ML/DL for Everyone with PYTERCH

Lecture 8: DataLoader



Call for Comments

Please feel free to add comments directly on these slides.

Other slides: http://bit.ly/PyTorchZeroAll



ML/DL for Everyone with PYTERCH

Lecture 8: DataLoader



Manual data feed

```
xy = np.loadtxt('data-diabetes.csv', delimiter=',', dtype=np.float32)
x data = Variable(torch.from numpy(xy[:, 0:-1]))
y data = Variable(torch.from numpy(xy[:, [-1]]))
. . .
# Training Loop
for epoch in range(100):
        # Forward pass: Compute predicted y by passing x to the model
    y pred = model(x data)
    # Compute and print loss
    loss = criterion(y pred, y data)
    print(epoch, loss.data[0])
    # Zero gradients, perform a backward pass, and update the weights.
    optimizer.zero grad()
    loss.backward()
    optimizer.step()
```



Batch (batch size)

```
# Training cycle
for epoch in range(training_epochs):
    # Loop over all batches
    for i in range(total_batch):
        batch_xs, batch_ys = ...
```

Batch (batch size)

```
# Training cycle
for epoch in range(training_epochs):
    # Loop over all batches
    for i in range(total_batch):
```



In the neural network terminology:

288

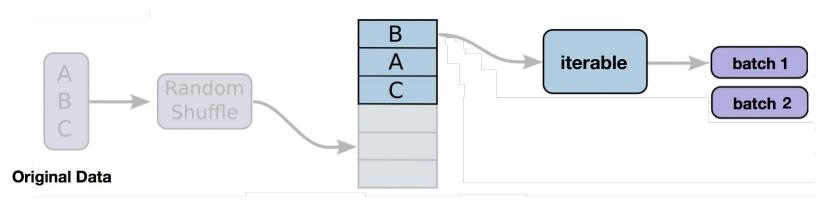
• one **epoch** = one forward pass and one backward pass of *all* the training examples



- batch size = the number of training examples in one forward/backward pass. The higher the batch size, the more memory space you'll need.
- number of iterations = number of passes, each pass using [batch size] number of examples.
 To be clear, one pass = one forward pass + one backward pass (we do not count the forward pass and backward pass as two different passes).

Example: if you have 1000 training examples, and your batch size is 500, then it will take 2 iterations to complete 1 epoch.

DataLoader



Queue

```
for i, data in enumerate(train_loader, 0):
    # get the inputs
    inputs, labels = data

# wrap them in Variable
    inputs, labels = Variable(inputs), Variable(labels)

# Run your training process
    print(epoch, i, "inputs", inputs.data, "labels", labels.data)
```

Custom DataLoader

```
class DiabetesDataset(Dataset):
    """ Diabetes dataset."""
   # Initialize your data, download, etc.
   def __init__(self):
                                             download, read data, etc.
                                         return one item on the index
   def __getitem__(self, index):
       return
                               return the data length
   def __len__(self):
       return
dataset = DiabetesDataset()
train loader = DataLoader(dataset=dataset,
                         batch size=32,
                         shuffle=True,
                         num_workers=2)
```

Custom DataLoader

```
class DiabetesDataset(Dataset):
    """ Diabetes dataset."""
   # Initialize your data, download, etc.
    def init (self):
       xy = np.loadtxt('data-diabetes.csv', delimiter=',', dtype=np.float32)
        self.len = xy.shape[0]
        self.x data = torch.from numpy(xy[:, 0:-1])
        self.y data = torch.from numpy(xy[:, [-1]])
    def getitem (self, index):
        return self.x_data[index], self.y_data[index]
    def __len__(self):
        return self.len
dataset = DiabetesDataset()
train loader = DataLoader(dataset=dataset,
                          batch size=32,
                          shuffle=True,
                          num workers=2)
```

Using DataLoader

```
dataset = DiabetesDataset()
train loader = DataLoader(dataset=dataset, batch size=32, shuffle=True, num workers=2)
# Training Loop
for epoch in range(2):
    for i, data in enumerate(train_loader, 0):
        # get the inputs
        inputs, labels = data
        # wrap them in Variable
        inputs, labels = Variable(inputs), Variable(labels)
        # Forward pass: Compute predicted y by passing x to the model
        y pred = model(inputs)
        # Compute and print loss
        loss = criterion(y pred, labels)
        print(epoch, i, loss.data[0])
        # Zero gradients, perform a backward pass, and update the weights.
        optimizer.zero grad()
        loss.backward()
        optimizer.step()
```



Classifying Diabetes

```
# References
# https://qithub.com/yunjey/pytorch-tutorial/blob/master/tutorials/01-basics/pytorch basics/main.py
# http://pytorch.org/tutorials/beginner/data Loading tutorial.html#dataset-class
import torch
import numpy as np
from torch.autograd import Variable
from torch.utils.data import Dataset, DataLoader
class DiabetesDataset(Dataset):
    """ Diabetes dataset."""
   # Initialize your data, download, etc.
   def init (self):
       xy = np.loadtxt('data-diabetes.csv', delimiter=',', dtype=np.float32)
       self.len = xy.shape[0]
       self.x_data = torch.from_numpy(xy[:, 0:-1])
       self.y_data = torch.from_numpy(xy[:, [-1]])
   def getitem (self, index):
       return self.x data[index], self.y data[index]
   def len (self):
       return self.len
dataset = DiabetesDataset()
train loader = DataLoader(dataset=dataset,
                         batch size=32.
                         shuffle=True,
                         num workers=2)
```

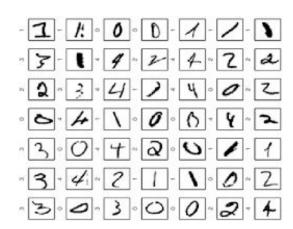
```
class Model(torch.nn.Module):
   def __init__(self):
        In the constructor we instantiate two nn.Linear module
        super(Model, self). init ()
        self.l1 = torch.nn.Linear(8, 6)
       self.12 = torch.nn.Linear(6, 4)
       self.13 = torch.nn.Linear(4, 1)
        self.sigmoid = torch.nn.Sigmoid()
   def forward(self, x):
        In the forward function we accept a Variable of input data and we must return
       a Variable of output data. We can use Modules defined in the constructor as
        well as arbitrary operators on Variables.
        out1 = self.sigmoid(self.l1(x))
        out2 = self.sigmoid(self.l2(out1))
       y_pred = self.sigmoid(self.13(out2))
        return y_pred
# our model.
model = Model()
# Construct our loss function and an Optimizer. The call to model.parameters()
# in the SGD constructor will contain the learnable parameters of the two
# nn.Linear modules which are members of the model.
criterion = torch.nn.BCELoss(size average=True)
optimizer = torch.optim.SGD(model.parameters(), lr=0.1)
# Training Loop
for epoch in range(2):
   for i, data in enumerate(train_loader, 0):
        # get the inputs
       inputs, labels = data
        # wrap them in Variable
       inputs, labels = Variable(inputs), Variable(labels)
        # Forward pass: Compute predicted y by passing x to the model
       y pred = model(inputs)
        # Compute and print loss
       loss = criterion(y pred, labels)
        print(epoch, i, loss.data[0])
        # Zero gradients, perform a backward pass, and update the weights.
        optimizer.zero grad()
        loss.backward()
        optimizer.step()
```

The following dataset loaders are available

- MNIST and FashionMNIST
- COCO (Captioning and Detection)
- LSUN Classification
- ImageFolder
- Imagenet-12
- CIFAR I 0 and CIFAR I 00
- STLI0
- SVHN
- PhotoTour

MNIST dataset loading

```
# MNIST Dataset
train dataset = datasets.MNIST(root='./data/',
                               train=True.
                               transform=transforms.ToTensor(),
                               download=True)
test dataset = datasets.MNIST(root='./data/',
                              train=False,
                              transform=transforms.ToTensor())
# Data Loader (Input Pipeline)
train loader = torch.utils.data.DataLoader(dataset=train dataset,
                                            batch size=batch size,
                                            shuffle=True)
test loader = torch.utils.data.DataLoader(dataset=test dataset,
                                          batch size=batch size,
                                           shuffle=False)
|for batch idx, (data, target) in enumerate(train loader):
    data, target = Variable(data), Variable(target)
```



More dataset loaders are available

- MNIST and FashionMNIST
- COCO (Captioning and Detection)
- LSUN Classification
- ImageFolder
- Imagenet-12
- CIFAR I 0 and CIFAR I 00
- STLI0
- SVHN
- PhotoTour

Exercise 8-1:

Check out existing data sets (torch.vision)

- Build DataLoader for
 - O Titanic dataset: https://www.kaggle.com/c/titanic/download/train.csv
- Build a classifier using the DataLoader



Lecture 9: Softmax Classifier