Assignment 4: Write a program to demonstrate ART

Code =>

```
import numpy as np

class ART1:
    def __init__(self, num_features, num_clusters, vigilance=0.5):
        self.num_features = num_features
        self.num_clusters = num_clusters
        self.vigilance = vigilance
        self.weights = np.ones((num_clusters, num_features * 2))

    def complement_coding(self, input_pattern):
        return np.concatenate((input_pattern, 1 - input_pattern))

    def calculate_similarity(self, input_pattern, cluster_weights):
        return np.sum(np.minimum(input_pattern, cluster_weights)) /
np.sum(input_pattern)

    def train(self, data):
        data = np.array([self.complement_coding(pattern) for pattern in data])
        for input_pattern in data:
            while True:
                similarities = [self.calculate_similarity(input_pattern, w)
for w in self.weights]
                selected_cluster = np.argmax(similarities)

                if similarities[selected_cluster] >= self.vigilance:
                    self.weights[selected_cluster] =
np.minimum(self.weights[selected_cluster], input_pattern)
                    break
                else:
                    self.weights[selected_cluster] =
np.zeros_like(self.weights[selected_cluster])

    def predict(self, data):
        data = np.array([self.complement_coding(pattern) for pattern in data])
        predictions = []
        for input_pattern in data:
            similarities = [self.calculate_similarity(input_pattern, w) for w
in self.weights]
            predictions.append(np.argmax(similarities))
        return predictions

# Example Data (Binary Inputs)
data = np.array([[1, 0, 0, 1],
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                [1, 1, 0, 0],
                [0, 1, 1, 0],
                [0, 0, 1, 1]])

# Initialize and Train ART1 Network
art = ART1(num_features=4, num_clusters=4, vigilance=0.7)
art.train(data)

# Predict Cluster
predictions = art.predict(data)
print("Predicted Clusters:", predictions)

print("Final Weights:")
print(art.weights)
```

Code =>

```
[Running] python -u "c:\Users\Shreyash Musmade\Desktop\Practical\ANN\ANN_Prac-4\Practical.py"
Predicted Clusters: [0, 1, 2, 3]
Final Weights:
[[1. 0. 0. 1. 0. 1. 1. 0.]
 [1. 1. 0. 0. 0. 0. 1. 1.]
 [0. 1. 1. 0. 1. 0. 0. 1.]
 [0. 0. 1. 1. 1. 1. 0. 0.]]

[Done] exited with code=0 in 0.333 seconds
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