Using FANN in Python

- Install FANN on your computer - see instructions at http://leenissen.dk/fann/wp/help/installing-fann/
- Install the fann2 Python module (pip install fann2).
- Test your installation by modelling the XOR function:

<table>
<thead>
<tr>
<th>Input1</th>
<th>Input2</th>
<th>Output</th>
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<tbody>
<tr>
<td>-1</td>
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In order to do so we will:
1. Create a file containing “training data”
2. Fit a neural network model.

Structure of the FANN data files:
1. First line = Number-of-observations Number-of-inputs Number-of-outputs (separated by a space)
2. Other lines: One line is an input, next line is the corresponding output (values separated by spaces)

Modelling the XOR function

Create a file named xor.data and containing:

```
4 2 1
-1 -1 -1
1 1 1
1 1 -1
1 1 1
```

Train a neural network with 1 hidden layer containing 4 hidden nodes:

```python
from fann2 import libfann
connection_rate = 1; learning_rate = 0.7
num_input = 2; num_hidden = 4
num_output = 1
desired_error = 0.0001
max_iterations = 1000
iterations_between_reports = 1000
ann = libfann.neural_net()
ann.create_sparse_array(connection_rate, # or ann.create_standard_array
(num_input, num_hidden, num_output))
ann.set_learning_rate(learning_rate)
ann.set_activation_function_output(libfann.SIGMOID_SYMMETRIC_STEPWISE)
ann.train_on_file("xor.data", max_iterations,
iterations_between_reports, desired_error)
ann.run([-1,-1])
```

The zip data

1. Load the zip data.
2. Convert the outputs to binary vectors in \{0, 1\}^{10}.
   ```python
y_train2 = sp.zeros((len(y_train), 10))
for i in range(len(y_train)):
y_train2[i, np.int(y_train[i])] = 1.0
```
3. Load the zip data and write them to a file using
   ```python
def format(value):
    return "%.6f" % value
def write_fann_data(filename, X, y):
    n = X.shape[0]
p_input = X.shape[1]
p_output = y.shape[1]
with open(filename, 'w') as f:
    f.write("%d %d %d
" % (n,p_input,p_output))
    for i in range(n-1):
        f.write(" ".join(format(x) for x in X[i,:]) + 
" 
"
    f.write(" ".join(format(x) for x in y[i,:]) + 
"
    f.write(" ".join(format(x) for x in y[n-1,:]))
```
4. Fit neural networks with 1 hidden layer and different number of hidden nodes to the data.
from pybrain.datasets import SupervisedDataSet
from pybrain.tools.shortcuts import buildNetwork
from pybrain.supervised.trainers import BackpropTrainer

dataModel = [
    (0,0), (0,1), (1,0), (1,1),
]

ds = SupervisedDataSet(2, 1)
for input, target in dataModel:
    ds.addSample(input, target)

import random
random.seed()
trainingSet = SupervisedDataSet(2, 1);
for ri in range(0,1000):
    input,target = dataModel[random.getrandbits(2)];
    trainingSet.addSample(input, target)

net = buildNetwork(2, 2, 1, bias=True)
trainer = BackpropTrainer(net, ds, learningrate = 0.001,
momentum = 0.99)
trainer.trainUntilConvergence( verbose=True, dataset=trainingSet, validationProportion=0.25, maxEpochs=10)

print '0,0->', net.activate([0,0])  # Try other inputs as well...