Keras

```
model = Sequential([
    Conv2D(filters=8, kernel_size=(3,3), strides=(1,1), padding='valid', activation='relu',
input_shape=(32,32,3)),
    Conv2D(filters=16, kernel_size=(3,3), strides=(1,1), padding='valid', activation='relu'),
    MaxPooling2D(pool_size=(2,2), strides=(2,2)),
    Flatten(),
    Dense(128, activation='relu'),
    Dense(10, activation='softmax')
])
```

Pytorch

```
class SimpleCNN(nn.Module):
    def __init__(self):
        super(SimpleCNN, self).__init__()

        # Two Conv Layers
        self.conv1 = nn.Conv2d(in_channels=3, out_channels=8, kernel_size=3, stride=1, padding=0)
        self.conv2 = nn.Conv2d(in_channels=8, out_channels=16, kernel_size=3, stride=1, padding=0)

        # Max Pooling Layer
        self.pool = nn.MaxPool2d(kernel_size=2, stride=2)

        # Fully Connected Layers
        self.fc1 = nn.Linear(14 * 14 * 16, 128)  # Output from Flatten layer to Dense
        self.fc2 = nn.Linear(128, 10)  # Output layer

    def forward(self, x):
        x = torch.relu(self.conv1(x))  # Conv1 -> ReLU
        x = torch.relu(self.conv2(x))  # Conv2 -> ReLU
        x = self.pool(x)  # MaxPooling
        x = torch.flatten(x, start_dim=1)  # Flatten
        x = torch.relu(self.fc1(x))  # Dense Layer 1
        x = self.fc2(x)  # Output Layer
        return x
```

```
# Formula for CNN Layers
Total Parameters = (kernel_height * kernel_width * input_channels + 1) * filters

# Formula for Dense Layers
Total Parameters = (input_size + 1) * output_size
#OR
Total Parameters = (Number of input neurons + 1) * Number of output neurons
```

Layer 1 Conv

$$\text{Params} = (3 \times 3 \times 3 + 1) \times 8$$
$$= (27 + 1) \times 8$$
$$= 28 \times 8 = 224$$

Output Shape

$30 \times 30 \times 8$

Layer 2 Conv

$$\text{Params} = (3 \times 3 \times 8 + 1) \times 16$$
$$= (72 + 1) \times 16$$
$$= 73 \times 16$$
$$= 1168$$

Output

$28 \times 28 \times 16$

MP Output

$14 \times 14 \times 16$

Output Flatten Layer

$= 3136$

Layer 3 Dense

$$\text{Params} = (3136 + 1) \times 128$$

$= 401536$

Layer 4 Dense

$$\text{Params} = (128 + 1) \times 10$$

$$= 1290$$

$$\text{Total Params} = \text{Conv1} + \text{Conv2} + \text{Dense1} + \text{Dense2}$$

$$= 224 + 1168 + 401536 + 1290$$

$$= 404,218$$