Assignment No-03

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Title- Perceptron Neural Network to recognize even and odd numbers. Given numbers are in ASCII from 0 to 9.

Program

```
import numpy as np

class Perceptron:

    def__init_(self, input_size, lr=0.1):
        self.W = np.zeros(input_size + 1)
        self.lr = lr

    def activation_fn(self, x):
        return 1 if x >= 0 else 0

    def predict(self, x):

        x = np.insert(x, 0, 1)
        z = self.W.T.dot(x)

        a = self.activation_fn(z)
        return a

    def train(self, X, Y, epochs):
        for _ in range(epochs):

            for i in range(Y.shape[0]):
                x = X[i]

                y = self.predict(x)
                e = Y[i] - y

                self.W = self.W + self.lr * e * np.insert(x, 0, 1)

X = np.array([

    [0,0,0,0,0,0,1,0,0,0], # 0

    [0,0,0,0,0,0,0,1,0,0], # 1
```

```
    [0,0,0,0,0,0,0,0,1,0], # 2
    [0,0,0,0,0,0,0,0,0,1], # 3
    [0,0,0,0,0,0,1,1,0,0], # 4
    [0,0,0,0,0,0,1,0,1,0], # 5
    [0,0,0,0,0,0,1,1,1,0], # 6
    [0,0,0,0,0,0,1,1,1,1], # 7
    [0,0,0,0,0,0,1,0,1,1], # 8
    [0,0,0,0,0,0,0,1,1,1], # 9

])

Y = np.array([0, 1, 0, 1, 0, 1, 0, 1, 0, 1])

# Create the perceptron and train it
perceptron = Perceptron(input_size=10)
perceptron.train(X, Y, epochs=100)

# Test the perceptron on some input data
test_X = np.array([
    [0,0,0,0,0,0,1,0,0,0], # 0
    [0,0,0,0,0,0,0,1,0,0], # 1
    [0,0,0,0,0,0,0,0,1,0], # 2
    [0,0,0,0,0,0,0,0,0,1], # 3
    [0,0,0,0,0,0,1,1,0,0], # 4
    [0,0,0,0,0,0,1,0,1,0], # 5
    [0,0,0,0,0,0,1,1,1,0], # 6
    [0,0,0,0,0,0,1,1,1,1], # 7
```

```
    [0,0,0,0,0,0,1,0,1,1], # 8
    [0,0,0,0,0,0,0,1,1,1], # 9
])

for i in range(test_X.shape[0]):
  x = test_X[i]
  y = perceptron.predict(x)
  print(f'{x} is {"even" if y == 0 else "odd"}')
```

Output:

```
[0 0 0 0 0 0 1 0 0 0] is even
[0 0 0 0 0 0 0 1 0 0] is odd
[0 0 0 0 0 0 0 0 1 0] is even
[0 0 0 0 0 0 0 0 0 1] is odd
[0 0 0 0 0 0 1 1 0 0] is even
[0 0 0 0 0 0 1 0 1 0] is even
[0 0 0 0 0 0 1 1 1 0] is even
[0 0 0 0 0 0 1 1 1 1] is even
[0 0 0 0 0 0 1 0 1 1] is even
[0 0 0 0 0 0 0 1 1 1] is odd
```