.042553	0.957447	00:07
6	0.017383	0.215570	0.063830	0.936170	00:07
7	0.015289	0.262880	0.063830	0.936170	00:07
8	0.013922	0.307496	0.063830	0.936170	00:07
9	0.013757	0.336888	0.063830	0.936170	00:07