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(http://cocl.us/pytorch_link_top)

Multiple Linear Regression

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In this lab, you will review how to make a prediction in several different ways by using PyTorch.

Estimated Time Needed: **15 min**

Preparation

Import the libraries and set the random seed.

In [1]:

```
# Import the libraries and set the random seed

from torch import nn
import torch
torch.manual_seed(1)
```

Out[1]:

```
<torch._C.Generator at 0x7fc409057d10>
```

Prediction

Set weight and bias.

In [2]:

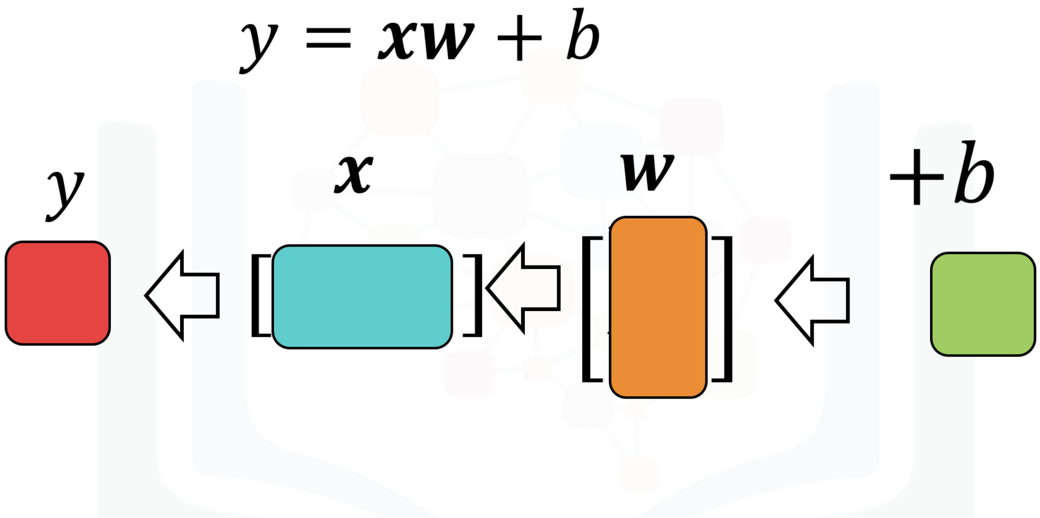
```
# Set the weight and bias

w = torch.tensor([[2.0], [3.0]], requires_grad=True)
b = torch.tensor([[1.0]], requires_grad=True)
```

Define the parameters. `torch.mm` uses matrix multiplication instead of scaler multiplication.

In [3]:

```
# Define Prediction Function

def forward(x):
    yhat = torch.mm(x, w) + b
    return yhat
```

The function `forward` implements the following equation:



If we input a *1x2* tensor, because we have a *2x1* tensor as `w` , we will get a *1x1* tensor:

In [4]:

```
# Calculate yhat

x = torch.tensor([[1.0, 2.0]])
yhat = forward(x)
print("The result: ", yhat)
```

```
The result:  tensor([[9.]], grad_fn=<AddBackward0>)
```

$$b = \boxed{-1}, w = \boxed{\begin{bmatrix} 2 \\ 3 \end{bmatrix}}$$

$$\hat{y} = \boldsymbol{xw} + b$$

$$x = \boxed{[3,2]}$$

$$\boxed{\hat{y}} = \boxed{[1,2]} \boxed{\begin{bmatrix} 2 \\ 3 \end{bmatrix}} + \boxed{1}$$

$$\hat{y}: 9$$

Each row of the following tensor represents a sample:

In [5]:

```
# Sample tensor X

X = torch.tensor([[1.0, 1.0], [1.0, 2.0], [1.0, 3.0]])
```

In [6]:

```
# Make the prediction of X

yhat = forward(X)
print("The result: ", yhat)
```

```
The result:  tensor([[ 6.],
        [ 9.],
        [12.]], grad_fn=<AddBackward0>)
```

Class Linear

We can use the linear class to make a prediction. You'll also use the linear class to build more complex models.

Let us create a model.

In [7]:

```
# Make a linear regression model using build-in function

model = nn.Linear(2, 1)
```

Make a prediction with the first sample:

In [8]:

```
# Make a prediction of x

yhat = model(x)
print("The result: ", yhat)
```

```
The result:  tensor([[-0.3969]], grad_fn=<AddmmBackward>)
```

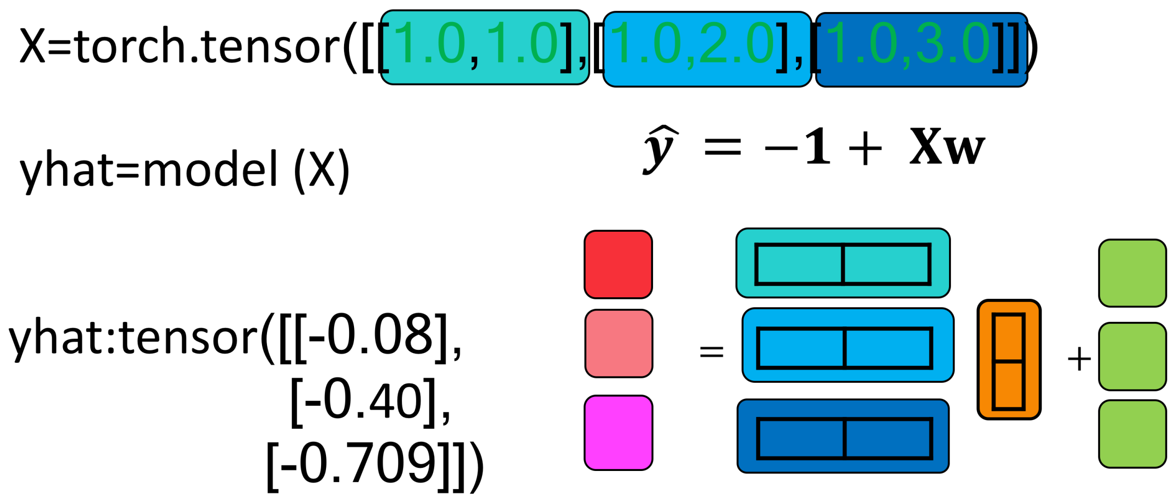
Predict with multiple samples `X` :

In [9]:

```
# Make a prediction of X

yhat = model(X)
print("The result: ", yhat)
```

```
The result:  tensor([[-0.0848],
        [-0.3969],
        [-0.7090]], grad_fn=<AddmmBackward>)
```

The function performs matrix multiplication as shown in this image:



Build Custom Modules

Now, you'll build a custom module. You can make more complex models by using this method later.

In [10]:

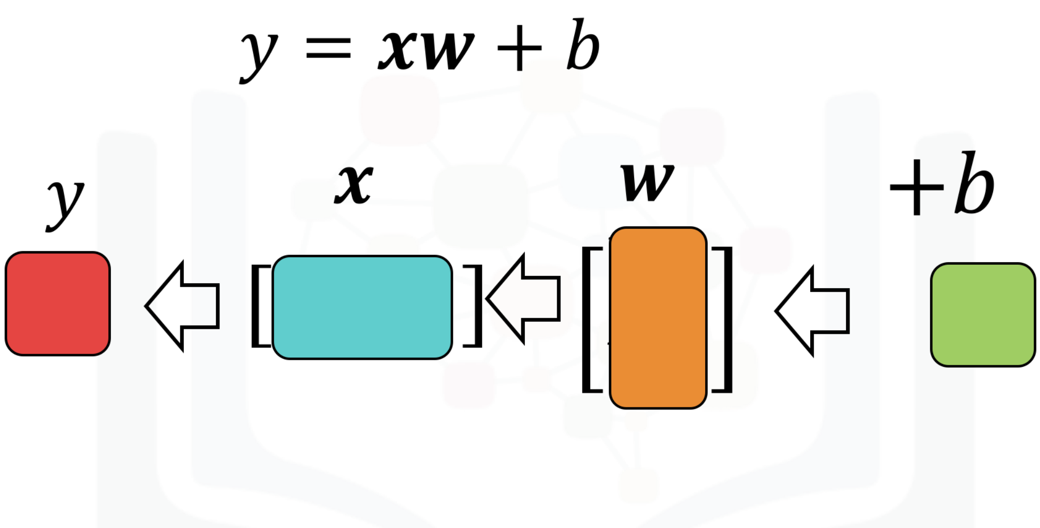
```
# Create linear_regression Class

class linear_regression(nn.Module):

    # Constructor
    def __init__(self, input_size, output_size):
        super(linear_regression, self).__init__()
        self.linear = nn.Linear(input_size, output_size)

    # Prediction function
    def forward(self, x):
        yhat = self.linear(x)
        return yhat
```

Build a linear regression object. The input feature size is two.

In [11]:

```
model = linear_regression(2, 1)
```

This will input the following equation:



You can see the randomly initialized parameters by using the `parameters()` method:

In [12]:

```
# Print model parameters

print("The parameters: ", list(model.parameters()))
```

```
The parameters:  [Parameter containing:
tensor([[ 0.3319, -0.6657]], requires_grad=True), Parameter containing:
tensor([0.4241], requires_grad=True)]
```

You can also see the parameters by using the `state_dict()` method:

In [13]:

```
# Print model parameters

print("The parameters: ", model.state_dict())
```

```
The parameters:  OrderedDict([('linear.weight', tensor([[ 0.3319, -0.66
57]])), ('linear.bias', tensor([0.4241]))])
```

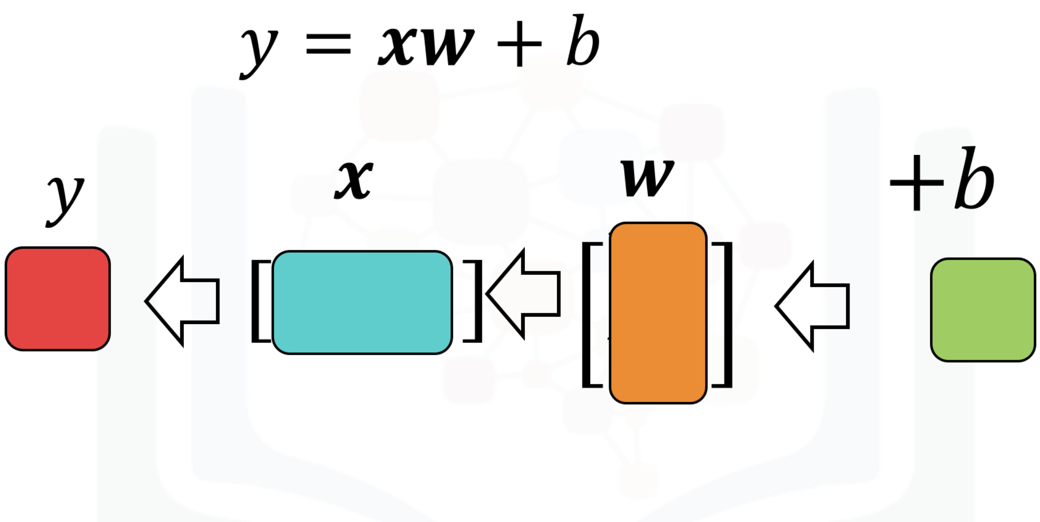
Now we input a 1x2 tensor, and we will get a 1x1 tensor.

In [14]:

```
# Make a prediction of x

yhat = model(x)
print("The result: ", yhat)
```

```
The result:  tensor([[-0.5754]], grad_fn=<AddmmBackward>)
```

The shape of the output is shown in the following image:



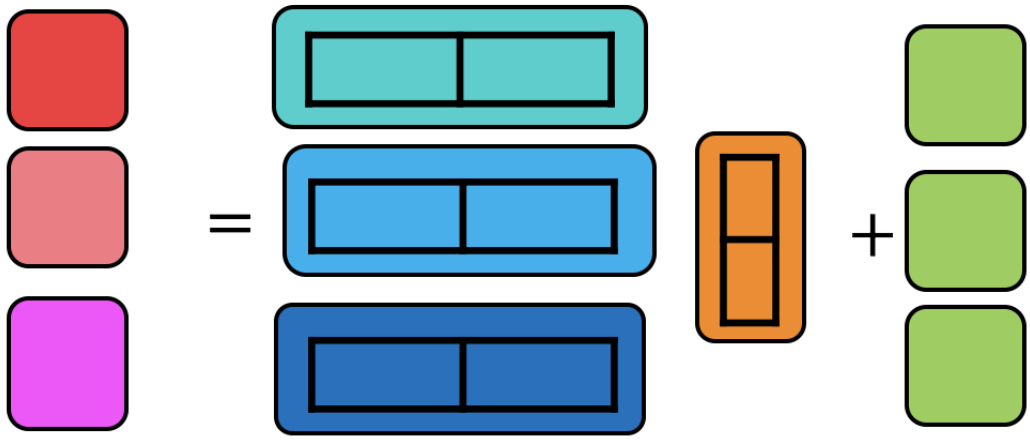
Make a prediction for multiple samples:

In [15]:

```
# Make a prediction of X

yhat = model(X)
print("The result: ", yhat)
```

```
The result:  tensor([[ 0.0903],
        [-0.5754],
        [-1.2411]], grad_fn=<AddmmBackward>)
```

The shape is shown in the following image:



Practice

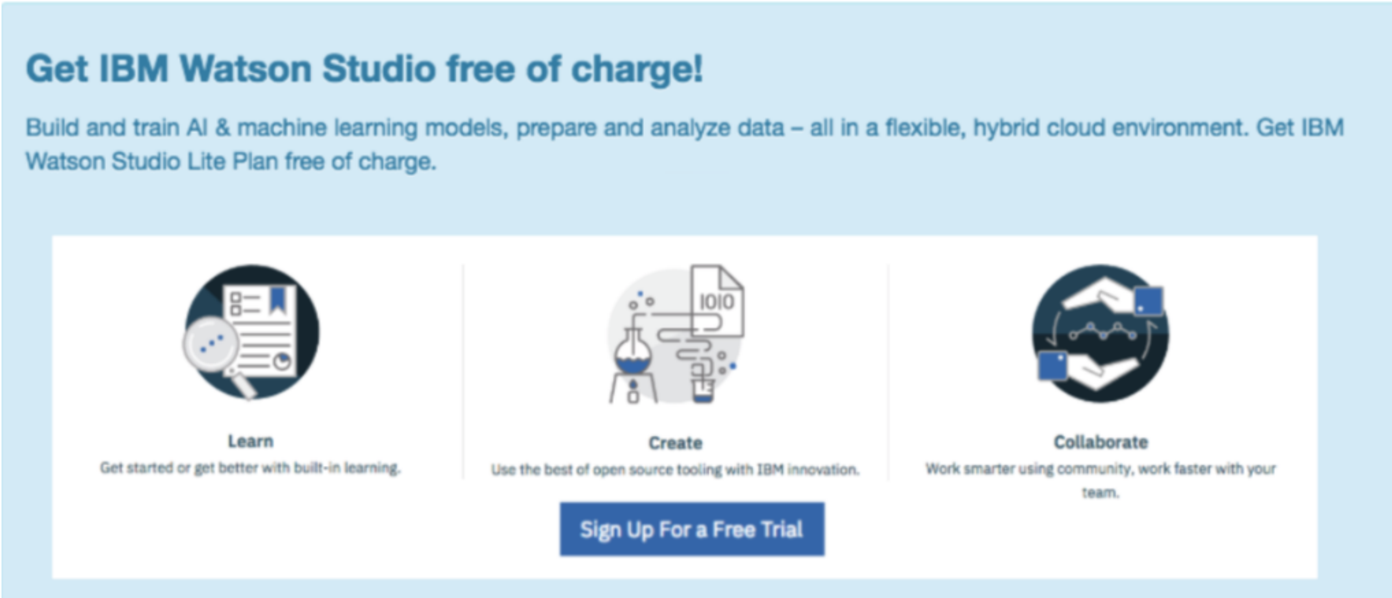
Build a model or object of type `linear_regression` . Using the `linear_regression` object will predict the following tensor:

In [17]:

```
# Practice: Build a model to predict the follow tensor.

X = torch.tensor([[11.0, 12.0, 13, 14], [11, 12, 13, 14]])
model = linear_regression(4, 1)
yhat = model(X)
print('The result: ', yhat)
```

```
The result:  tensor([[2.1062],
        [2.1062]], grad_fn=<AddmmBackward>)
```

Double-click **here** for the solution.



(http://cocl.us/pytorch_link_bottom)

About the Authors:

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