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January 23, 2024

[1]:
```
%pylab inline
import torch
# Making sure we can find the data loader
import sys
sys.path.append('..')
sys.path.append('../..')
from data import load
device = torch.device('cuda') if torch.cuda.is_available() else torch.
 ↪device('cpu')
print('device = ', device)
```

```
%pylab is deprecated, use %matplotlib inline and import the required libraries.
Populating the interactive namespace from numpy and matplotlib
device =  cuda
```

[2]:
```
# Let's load the dataset
train_data, train_label = load.get_dogs_and_cats_data(resize=(32,32))
valid_data, valid_label = load.get_dogs_and_cats_data(split='valid',␣
 ↪resize=(32,32))
input_size = 32*32*3
to_image = load.to_image_transform()

train_data, train_label = train_data.to(device), train_label.to(device)
valid_data, valid_label = valid_data.to(device), valid_label.to(device)
```

[3]:
```
class Network2(torch.nn.Module):
    def __init__(self, *hidden_size):
        super().__init__()
        layers = []
        # Add the hidden layers
        n_in = input_size
        for n_out in hidden_size:
            layers.append(torch.nn.Linear(n_in, n_out))
            layers.append(torch.nn.ReLU())
            n_in = n_out

        # Add the classifier
```

```
        layers.append(torch.nn.Linear(n_out, 1))
        self.network = torch.nn.Sequential(*layers)

    def forward(self, x):
        return self.network(x.view(x.size(0), -1)).view(-1)
```

[4]:
```
%load_ext tensorboard
import tempfile
log_dir = tempfile.mkdtemp()
%tensorboard --logdir {log_dir} --reload_interval 1 --bind_all
```

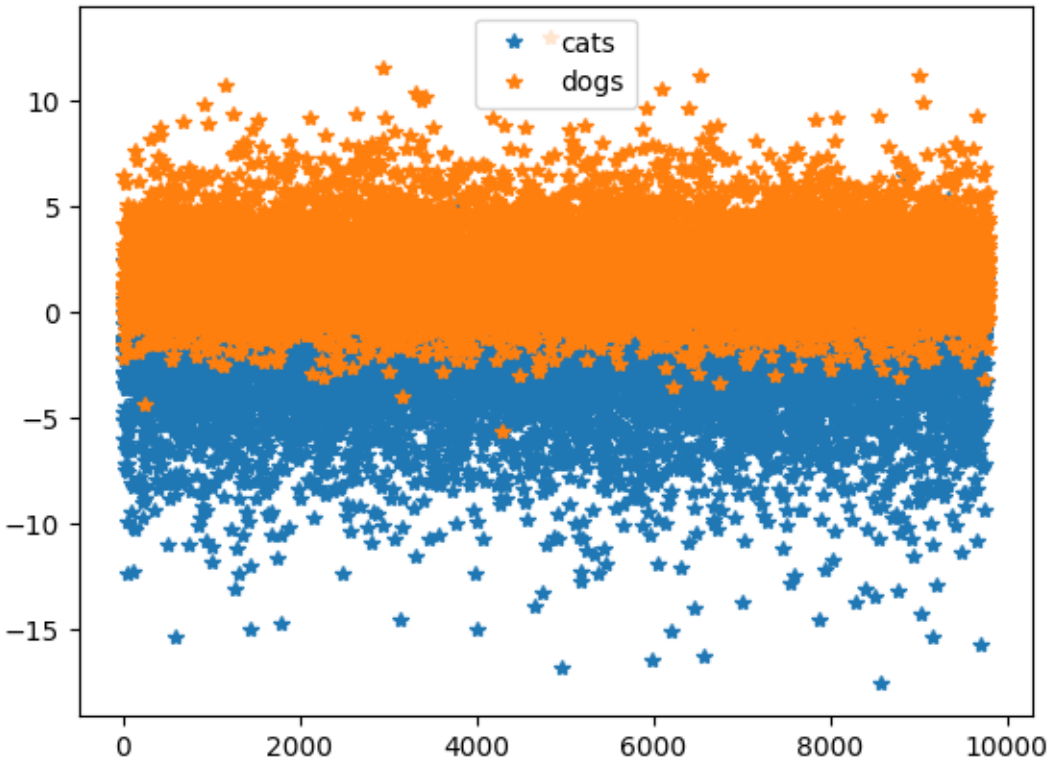
```
<IPython.core.display.HTML object>
```

[5]:
```
import torch.utils.tensorboard as tb
n_epochs = 100
batch_size = 128

train_logger = tb.SummaryWriter(log_dir+'/deepnet1/train', flush_secs=1)
valid_logger = tb.SummaryWriter(log_dir+'/deepnet1/valid', flush_secs=1)

# Create the network
net2 = Network2(100,50,50).to(device)

# Create the optimizer
optimizer = torch.optim.SGD(net2.parameters(), lr=0.01, momentum=0.9,␣
 ↪weight_decay=1e-4)

# Create the loss
loss = torch.nn.BCEWithLogitsLoss()

# Start training
global_step = 0
for epoch in range(n_epochs):
    # Shuffle the data
    permutation = torch.randperm(train_data.size(0))

    # Iterate
    train_accuracy = []
    for it in range(0, len(permutation)-batch_size+1, batch_size):
        batch_samples = permutation[it:it+batch_size]
        batch_data, batch_label = train_data[batch_samples],␣
 ↪train_label[batch_samples]

        # Compute the loss
        o = net2(batch_data)
        loss_val = loss(o, batch_label.float())
```

```
        train_logger.add_scalar('train/loss', loss_val, global_step=global_step)
        # Compute the accuracy
        train_accuracy.extend(((o > 0).long() == batch_label).cpu().detach().
↪numpy())

        optimizer.zero_grad()
        loss_val.backward()
        optimizer.step()

        # Increase the global step
        global_step += 1

    # Evaluate the model
    valid_pred = net2(valid_data) > 0
    valid_accuracy = float((valid_pred.long() == valid_label).float().mean())

    train_logger.add_scalar('train/accuracy', np.mean(train_accuracy),␣
↪global_step=global_step)
    valid_logger.add_scalar('valid/accuracy', valid_accuracy,␣
↪global_step=global_step)
```

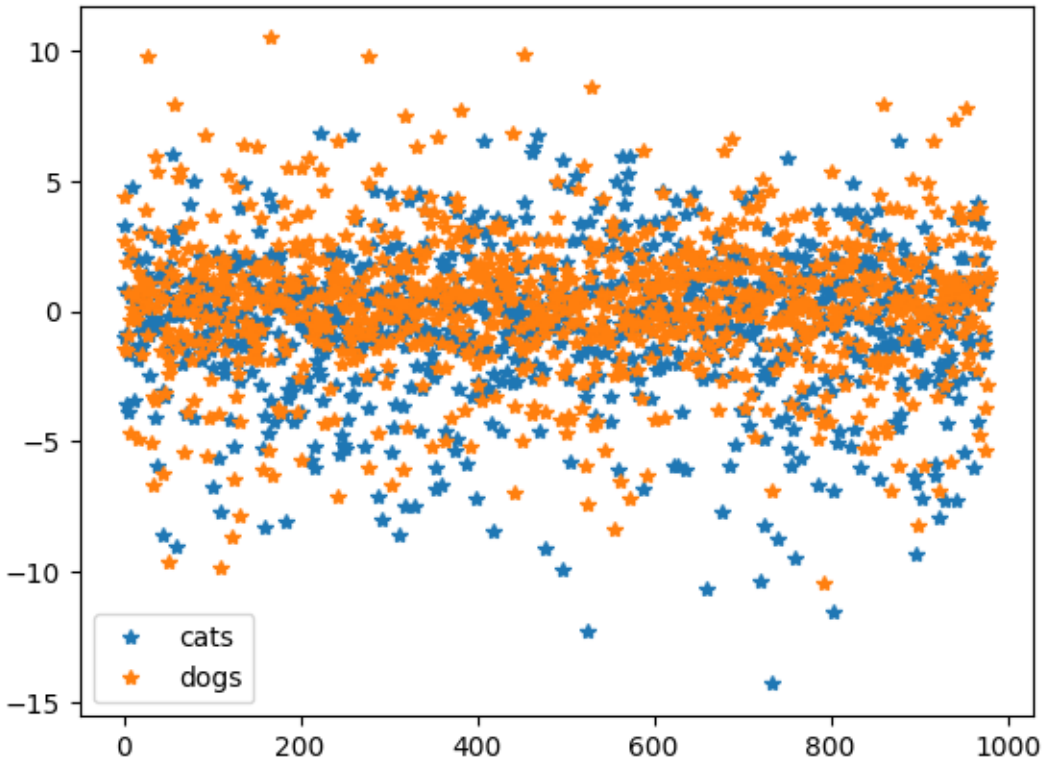
[6]:
```
plot( net2(train_data[train_label==0]).view(-1).cpu().detach().numpy(), '*',␣
↪label='cats')
plot( net2(train_data[train_label==1]).view(-1).cpu().detach().numpy(), '*',␣
↪label='dogs')
legend()
```

[6]:
```
<matplotlib.legend.Legend at 0x7f3ba1400310>
```



[7]:
```
plot( net2(valid_data[valid_label==0]).view(-1).cpu().detach().numpy(), '*',␣
  ↪label='cats')
plot( net2(valid_data[valid_label==1]).view(-1).cpu().detach().numpy(), '*',␣
  ↪label='dogs')
legend()
```

[7]:
```
<matplotlib.legend.Legend at 0x7f3ba147a3e0>
```


10
5
0
−5
−10
−15
0
200
400
600
800
1000
cats
dogs

[ ]: