Whale_Sound

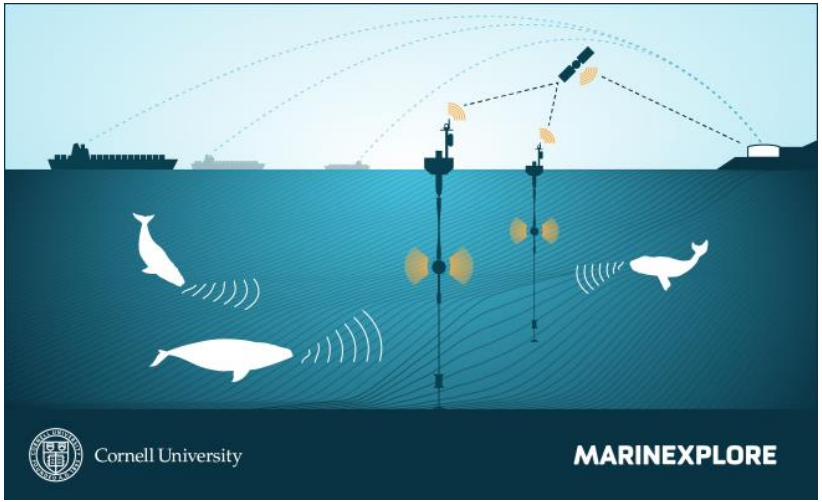
Sound for Anormal Detection

생활의 달인

장비 고장 진단

이 시스템에는 주변소음은 측정되지 않고 모니터링 하는 설비의 음만을 추적해 관리하는 사운드 필터법과 시간변화에 대한 주파수 분석이 자동으로 가능하도록 하는 사운드 워터폴 기술이 적용됐다. 하이텍홀딩스 관계자는 “음파를 이용한 발전설비 고장진단장치는 정상상태 기계의 고유한 음과 고장이 진행되는 동안에 발생하는 음의 차이를 주파수로 분석해 설비의 이상 상태를 파악하는 시스템”

Whale Sound Dataset

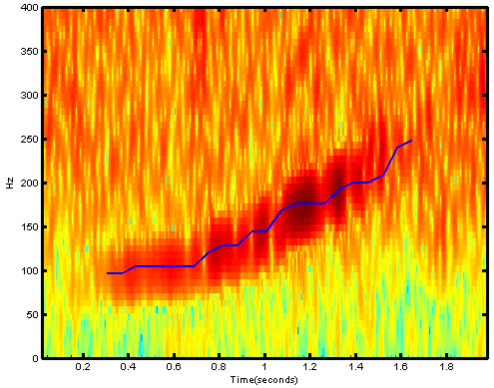


Handing the sound Image

Waveform

FFT

Specgram

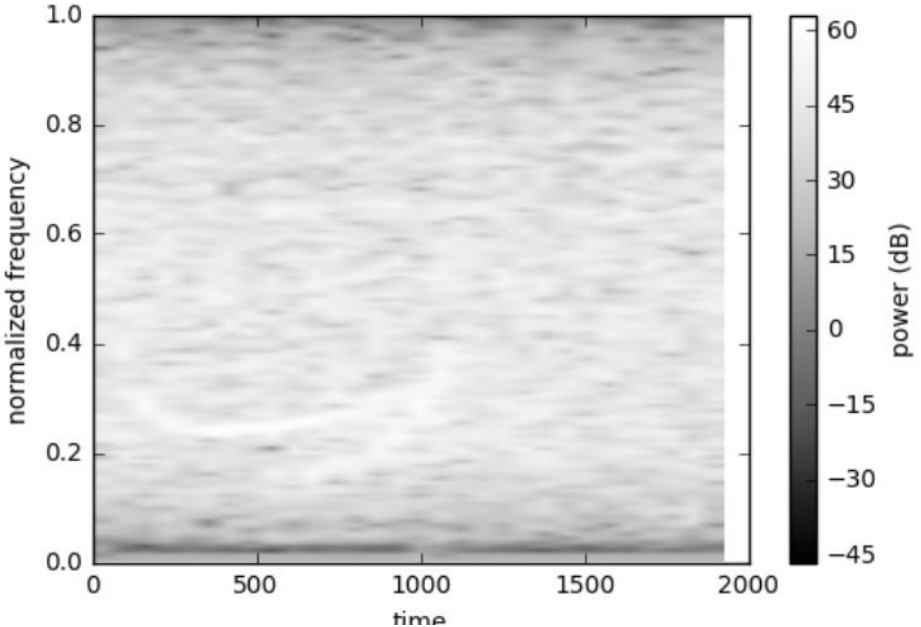


Python Script for FFT Specgram

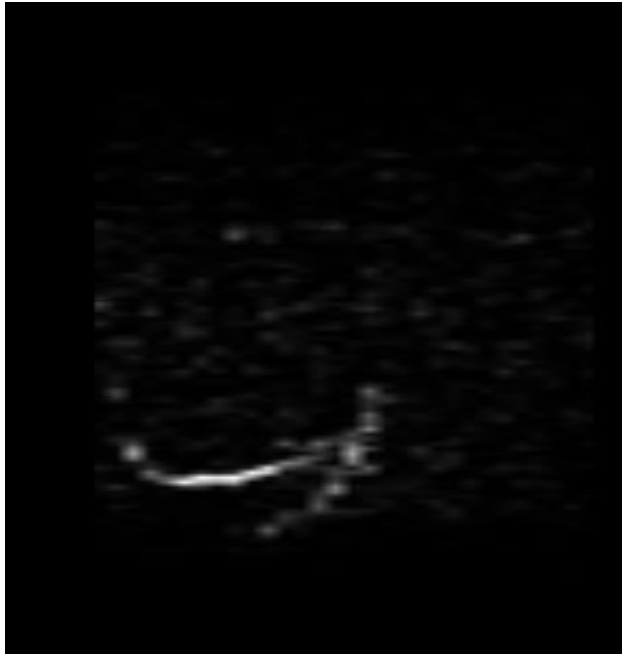
```
import aifc

ifn="data/train/train4.aiff"
sf=aifc.open(ifn)
str_frames=sf.readframes(sf.getnframes())
data = np.fromstring(str_frames, np.short).byteswap()
sf.close()


# Use specgram to plot the spectrogram of the data
fig,ax=plt.subplots()
pxx,freq,bins,im=ax.specgram(data,NFFT=256,noverlap=128,cmap='Greys_r')
cb=fig.colorbar(im)
cb.set_label('power (dB)')

plt.xlabel('time')
plt.ylabel('normalized frequency')

plt.show()
```

FFT for spectrogram

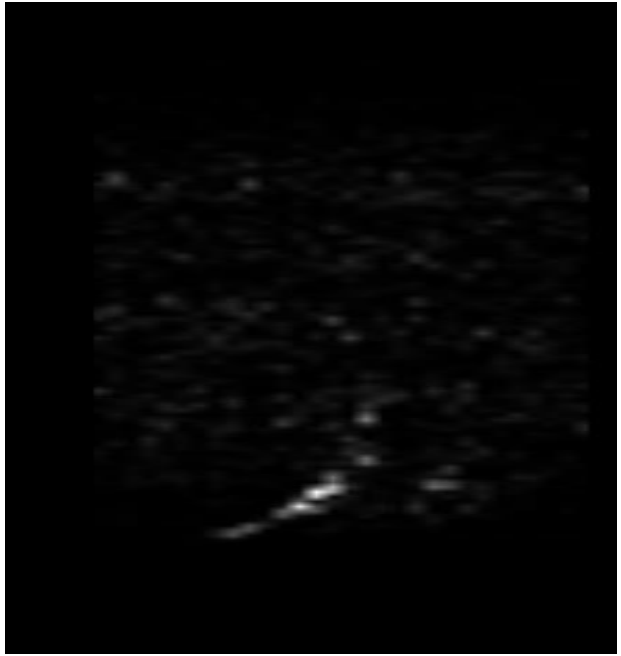
Filename: data/train/train4.aiff
Framerate: 2000
Num Channels: 1
Sample Width: 2
Number of Samples 4000



고래가 아닌 소리



고래 소리



Dataset prepare Method1. labeltext

train.csv in Kaggle

```
clip_name,label
train1.aiff,0
train2.aiff,0
train3.aiff,0
train4.aiff,0
train5.aiff,0
train6.aiff,1
train7.aiff,1
train8.aiff,0
train9.aiff,1
```

- Separate train/val dataset
- Generate label data
- Handle directory
- Handle File extension
- Replace Comma to Space

Label info for caffe

train.txt

```
clip_name,label
data/train/train1.png 0
data/train/train2.png 0
data/train/train3.png 0
data/train/train4.png 0
data/train/train5.png 0
data/train/train6.png 1
data/train/train7.png 1
data/train/train8.png 0
data/train/train9.png 1
```

labels.txt

```
Not_whale
whale
```

val.txt

```
clip_name label
data/train/train26863.png 1
data/train/train610.png 0
data/train/train15434.png 0
data/train/train4185.png 0
data/train/train18105.png 0
```

Bash script

```
%%bash
# Change file extension
sed -i -e 's/aiff/png/g' data/train.csv

# Create training image list
tail -n +2 data/train.csv | sed 's/,/ /g' | awk -v dir=data/train
'{printf("%s/%s %s\n",dir,$1,$2);}' | sed 's/.aiff /.png /g' | head -n 27000 > train.txt

# Create validation image list
tail -n +2 data/train.csv | sed 's/,/ /g' | awk -v dir=data/train
'{printf("%s/%s %s\n",dir,$1,$2);}' | sed 's/.aiff /.png /g' | tail -n -3000 > validate.txt

# Create labels file
rm -f labels.txt
echo "not-whale" >> labels.txt
echo "whale" >> labels.txt
```

Dataset prepare Method2. subfolder

DIGITS

train.csv

/Dataset
train1.png
train1.png
train2.png
train3.png
train4.png
train5.png
train6.png
train7.png
train8.png
train9.png

- Make subfolder for each class
- Move each image files

/Dataset
/not_whale
train1.png
train1.png
train2.png
train3.png
train4.png
train5.png
train8.png

/whale
train6.png
train7.png
train9.png

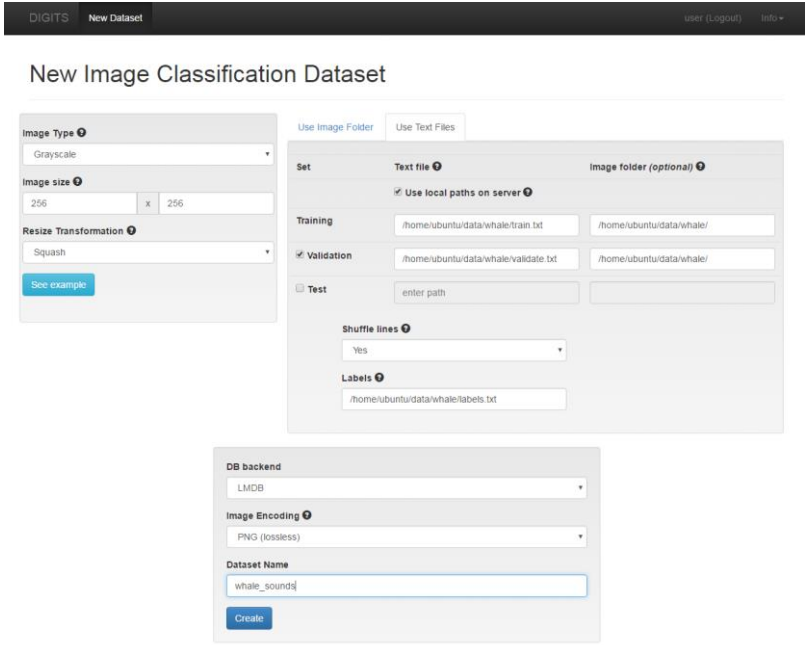
Python script for moving files

```
import os
import pandas as pd

# filelist
train = pd.read_csv(‘train-png.csv’, index_col='clip_name')
#foldername of class
whaleIDs = list(train['label'].unique())

#make subdirectory for class
  os.makedirs('./train-sub/'+w)

# copy image from original folder to sub folder
for image in train.index:
  folder = train.loc[image, 'label']
  old = './train-old/{}'.format(image)
  new = './train-sub/{}/{}'.format(folder, image)
  try:
    os.rename(old, new)
  except:
    print('{} - {}'.format(image,folder))
```

Prepare LMDB

DIGITS

/Dataset
- **/not_whale**
  - train1.png
  - train1.png
  - train2.png
  - train3.png
  - train4.png
  - train5.png
  - train8.png
- **/whale**
  - train6.png
  - train7.png
  - train9.png

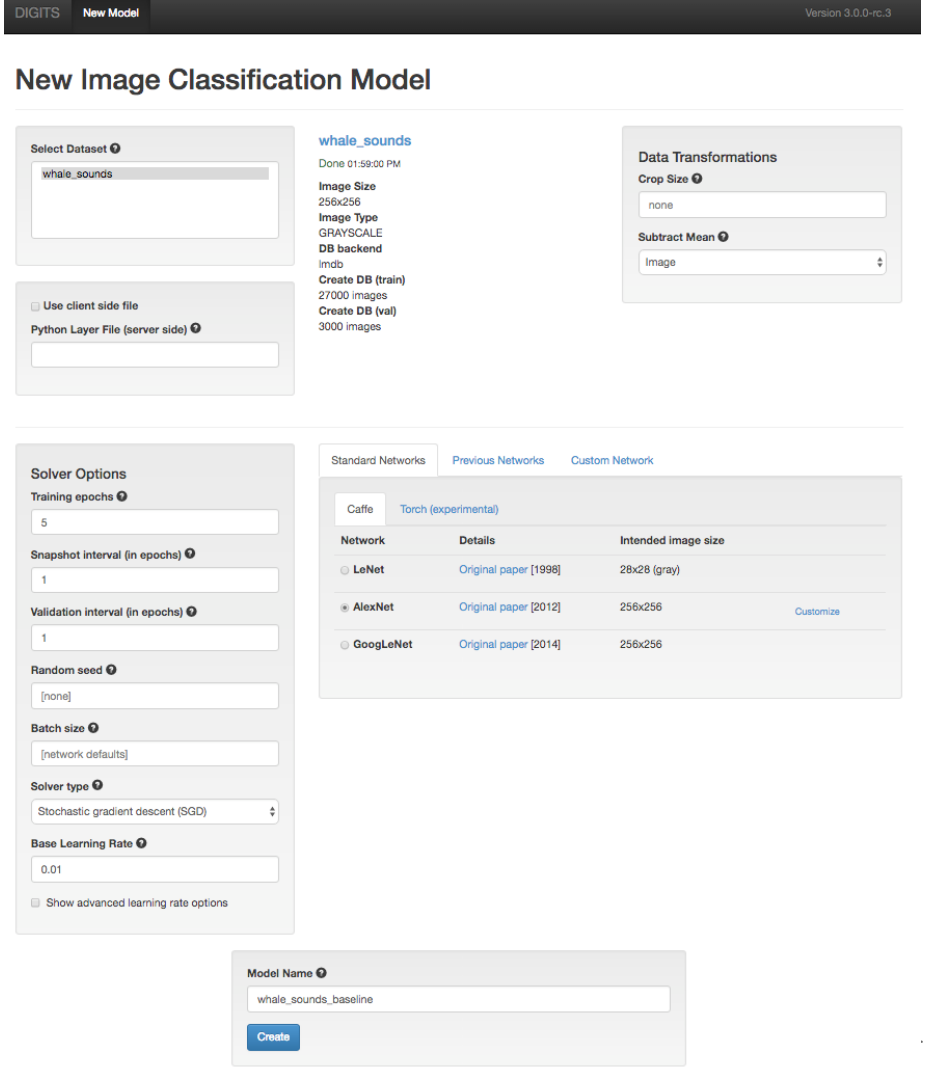


LMDB

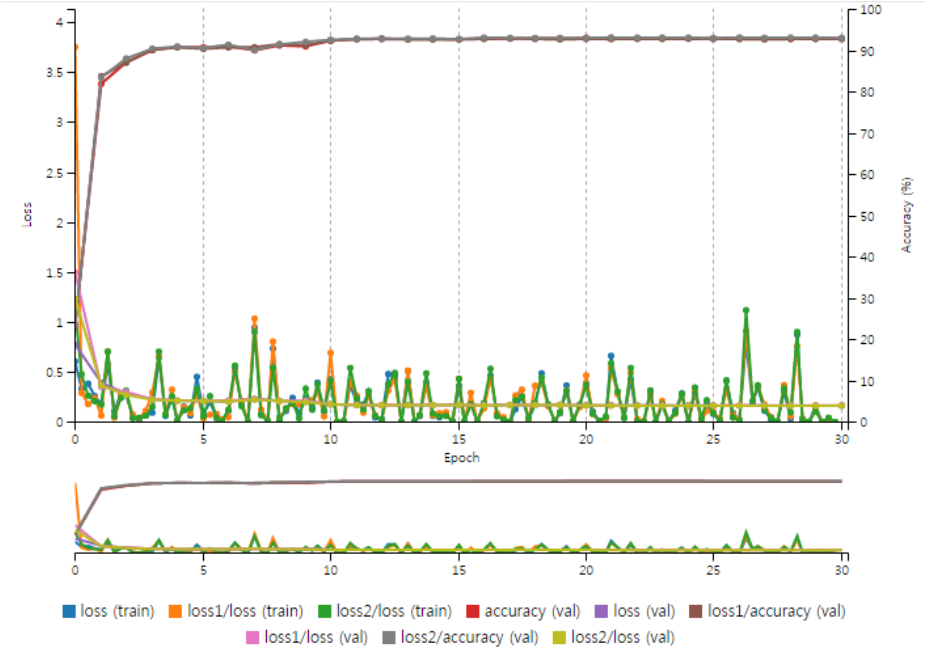
Training

Alexnet

Googlenet



result



30	
accuracy (val)	93.0037
loss (val)	0.165142
loss1/accuracy (val)	92.8172
loss1/loss (val)	0.16607
loss2/accuracy (val)	93.1103
loss2/loss (val)	0.164063

Deployment

Mobile Device

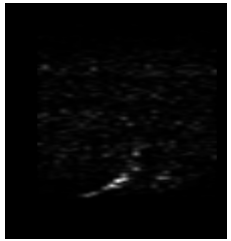
record

waveform

Server

waveform

FFT



specgram

classifier

result

고래입니다.

Classfier in python

```
import numpy as np
import matplotlib.pyplot as plt
import caffe

MODEL_JOB_NUM = '20170120-092148-8c17'
DATASET_JOB_NUM = '20170120-090913-a43d'

MODEL_FILE = '/home/ubuntu/digits/digits/jobs/' + MODEL_JOB_NUM + '/deploy.prototxt'
PRETRAINED = '/home/ubuntu/digits/digits/jobs/' + MODEL_JOB_NUM + '/snapshot_iter_32270.caffemodel'
MEAN_IMAGE = '/home/ubuntu/digits/digits/jobs/' + DATASET_JOB_NUM + '/mean.jpg‘

net = caffe.Classifier(MODEL_FILE, PRETRAINED,  channel_swap=(2,1,0), raw_scale=255, image_dims=(256, 256))

prediction = net.predict([inputimg])
```

aiff2FFT in python

```
def aiff2amplitudes(aiff_path):
     s = aifc.open(aiff_path, 'r')
     nframes = s.getnframes() #The total number of audio frames in the file
     strsig = s.readframes(nframes)
     return np.fromstring(strsig, np.short).byteswap()

def amplitudes2spectrogram(amplitudes):
     return_data = plt.specgram(amplitudes,NFFT=256,noverlap=128)
        pxx = return_data[0]
     return pxx

def convert(image_folder):
     for root, dirs, filenames in os.walk(image_folder):
          for f in filenames:
               if os.path.splitext(f)[-1] == '.aiff':
                    amplitudes = aiff2amplitudes(os.path.join(root,f))
                    spectrogram = amplitudes2spectrogram(amplitudes)
                              spectrogram=(spectrogram-np.min(spectrogram))/np.max(spectrogram)
                    out_name = os.path.splitext(f)[-2] + '.png'
                    io.imsave(os.path.join(root,out_name),spectrogram)
                    print out_name
```