

Neural Networks for Classification

Epoch, Batch and Iteration

Epoch

An epoch is one complete pass of training data through the training model. If we set $\text{epoch} = 10$, it means we pass the whole training samples 10 times through the training model.

Batch

In deep learning, the data is large, therefore, we use batches to pass the whole training data through the model. Batch size is the number of training samples we pass at particular time for training the model.

Iteration

Iterations are the number of batches we need to complete one epoch. Suppose we have 1000 training samples in our dataset, and we choose a batch size of 100. It means the number of iterations will be 10.

$$\text{Iterations} = \frac{\text{Samples in Epoch}}{\text{Batch Size}}$$

Iris Dataset



sepal_length	sepal_width	petal_length	petal_width
5.1	3.5	1.4	0.2
4.9	3.0	1.4	0.2
4.7	3.2	1.3	0.2
4.6	3.1	1.5	0.2
5.0	3.6	1.4	0.2
5.4	3.9	1.7	0.4
4.6	3.4	1.4	0.3
5.0	3.4	1.5	0.2
4.4	2.9	1.4	0.2
4.9	3.1	1.5	0.1

sepal_length	sepal_width	petal_length	petal_width
5.1	3.5	1.4	0.2
4.9	3.0	1.4	0.2
4.7	3.2	1.3	0.2
4.6	3.1	1.5	0.2
5.0	3.6	1.4	0.2
5.4	3.9	1.7	0.4
4.6	3.4	1.4	0.3
5.0	3.4	1.5	0.2
4.4	2.9	1.4	0.2
4.9	3.1	1.5	0.1

Creating ANN Model

```
model = nn.Sequential(  
    nn.Linear(4,32),  
    nn.ReLU(),  
    nn.Linear(32,32),  
    nn.ReLU(),  
    nn.Linear(32,3),  
)
```

model

```
Sequential(  
  (0): Linear(in_features=4, out_features=32, bias=True)  
  (1): ReLU()  
  (2): Linear(in_features=32, out_features=32, bias=True)  
  (3): ReLU()  
  (4): Linear(in_features=32, out_features=3, bias=True)  
)
```

Dataset

- We will use MNIST dataset to train our Neural Network
- MNIST dataset consists of images of handwritten digits (0-9).
- Size of each image is 28×28 .

Few Samples of Dataset

4 0 9 1 1 2 4 3 2 7

3 8 6 9 0 5 6 0 7 6

5 0 4 1 9 2 1 3 1 4

3 5 3 6 1 7 2 8 6 9

Code Preparation

- Size of each image is 28×28 .
- Number of pixels = $28 \times 28 = 784$.
- Number of features are equal to the number of pixels.

Creating Neural Network

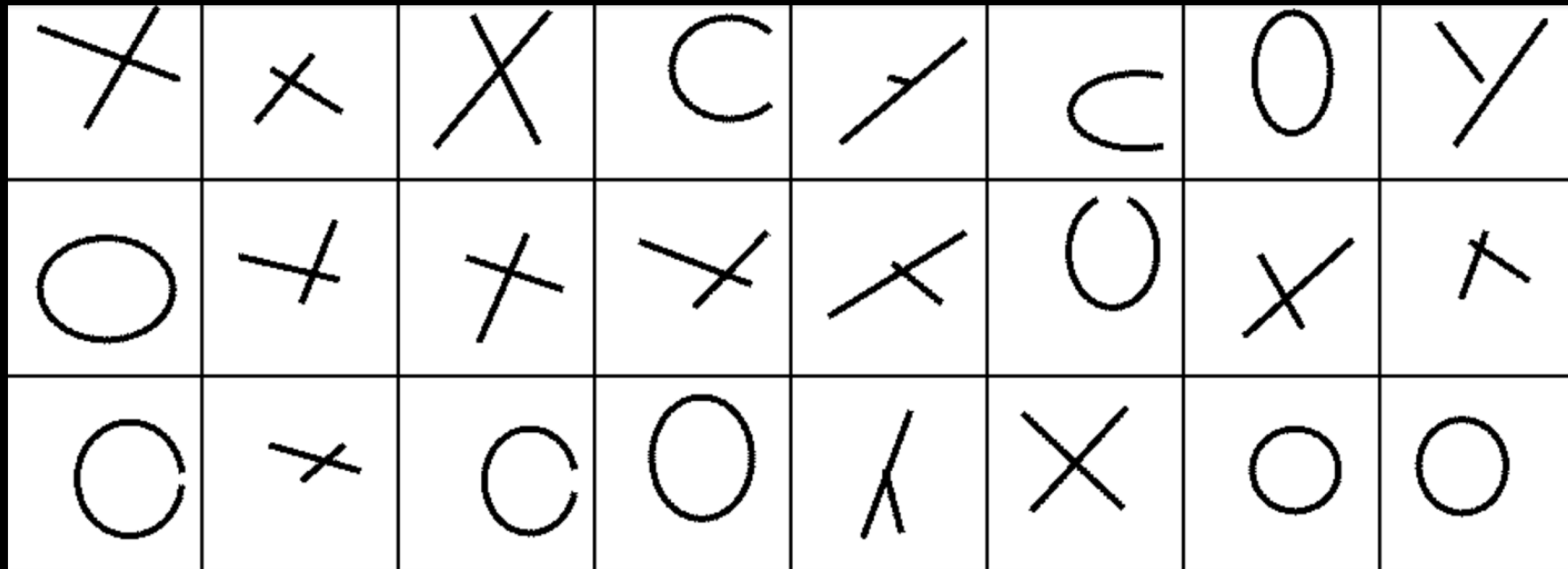
- Size of Input Layer = Number of features = 784.
- Size of Output Layer = Number of labels = 10
- Numbers and size of Hidden Layers ?

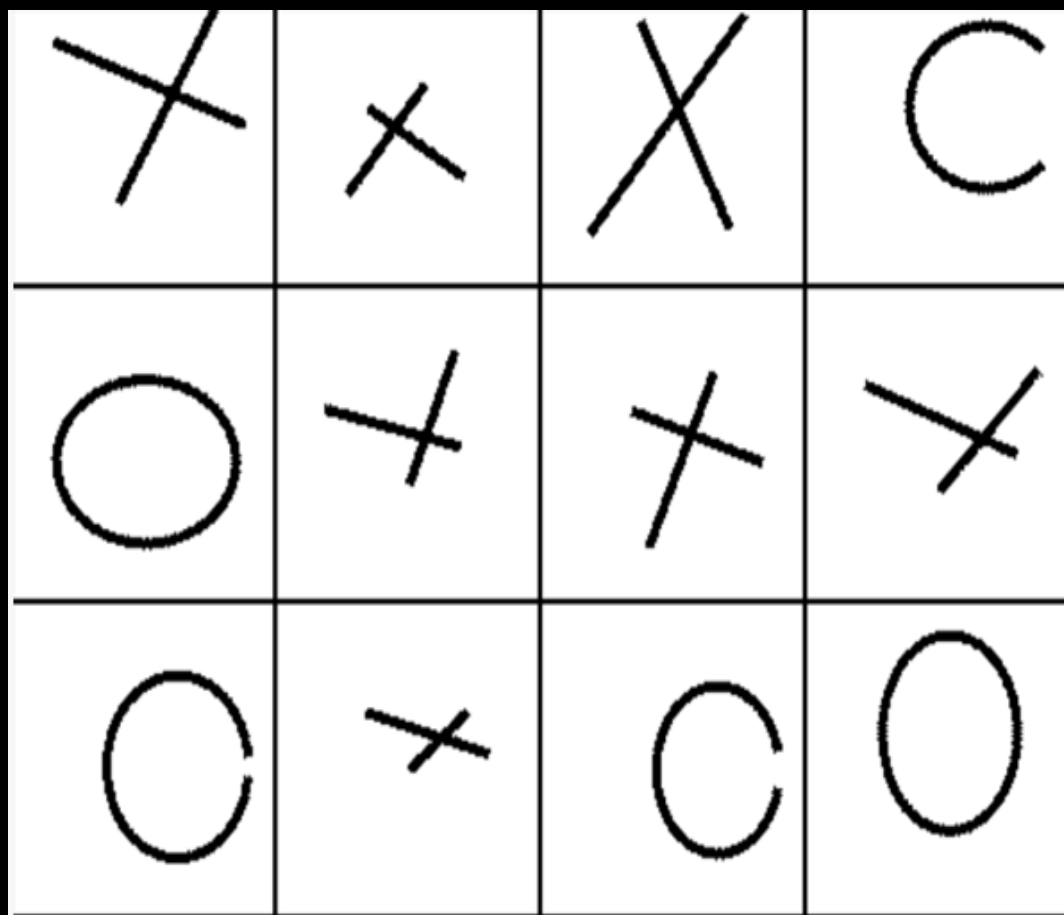
Creating Neural Network

- Size of Input Layer = Number of features = 784.
- Size of Output Layer = Number of labels = 10
- Numbers and size of Hidden Layers ?

```
model = nn.Sequential(  
    nn.Linear(784,64),  
    nn.ReLU(),  
    nn.Linear(64,32),  
    nn.ReLU(),  
    nn.Linear(32,32),  
    nn.ReLU(),  
    nn.Linear(32,10),  
)
```

Neural Network for Custom Images





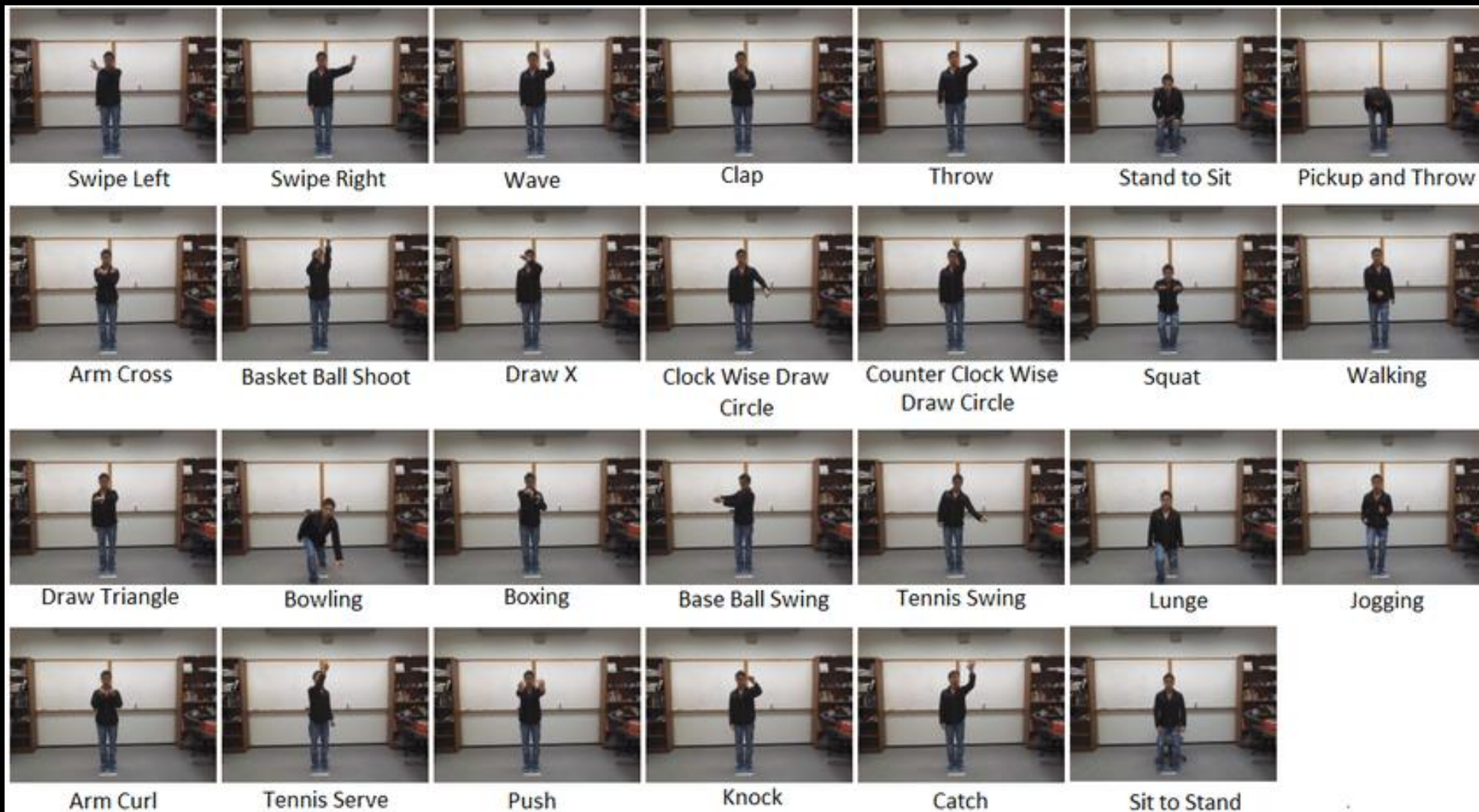
```

model = nn.Sequential(
    nn.Linear(40368,2048), # 3 x 116 x 116 = 40368
    nn.ReLU(),
    nn.Linear(2048,2048),
    nn.ReLU(),
    nn.Linear(2048,1024),
    nn.ReLU(),
    nn.Linear(1024,512),
    nn.ReLU(),
    nn.Linear(512,256),
    nn.ReLU(),
    nn.Linear(256,128),
    nn.ReLU(),
    nn.Linear(128,64),
    nn.ReLU(),
    nn.Linear(64,2),
)

```

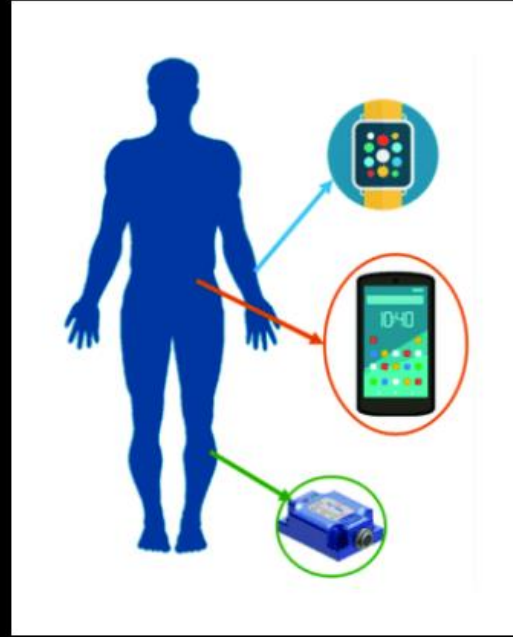
model

Human Action



Heterogeneous Human Action Dataset

'stand',
'sit',
'walk',
'stairsup',
'stairsdown',
'bike':



**Data Collection With
Sensors**

Reference : New Sensor Data Structuring for Deeper Feature Extraction in Human Activity Recognition

