Unsupervised Learning
Practical Work 4

Artificial Intelligence Systems 2023 2C

1. Exercise Europe

The europe.csv data set corresponds to economic, social and geographic characteristics. almost 28 countries in Europe. The variables are:

- Country: Name of the country.
- Area: area
- GDP: gross domestic product.
- Inflation: annual inflation.
- Life.expect: average life expectancy in years.
- Military: military budget.
- Pop.growth: population growth rate.
- Unemployment: unemployment rate.

1.1. Kohonen network

Implement the Kohonen network and apply it to solve the following problems:

- Associate countries that have the same geopolitical, economic and social characteristics.
- Make at least one graph that shows the results.
- Make a graph that shows the average distances between neighboring neurons.
- Analyze the number of elements that were associated with each neuron.

1.2. Oja Model

Implement a neural network using Oja's rule to solve the following problems.
problems:

- Calculate the first principal component for this data set.
- Interpret the result of the first component.
- Compare the result of Oja's exercise with the result of calculating the first principal component with a library.

2. Exercise Patterns

2.1. Hopfield model

Construct letter patterns of the alphabet using 1 and ÿ1 and 5 × 5 matrices.
example, with the matrix

$$\begin{bmatrix} ÿ & & & & & ÿ \\ 1 & 1 & 1 & 1 & 1 & \\ ÿ1 & ÿ1 & ÿ1 & 1 & ÿ1 & \\ ÿ1 & ÿ1 & ÿ1 & 1 & ÿ1 & \\ 1 & ÿ1 & ÿ1 & 1 & ÿ1 & \\ 1 & 1 & 1 & ÿ1 & ÿ1 & \end{bmatrix}$$

the letter J can be drawn:

```
* * * * *
        *
        *
*       *
* * *
```

- to. Store 4 letter patterns. Implement the Hopfield model to associate noisy 5x5 matrices with stored letter patterns. Query patterns
  They must be random alterations of the original patterns. Show the results that are obtained in each step until reaching the final result.
- b. Enter a very noisy pattern and identify a spurious state.

3. Delivery

Send an email with the presentation, the repository with README.md and configuration file. ration and the hash of the commit before 10/24 at 3:00 p.m.