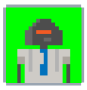
Visualizing Linear Regression with PyTorch

April 9th 2020



@aakashns
Aakash N S

Linear regression is a common machine learning technique that predicts a real-valued output using a weighted linear combina
values.
For instance, the sale price of a house can often be estimated using a linear combination of features such as area, number of
floors, date of construction etc. Mathematically, it can be expressed using the following equation:

```
house_price = w1 * area + w2 * n_bedrooms + w3 * n_floors + ... + w_n * age_in_years + b
```

The "learning" part of linear regression is to figure out a set of weights `w1, w2, w3, ... w_n, b` that leads to good predictions.
lots of examples one by one (or in batches) and adjusting the weights slightly each time to make better predictions, using an c
called Gradient Descent.
Let's create some sample data with one feature `x` (e.g. floor area) and one dependent variable `y` (e.g. house price). We'll assu
function of `x`, with some noise added to account for features we haven't considered here. Here's how we generate the data p

```
m, c = 2, 3
noise = np.random.randn(250) / 4
x = np.random.rand(250)
y = x * m + c + noise
```

And here's what it looks like visually:

Now we can define and instantiate a linear regression model in PyTorch:

```
class LinearRegressionModel(nn.Module):
    def __init__(self, input_dim, output_dim):
        super(LinearRegressionModel, self).__init__()
        self.linear = nn.Linear(input_dim, output_dim)

    def forward(self, x):
        out = self.linear(x)
        return outmodel = LinearRegressionModel(1, 1)
criterion = nn.MSELoss()
optimizer = torch.optim.SGD(model.parameters(), lr=0.01)
```

For the full code, including imports etc. see this link. Here's how the model weights look like right now:

As you can see, it's quite far from the desired result. Now we can define a utility function to run a training epoch:

```
def run_epoch(epoch):
    # Convert from numpy array to torch tensors
    inputs = Variable(torch.from_numpy(x.reshape(-1, 1).astype('float32')))
    labels = Variable(torch.from_numpy(y.reshape(-1, 1).astype('float32')))

    # Clear the gradients w.r.t. parameters
    optimizer.zero_grad()

    # Forward to get the outputs
    outputs = model(inputs)

    # Calcuate loss
    loss = criterion(outputs, labels)

    # Getting gradients from parameters
    loss.backward()

    # Updating parameters
    optimizer.step()

    return loss
```

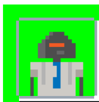
Next, we can train the model and update the state of a animated graph at the end of each epoch:

```
%matplotlib notebook
fig, (ax1) = plt.subplots(1, figsize=(12, 6))
ax1.scatter(x, y, s=8)w1, b1 = get_param_values()
x1 = np.array([0., 1.])
y1 = x1 * w1 + b1
fit, = ax1.plot(x1, y1, 'r', label='Predicted'.format(w1, b1))
ax1.plot(x1, x1 * m + c, 'g', label='Best Fit')
ax1.legend()
ax1.set_xlabel('x')
ax1.set_ylabel('y')
ax1.set_title('Linear Regression')def init():
    ax1.set_ylim(0, 6)
    return fit,def animate(i):
    loss = run_epoch(i)
    [w, b] = model.parameters()
    w1, b1 = w.data[0][0], b.data[0]
    y1 = x1 * w1 + b1
    fit.set_ydata(y1)epochs = np.arange(1, 250)
ani = FuncAnimation(fig, animate, epochs, init_func=init, interval=100, blit=True, repeat=False)
plt.show()
```

This will result in following animated graph:

That's it! It takes about 200 epochs for the model to come quite close to the best fit line. The complete code for this post can l
notebook: https://gist.github.com/aakashns/82db9df1e6c20eb13523903507dbd537

Share



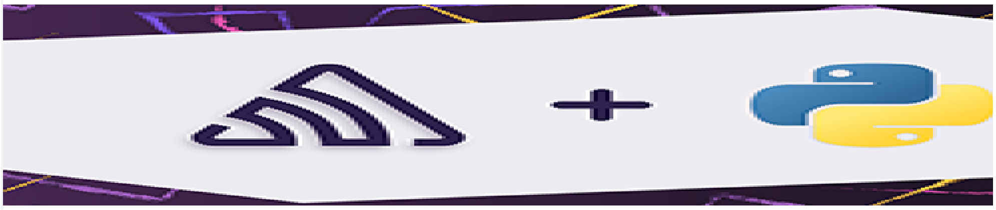
@aakashns

Aakash N S

Read my stories

Related

Discover, triage, and prioritize Python errors in real-time



Training an Image Classifier From Scratch in 15 Minutes

@aakashns

Aakash N S

Machine Learning: What Does The Future Look Like?

@vincent-olago

Vincent Olago

Tags

#machine-learning #python #visualization #pytorch #linear-regression #jupyter #regression #cha