TP3
Perceptrón Simple y Multicapa

Grupo 2

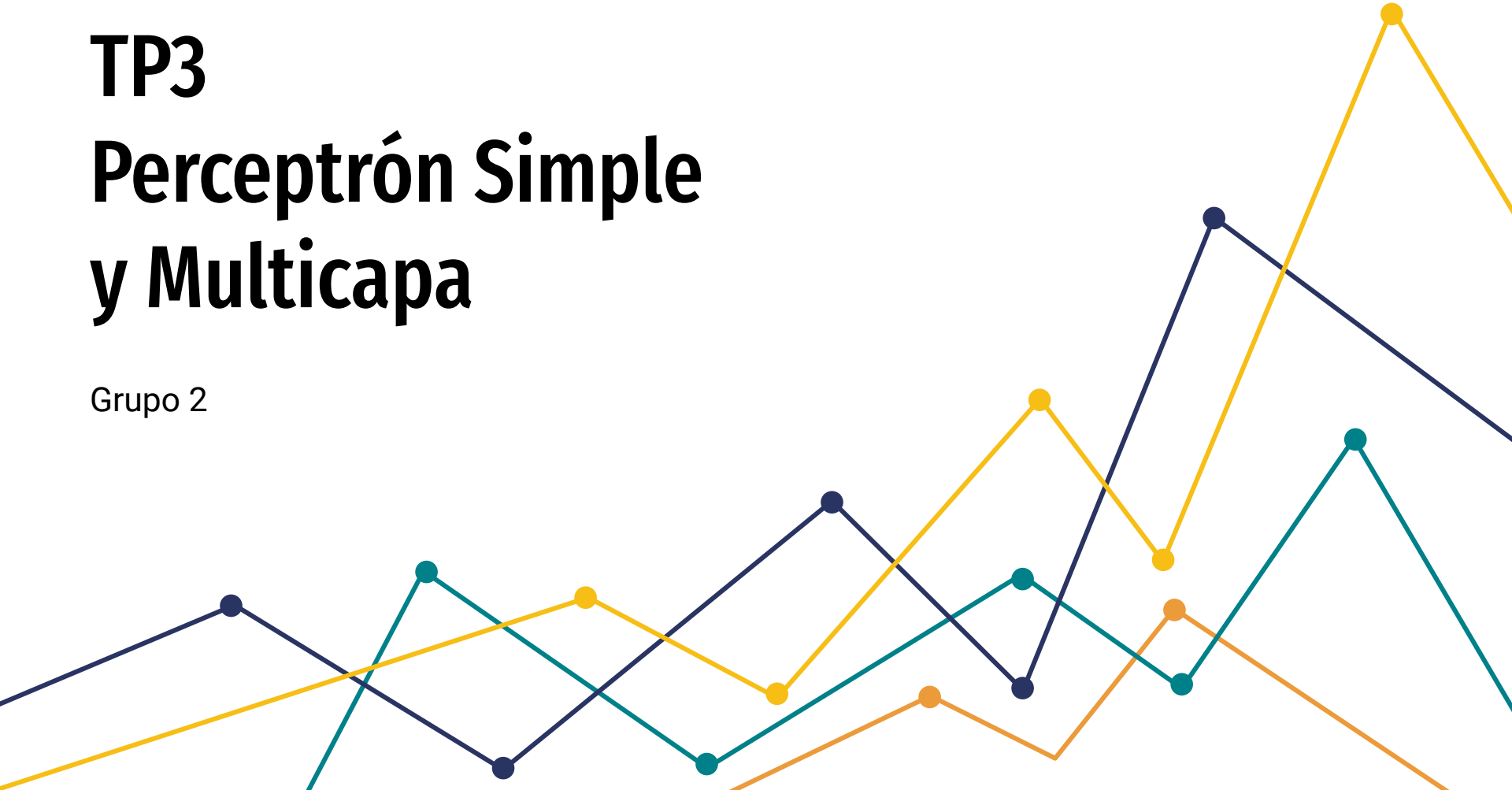


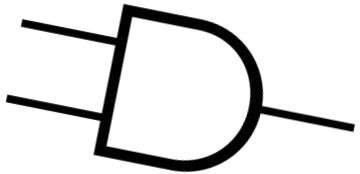
Tabla de contenidos

Ejercicio 1

❓ Preguntas:

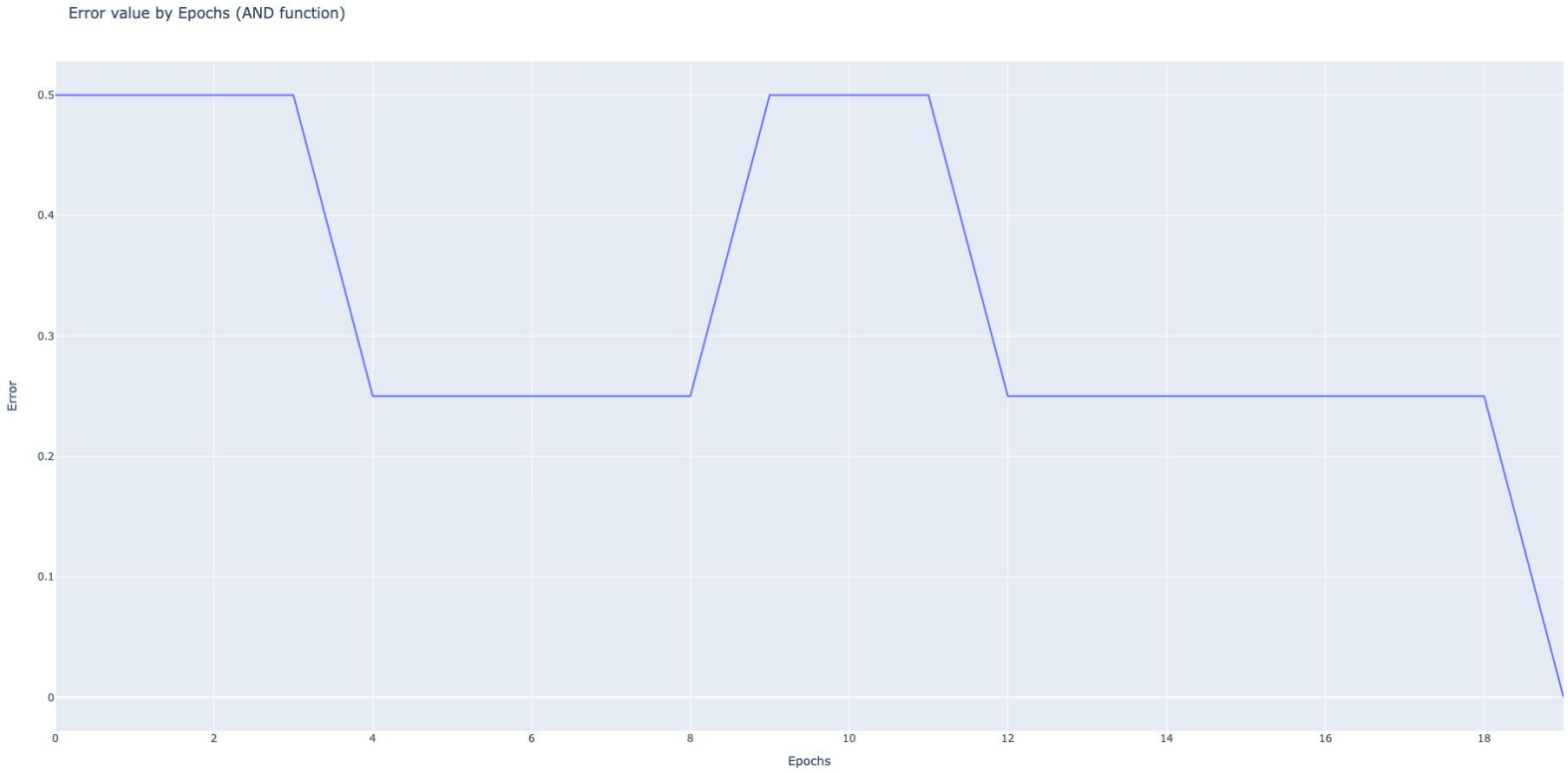
- ¿Qué puede decir acerca de los problemas que puede resolver el perceptrón simple escalón en relación a los problemas planteados en la consigna?

AND



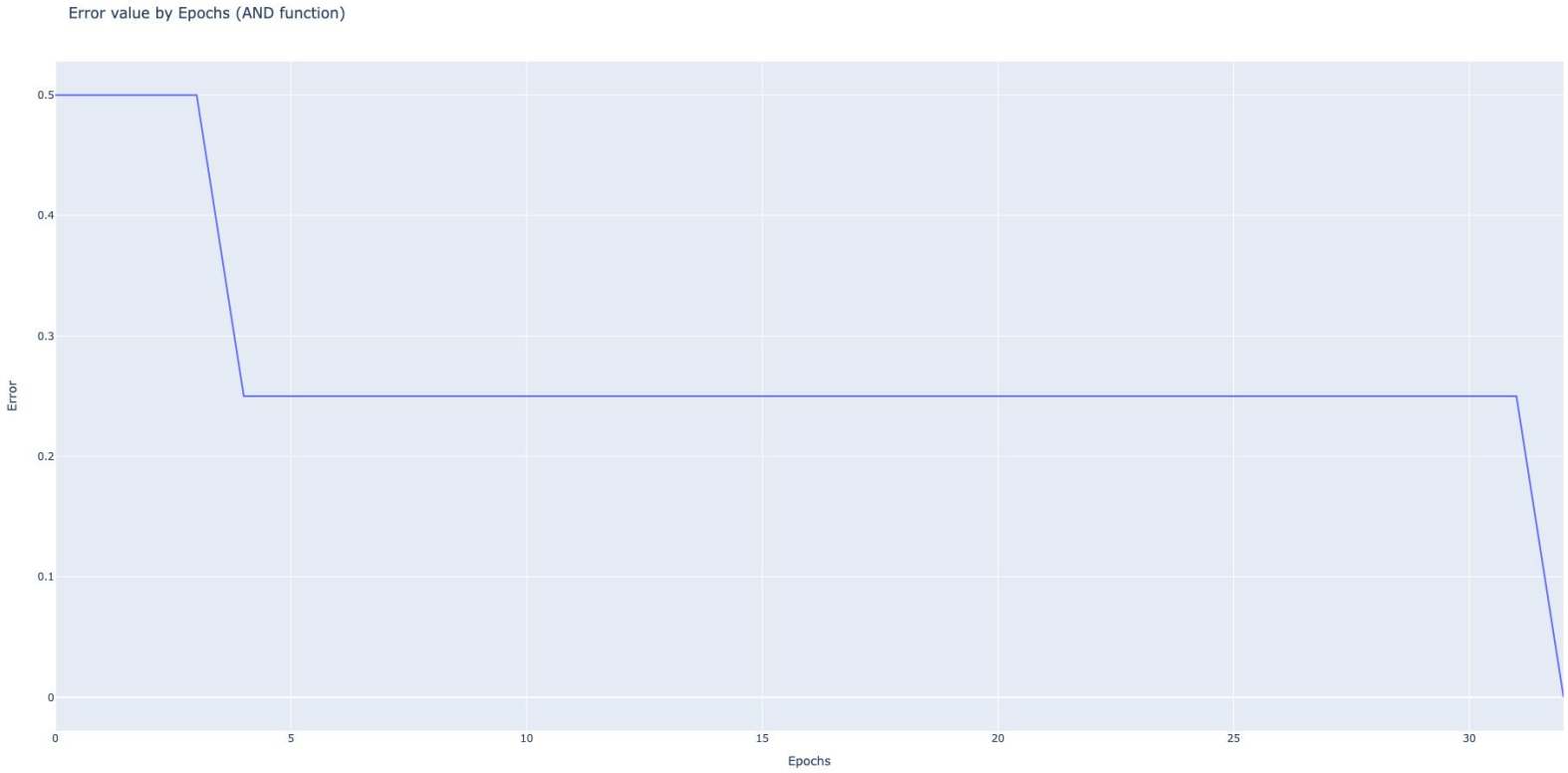
AND

Ejercicio 1



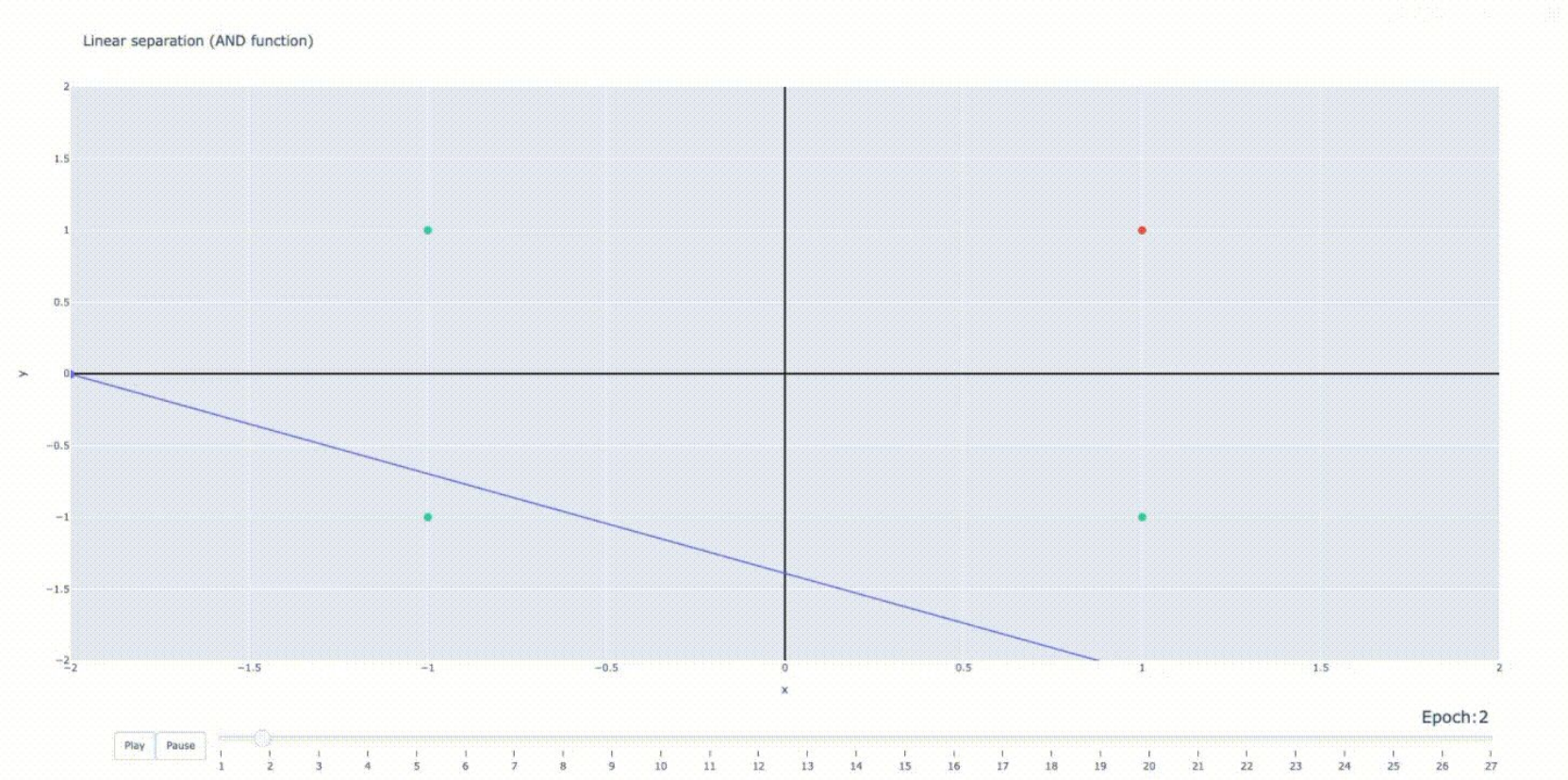
AND

Ejercicio 1



AND

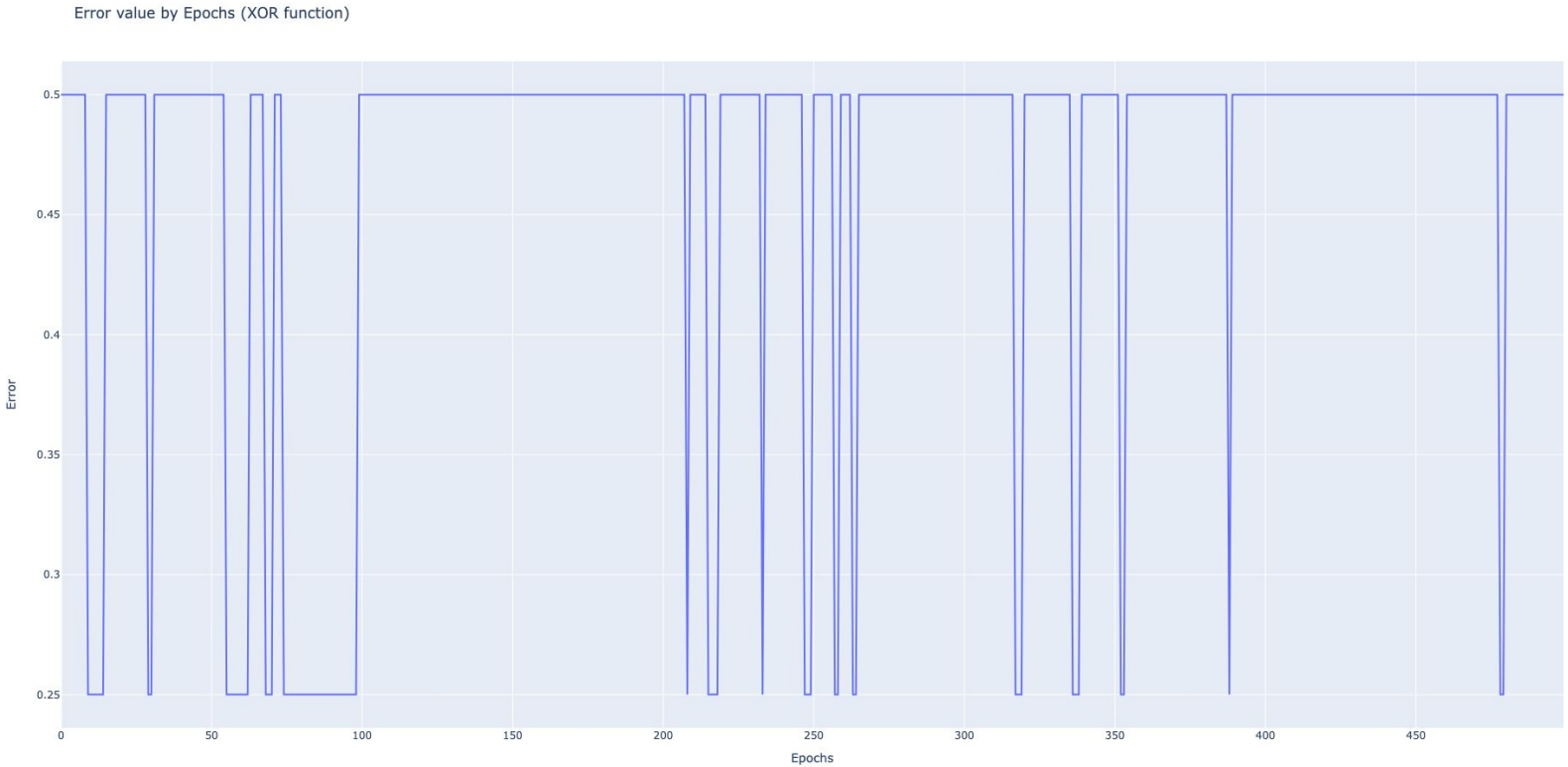
Ejercicio 1



XOR

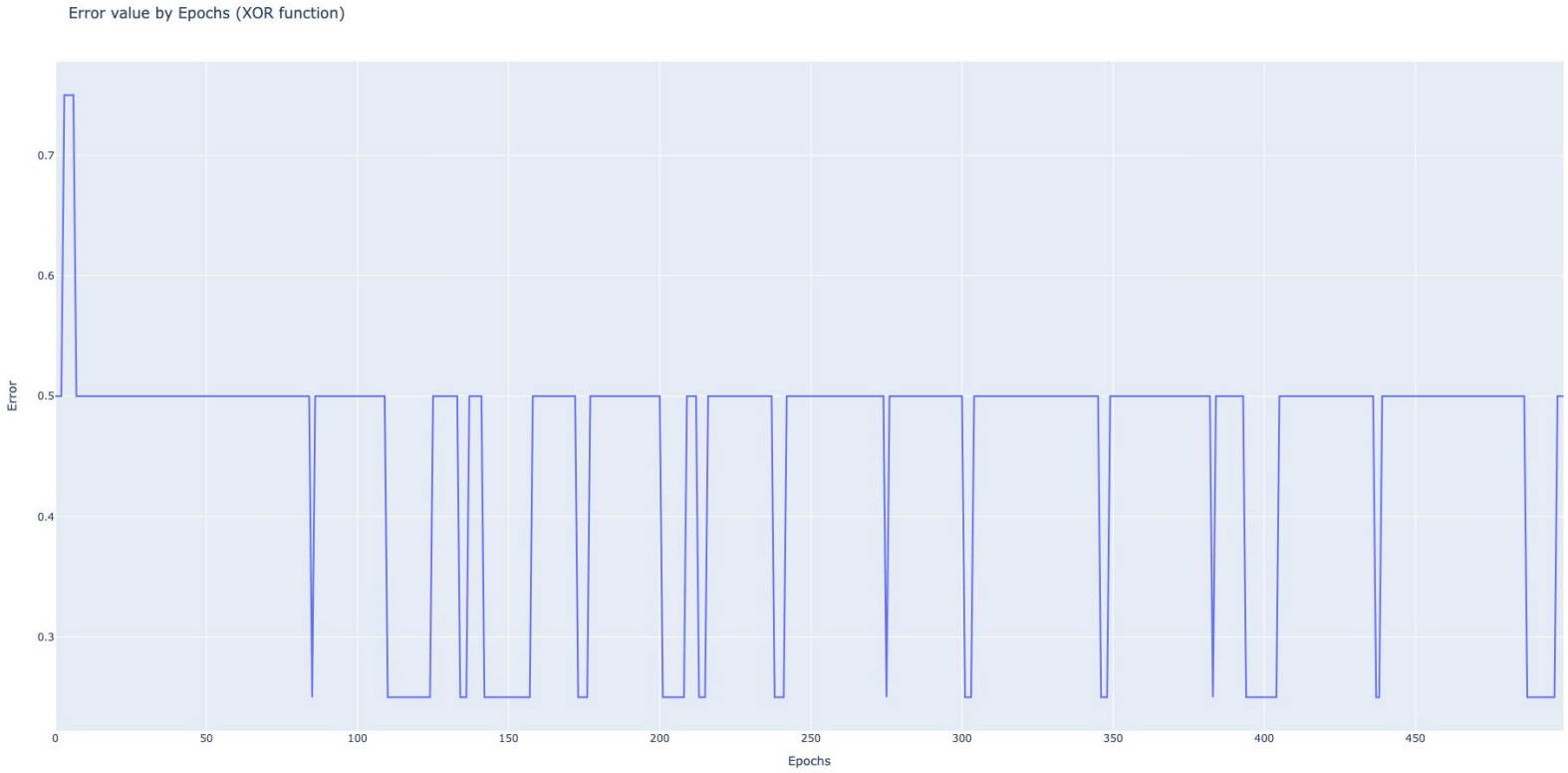
XOR

Ejercicio 1



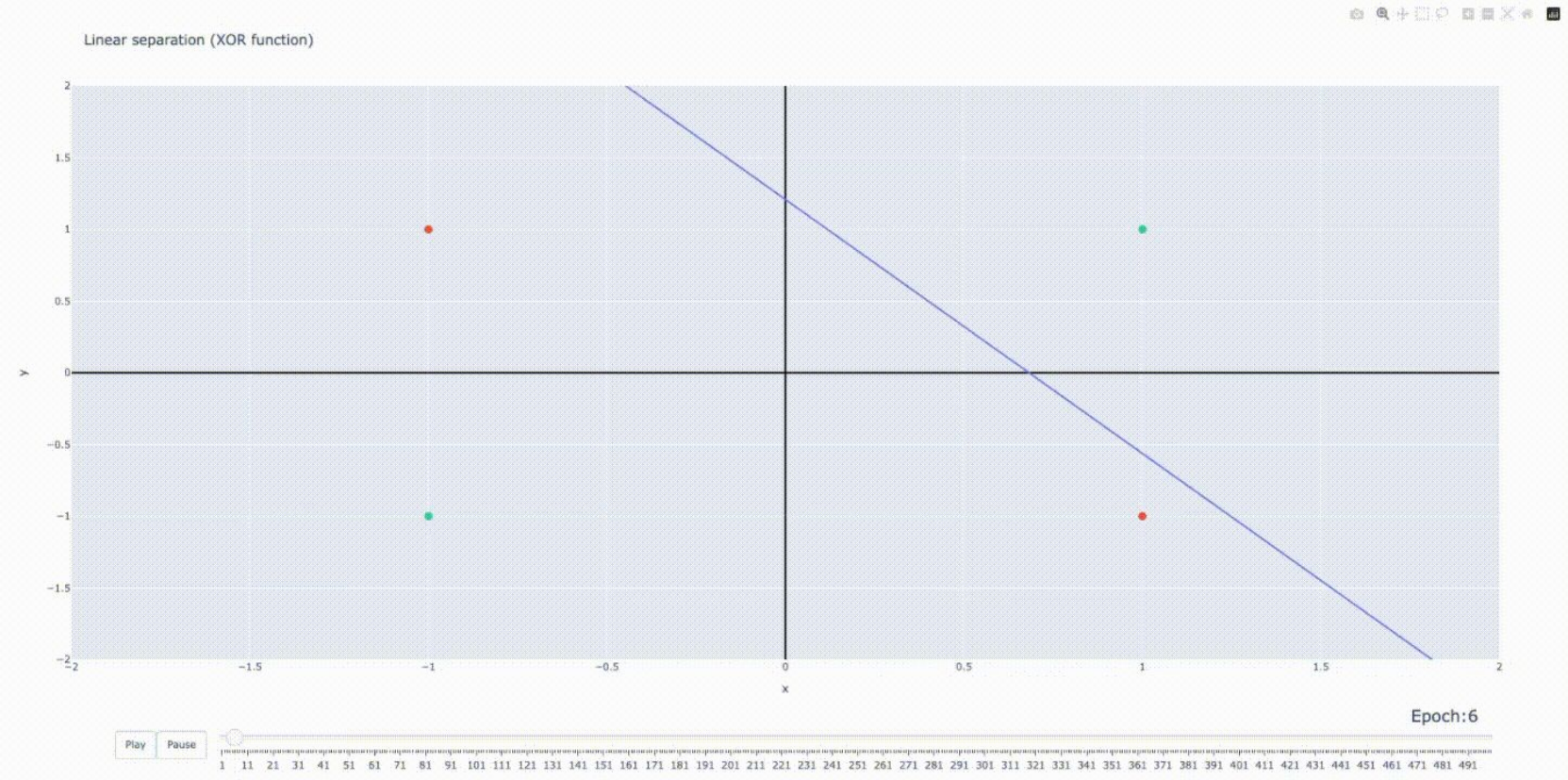
XOR

Ejercicio 1



XOR

Ejercicio 1



Ejercicio 2

❓ Preguntas:

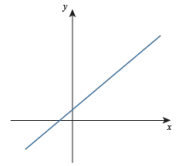
- Evaluar la capacidad de cada uno de los perceptrones para aprender la función cuyas muestras están en los archivos.
- Evaluar la capacidad de generalización del perceptrón simple no lineal utilizando, de los datos provistos, un subconjunto para entrenar y otro para testear.
- ¿Cómo elegirían el mejor conjunto de entrenamiento? ¿Qué efecto tiene la elección en la capacidad de generalización del perceptrón?

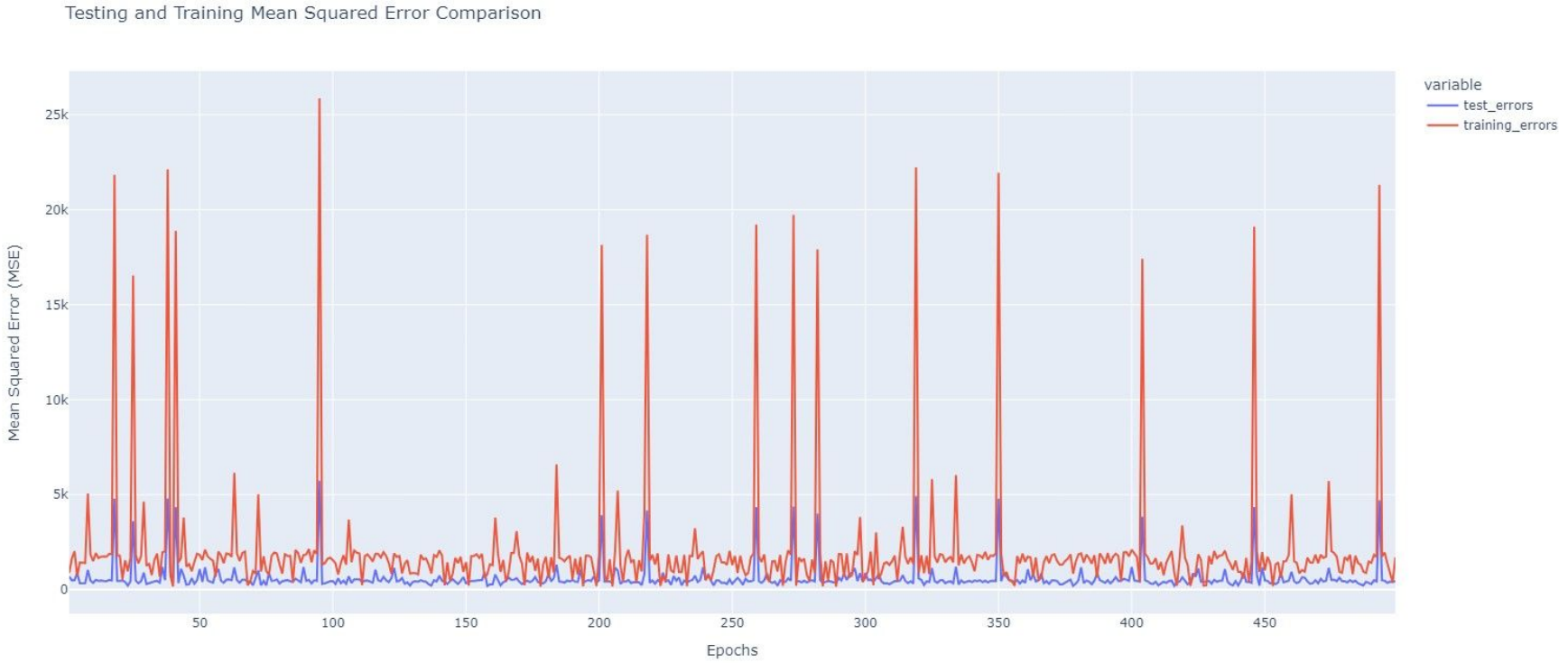
Perceptrones Lineales: Comparación de error entre entrenamiento y prueba

Perceptrón Lineal

Perceptrones Simples: Comparación de errores

```
dataset: TP3-ej2-conjunto.csv
activation_function = IDENTITY
learning_rate = 0.1
beta = 1
split_ratio = 0.8
```

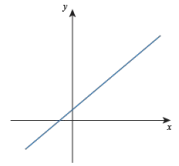


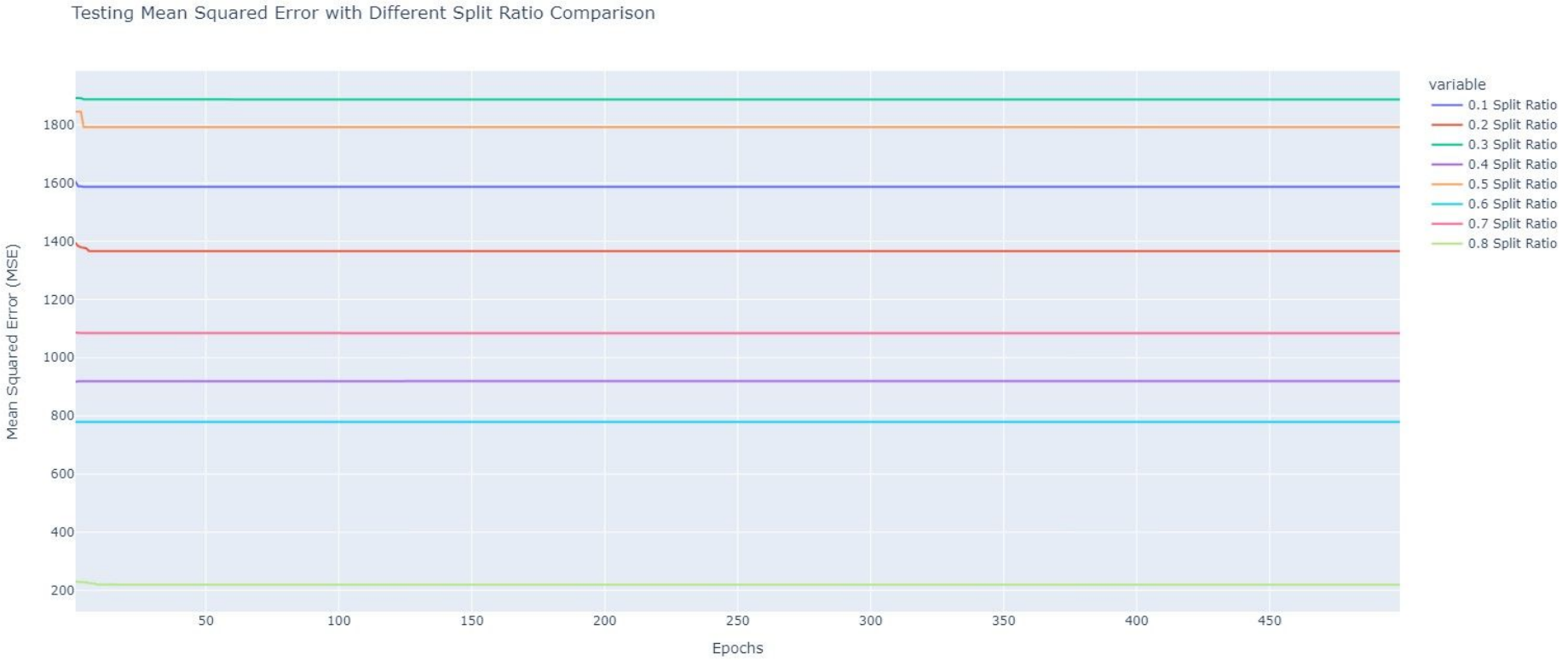


Perceptrón Lineal

Perceptrones Simples: Comparación con distintas proporciones

```
dataset: TP3-ej2-conjunto.csv
activation_function = IDENTITY
learning_rate = 0.1
beta = 1
```



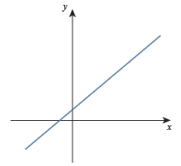


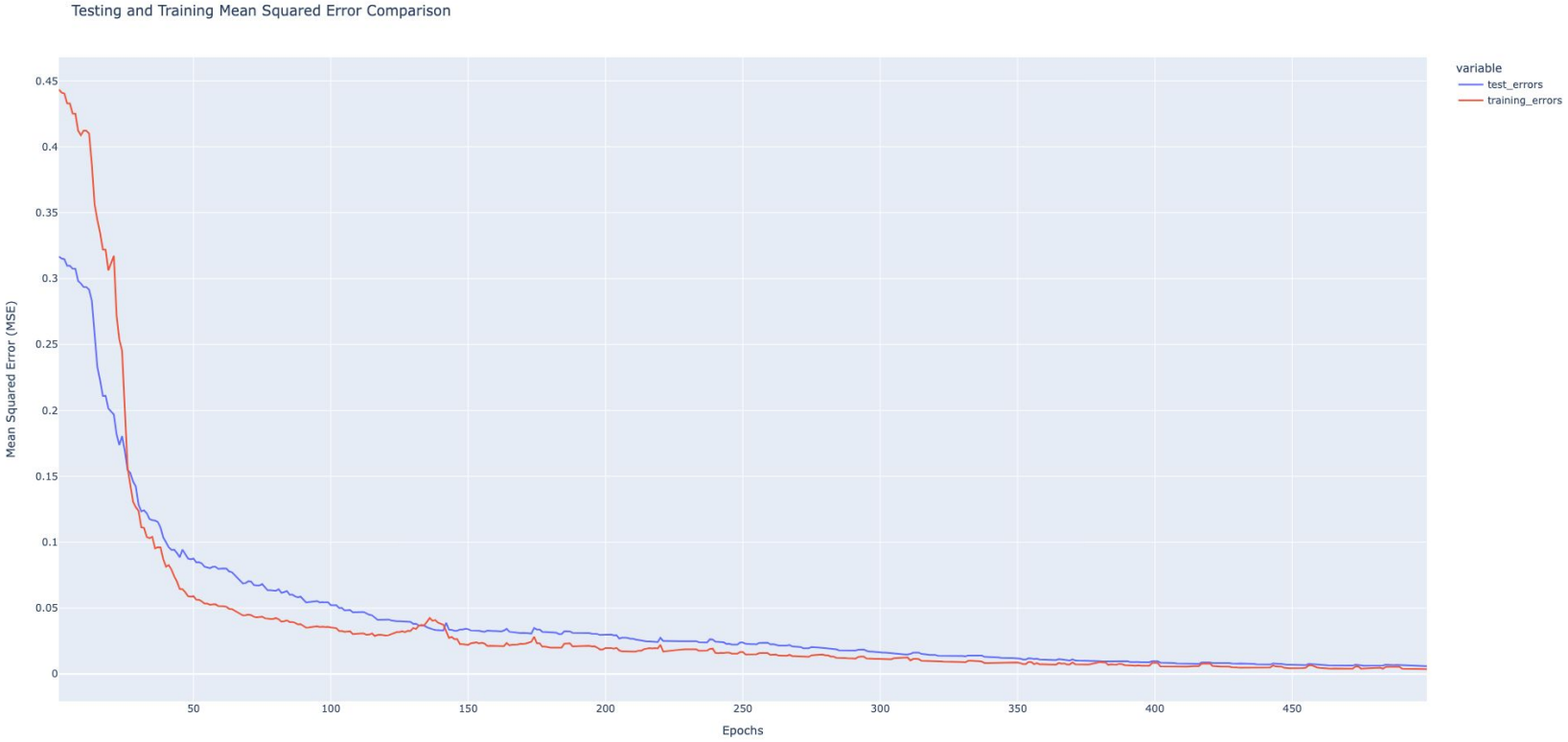
Perceptrones No Lineales: Comparación de error entre entrenamiento y prueba

Perceptrón No Lineal

Perceptrones Simples: Comparación de errores

```
dataset: TP3-ej2-conjunto.csv
activation_function = SIGMOID
learning_rate = 0.1
beta = 1
split_ratio = 0.5
normalized (0, 1)
```

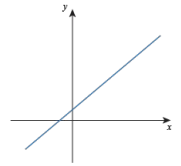


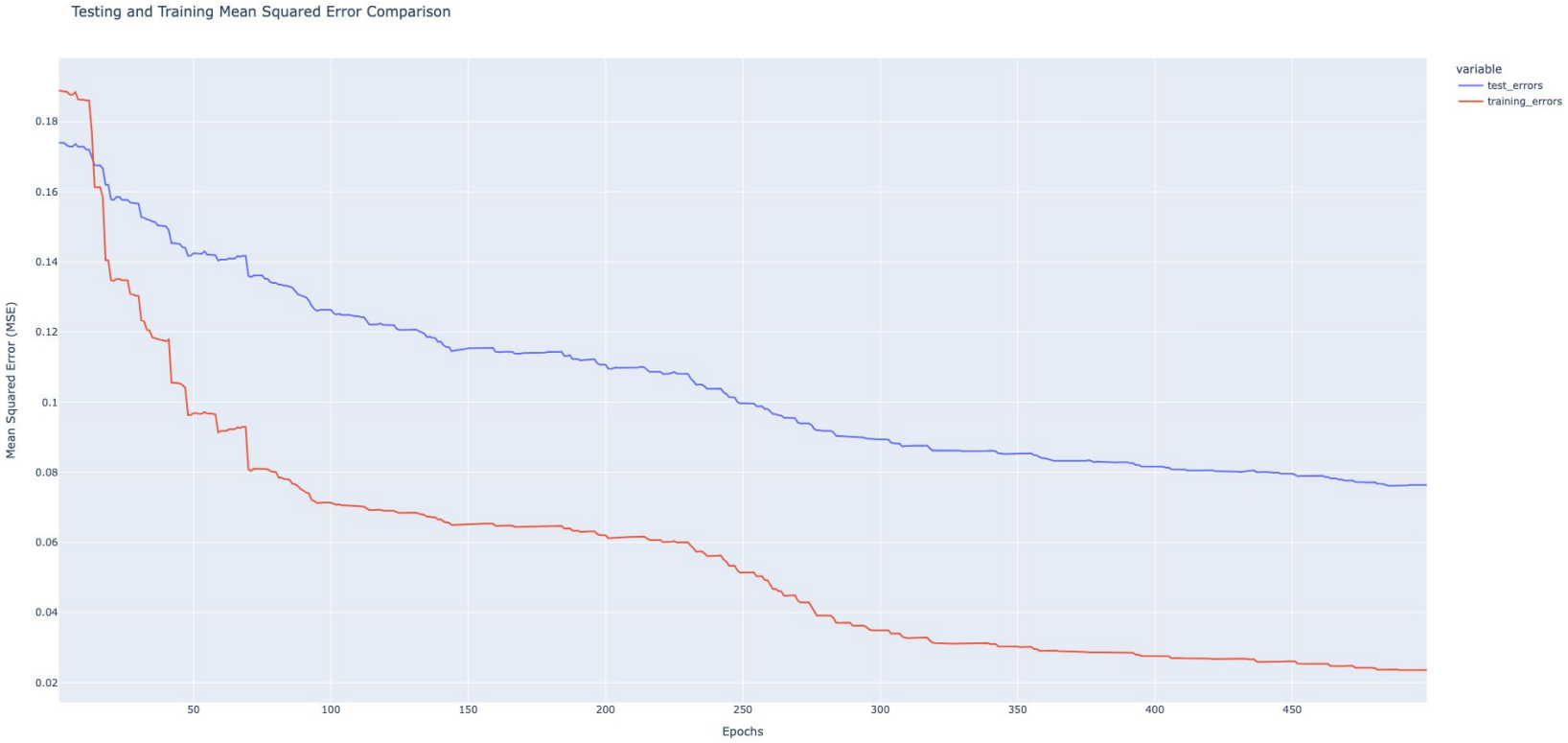


Perceptrón No Lineal

Perceptrones Simples: Comparación de errores

```
dataset: TP3-ej2-conjunto.csv
activation_function = SIGMOID
learning_rate = 0.1
beta = 1
split_ratio = 0.5
normalized (0, 1)
```

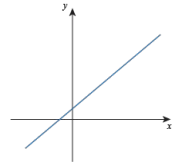


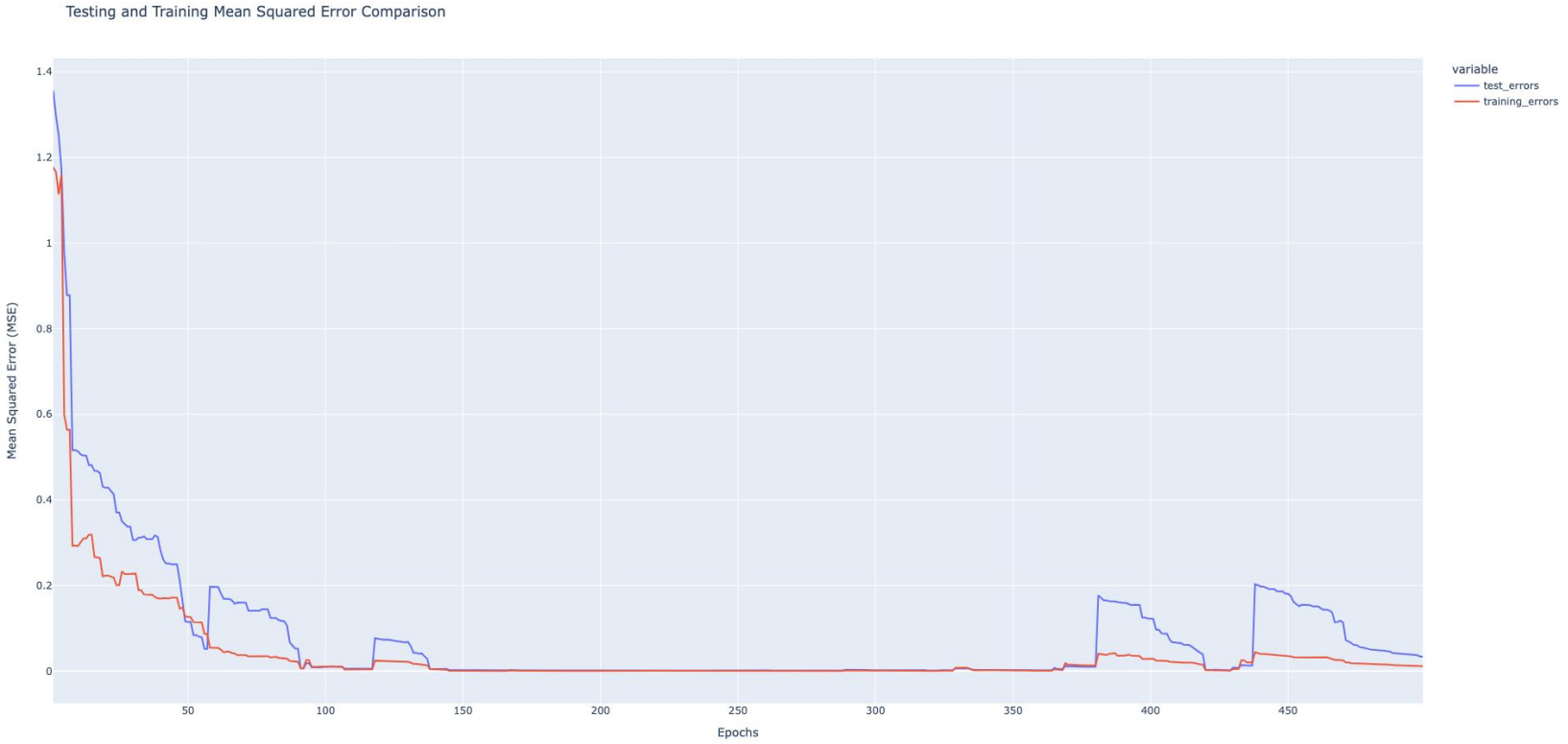


Perceptrón No Lineal

Perceptrones Simples: Comparación de errores

```
dataset: TP3-ej2-conjunto.csv
activation_function = TAN_H
learning_rate = 0.1
beta = 1
split_ratio = 0.5
normalized (-1, 1)
```

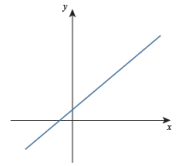


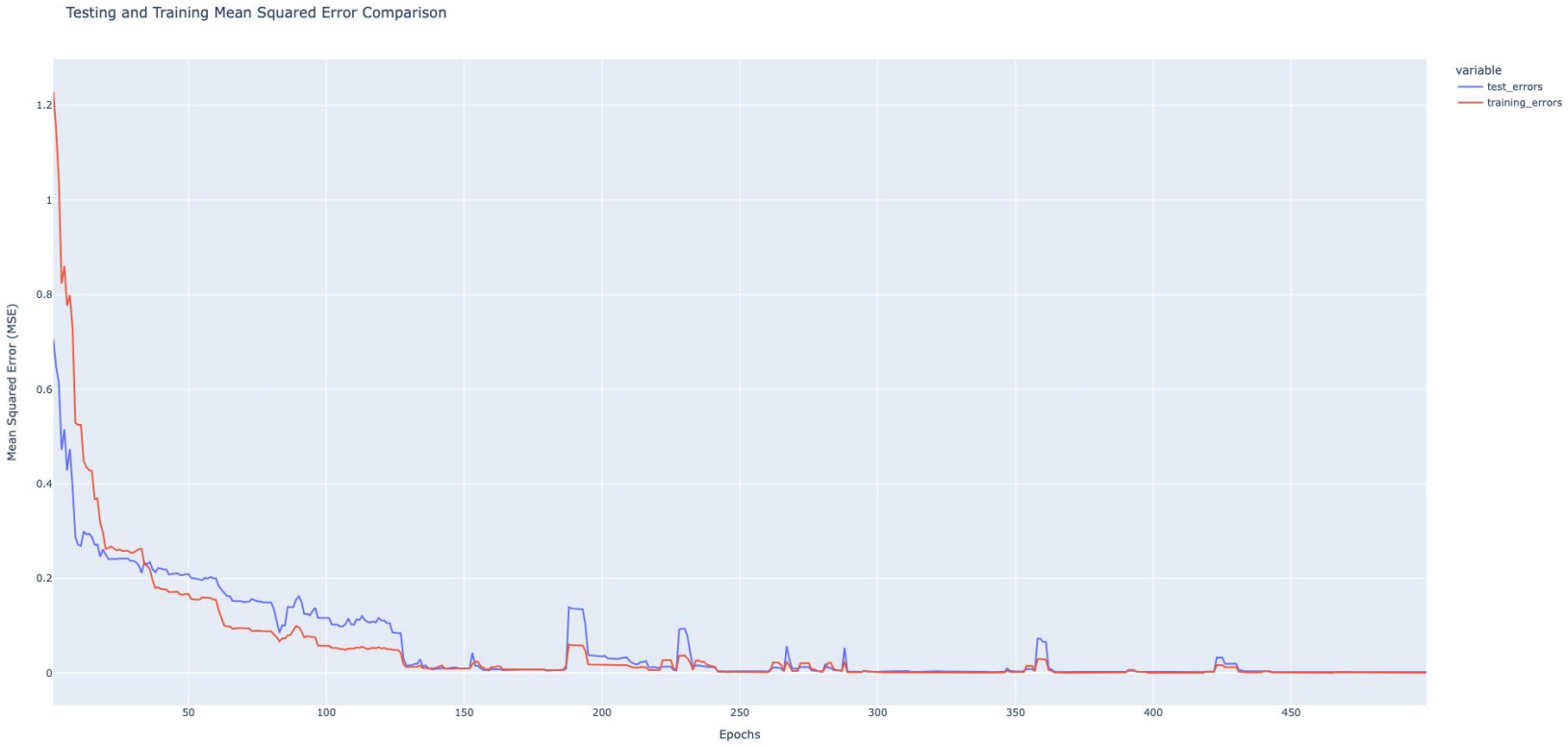


Perceptrón No Lineal

Perceptrones Simples: Comparación de errores

```
dataset: TP3-ej2-conjunto.csv
activation_function = TAN_H
learning_rate = 0.1
beta = 1
split_ratio = 0.5
normalized (-1, 1)
```



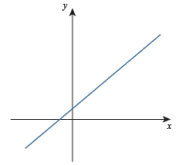


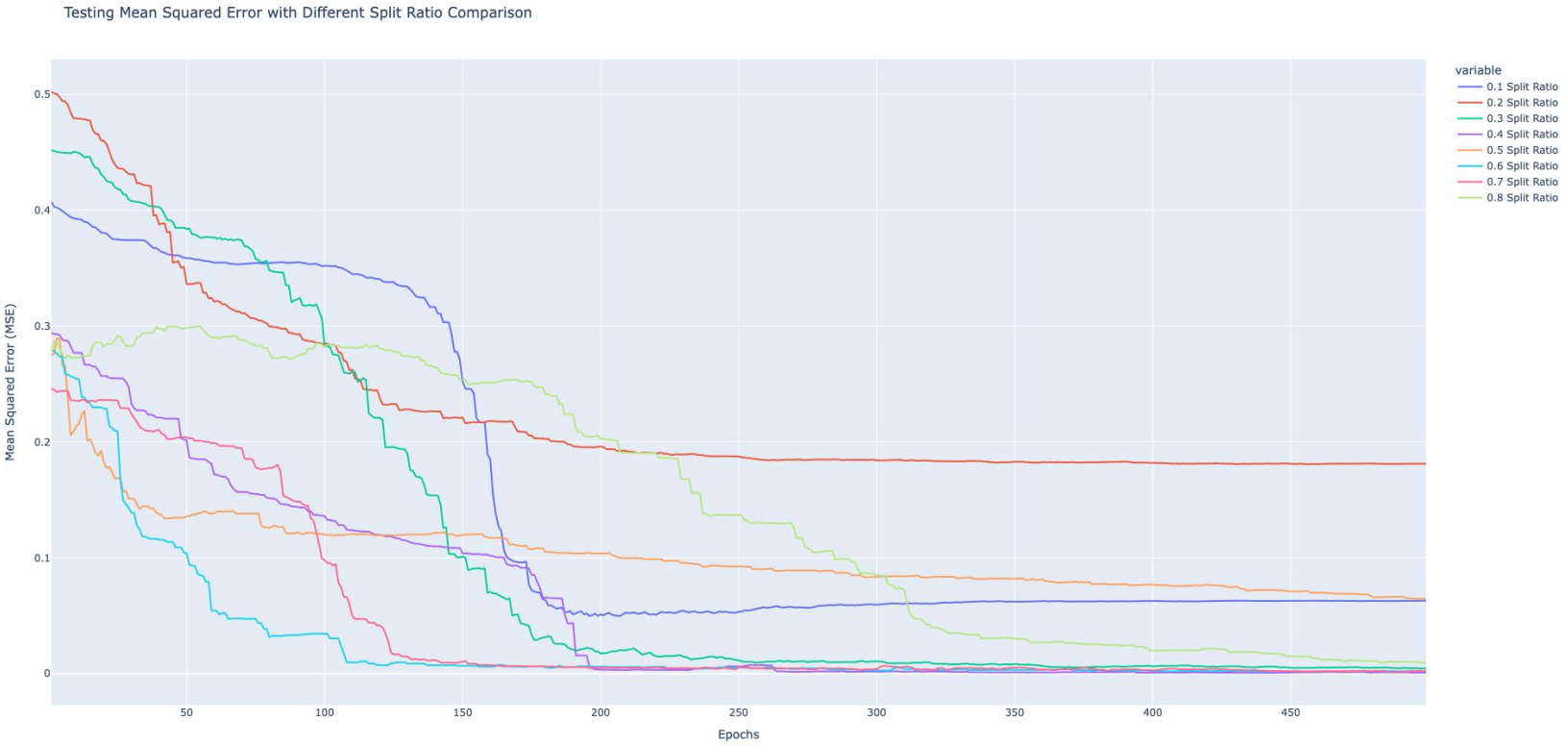
Perceptrones No Lineales: Comparación con distintas proporciones de partición

Perceptrón No Lineal

Perceptrones Simples: Comparación con distintas proporciones

```
dataset: TP3-ej2-conjunto.csv
activation_function = SIGMOID
learning_rate = 0.1
beta = 1
normalized (0, 1)
```

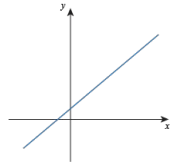


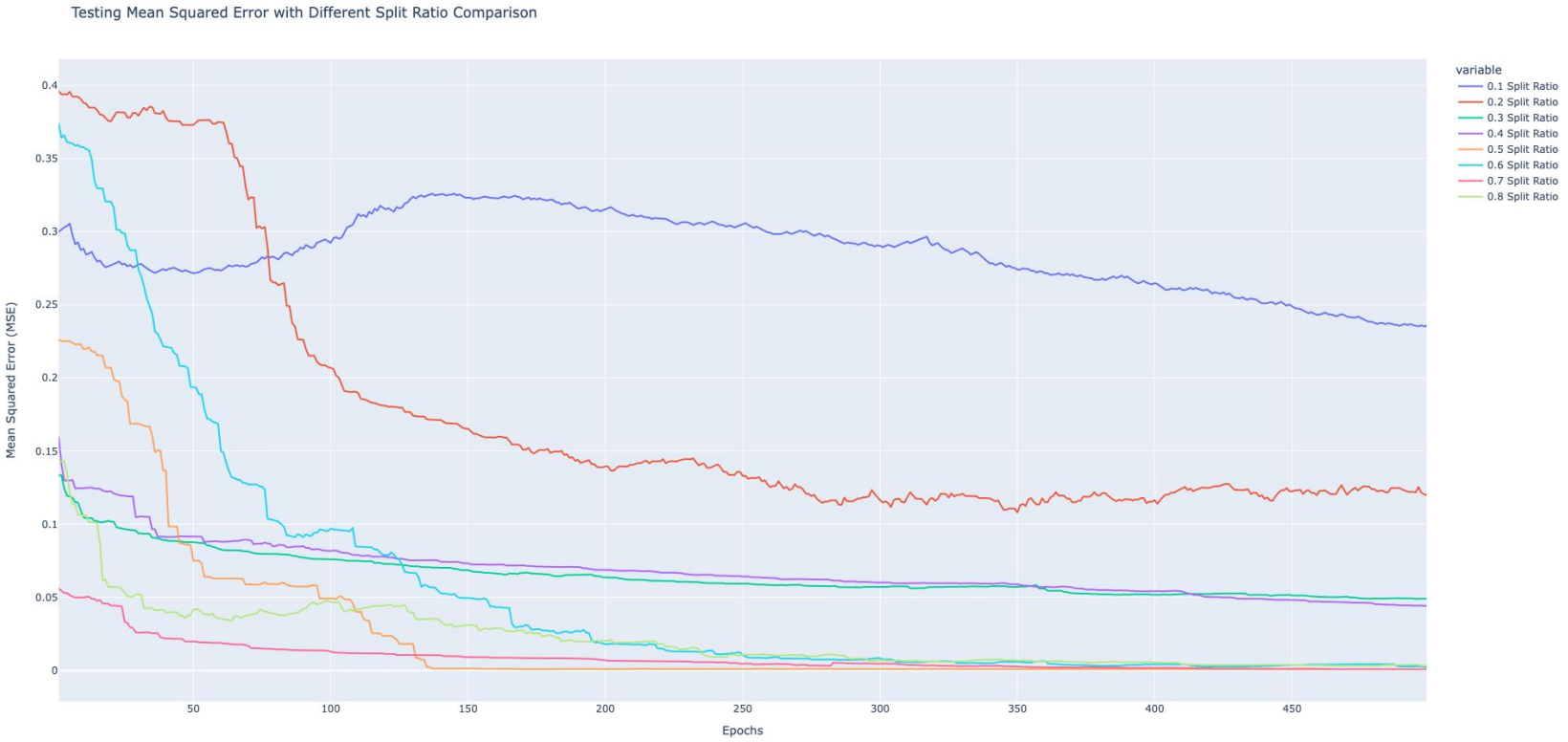


Perceptrón No Lineal

Perceptrones Simples: Comparación con distintas proporciones

```
dataset: TP3-ej2-conjunto.csv
activation_function = SIGMOID
learning_rate = 0.1
beta = 1
normalized (0, 1)
```

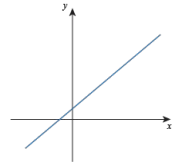


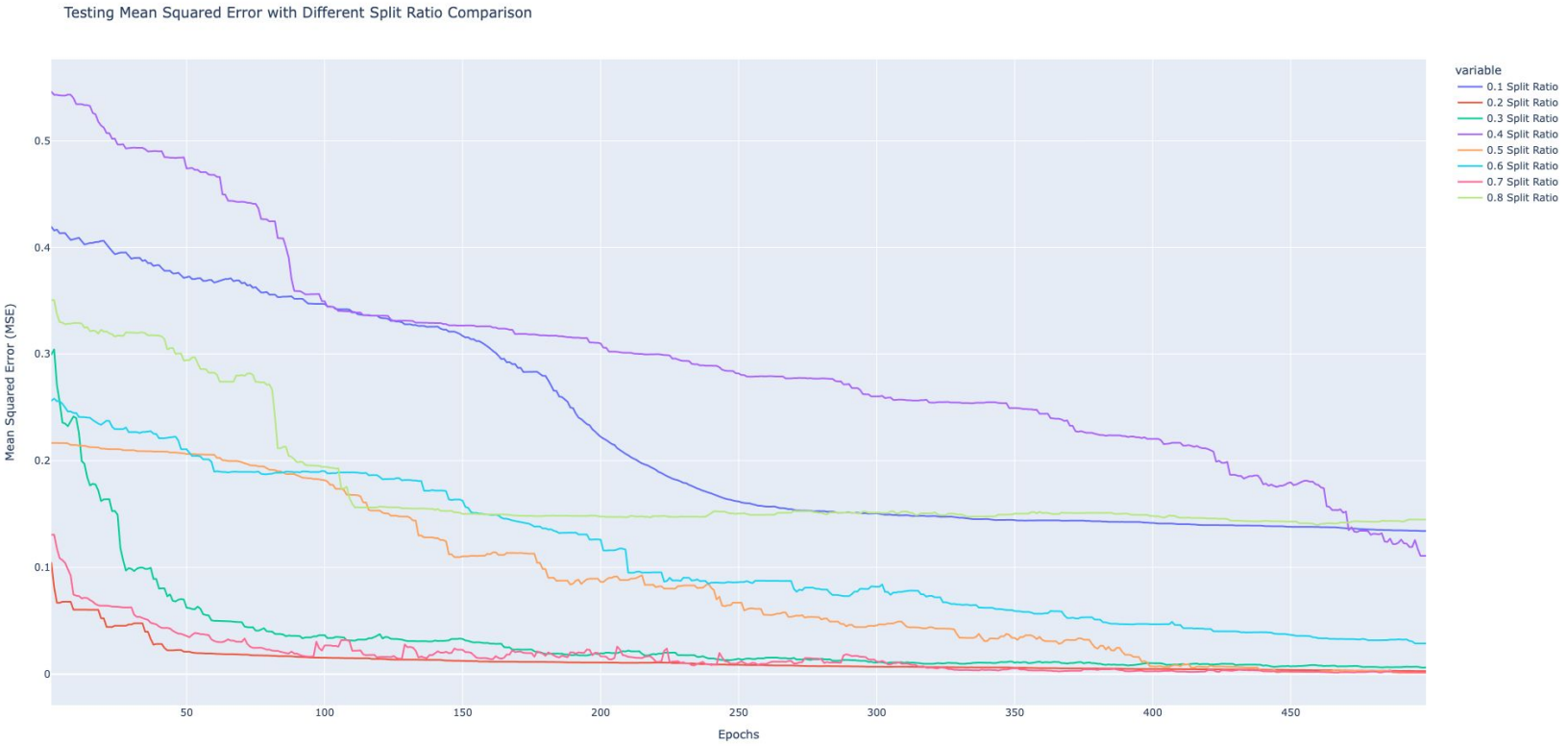


Perceptrón No Lineal

Perceptrones Simples: Comparación con distintas proporciones

```
dataset: TP3-ej2-conjunto.csv
activation_function = SIGMOID
learning_rate = 0.1
beta = 1
normalized (0, 1)
```

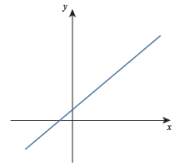


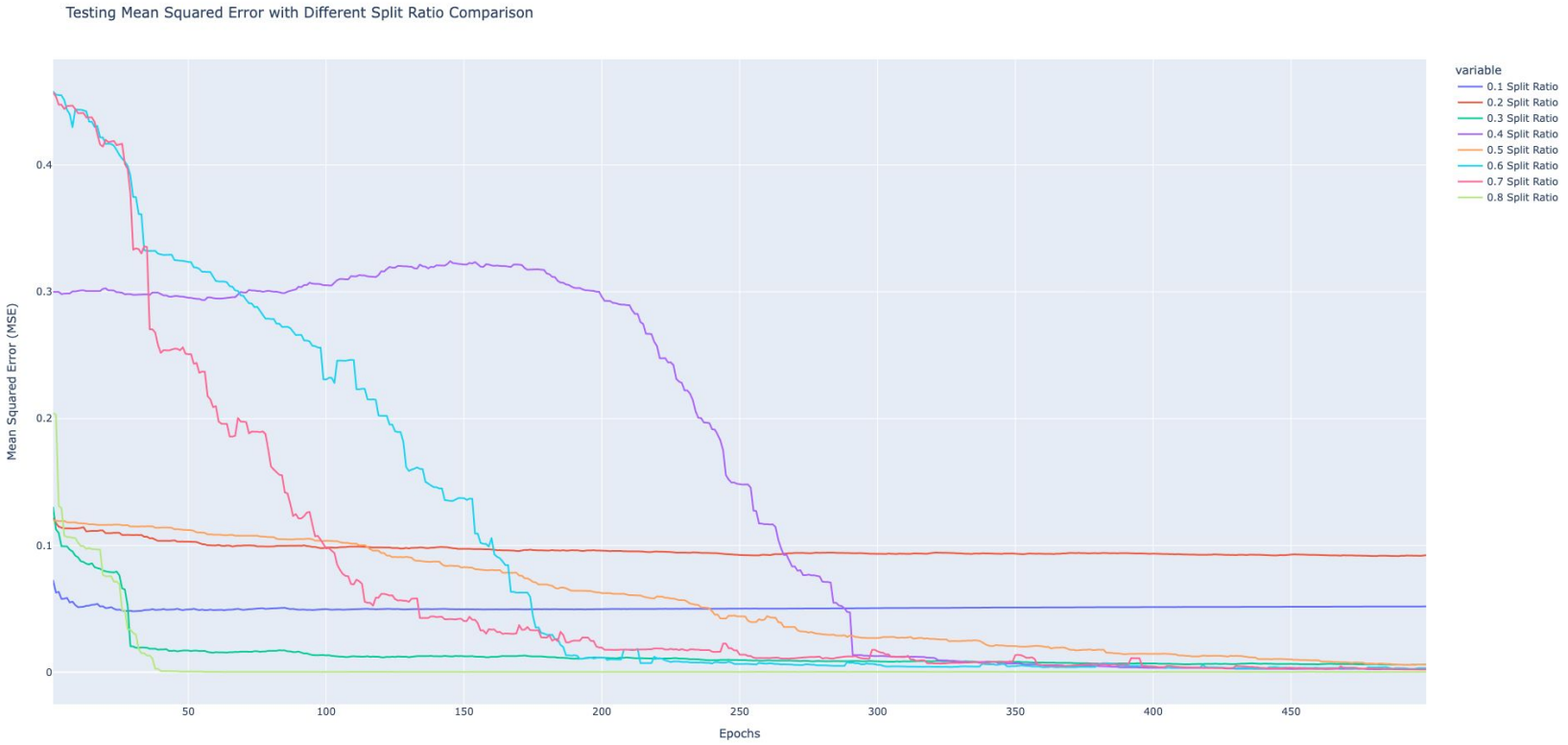


Perceptrón No Lineal

Perceptrones Simples: Comparación con distintas proporciones

```
dataset: TP3-ej2-conjunto.csv
activation_function = SIGMOID
learning_rate = 0.1
beta = 1
normalized (0, 1)
```

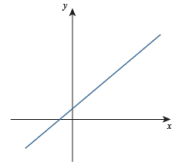


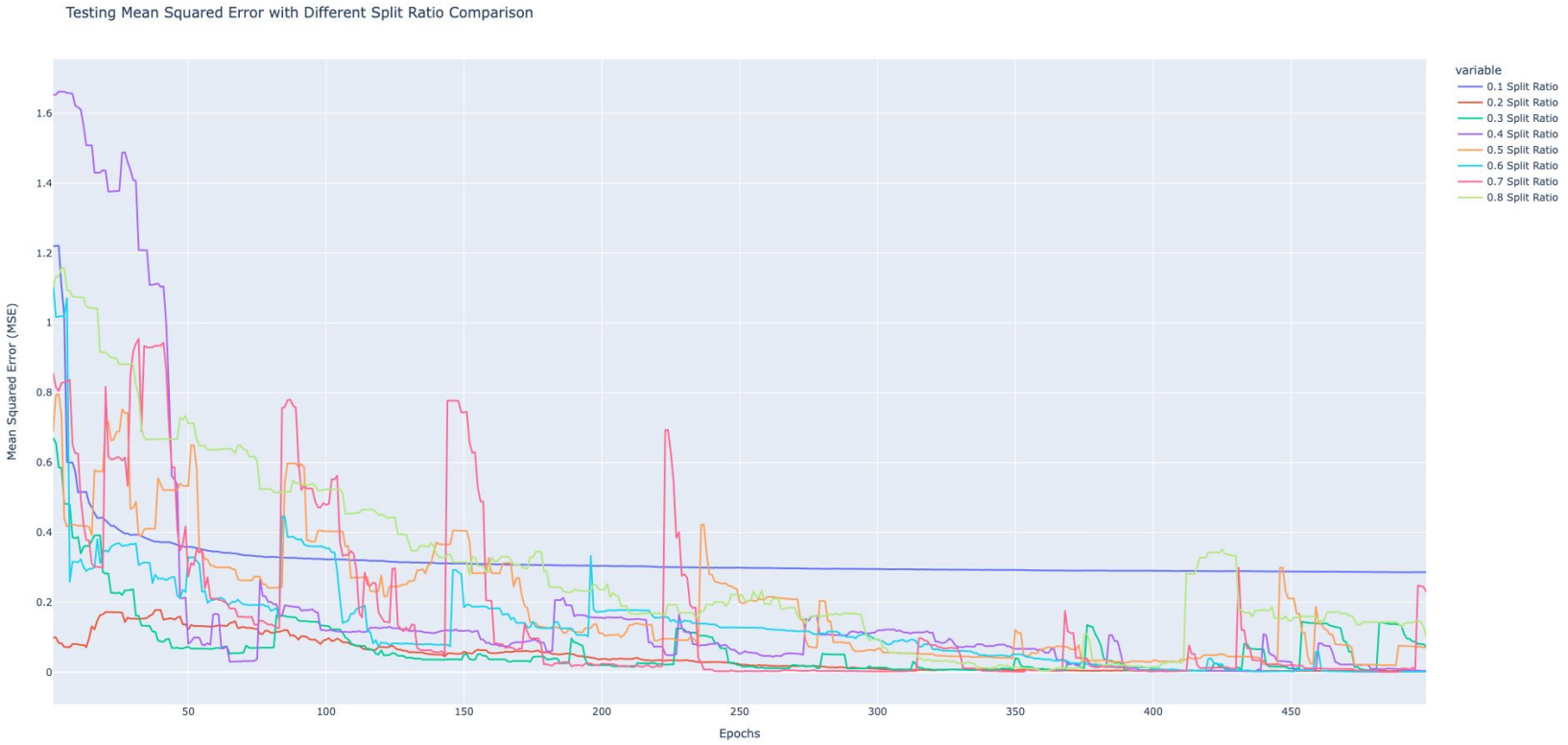


Perceptrón No Lineal

Perceptrones Simples: Comparación con distintas proporciones

```
dataset: TP3-ej2-conjunto.csv
activation_function = TAN_H
learning_rate = 0.1
beta = 1
normalized (-1, 1)
```

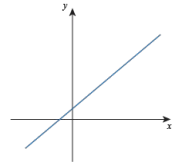


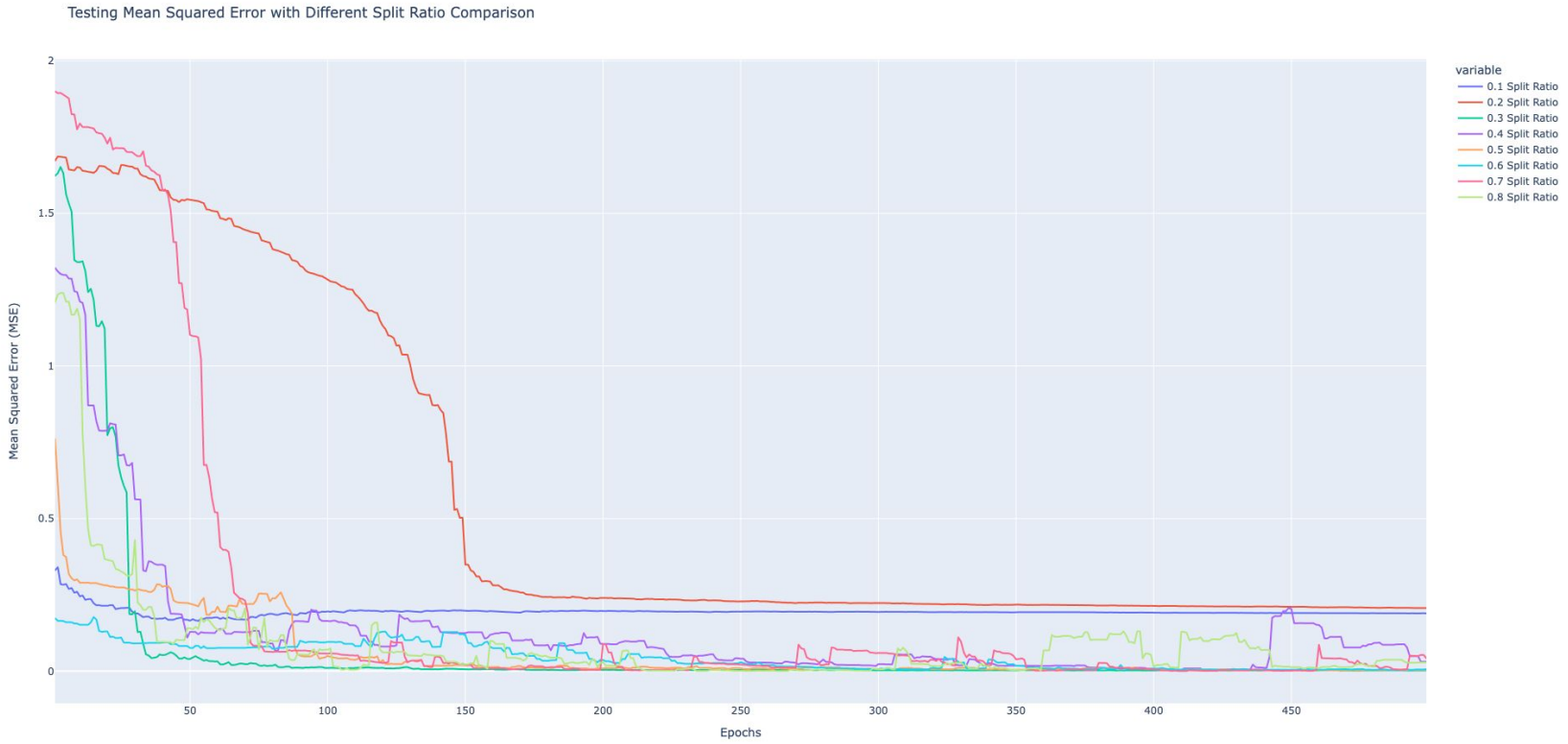


Perceptrón No Lineal

Perceptrones Simples: Comparación con distintas proporciones

```
dataset: TP3-ej2-conjunto.csv
activation_function = TAN_H
learning_rate = 0.1
beta = 1
normalized (-1, 1)
```





Ejercicio 3

❓ Preguntas:

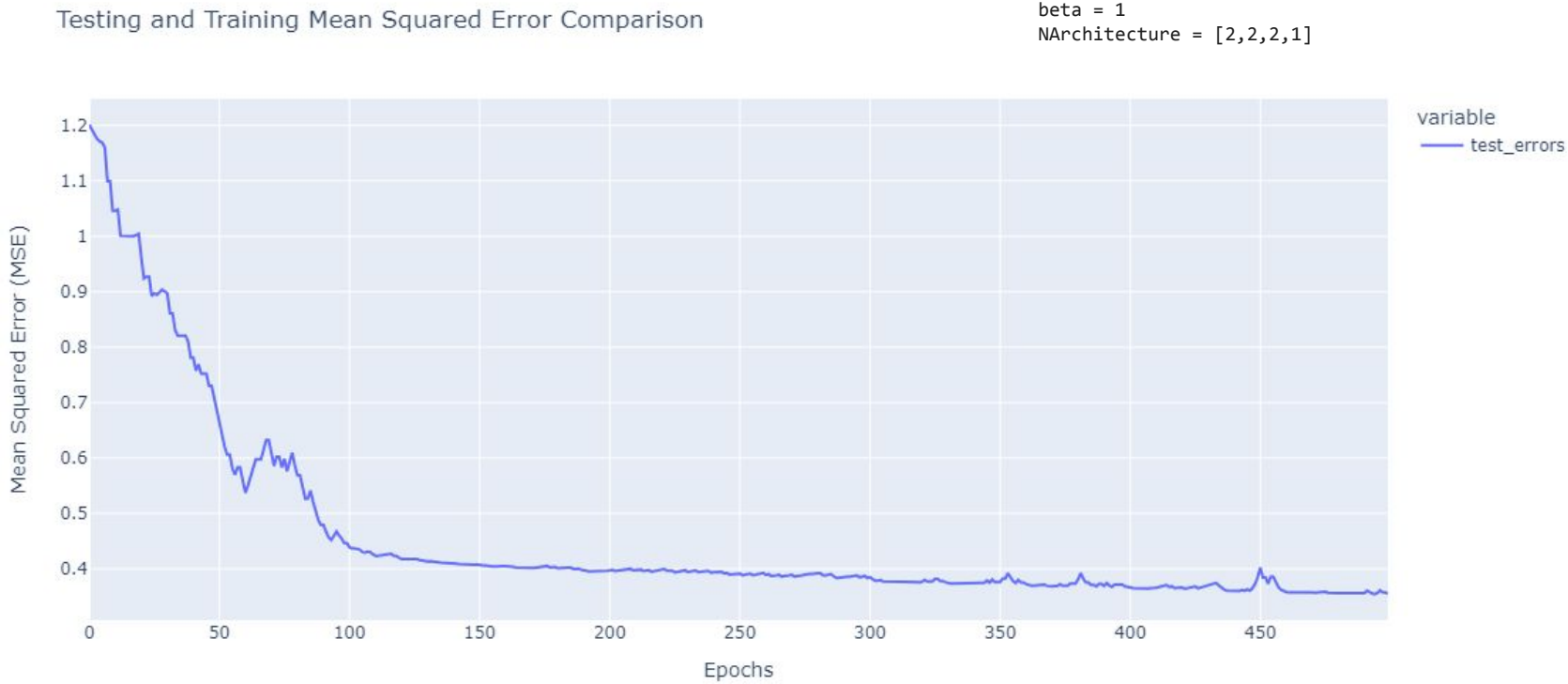
- ¿Qué problemas puede resolver el perceptrón multicapa que no puede resolver el perceptrón simple?
- ¿Cómo influye el ruido del conjunto de entrenamiento en los resultados finales?

Perceptrón Multicapa: Ejercicio 1

Perceptrón Multicapa: XOR

Ejercicio 1

```
dataset: XOR
activation_function = TAN_H
learning_rate = 0.1
beta = 1
NArchitecture = [2,2,2,1]
```

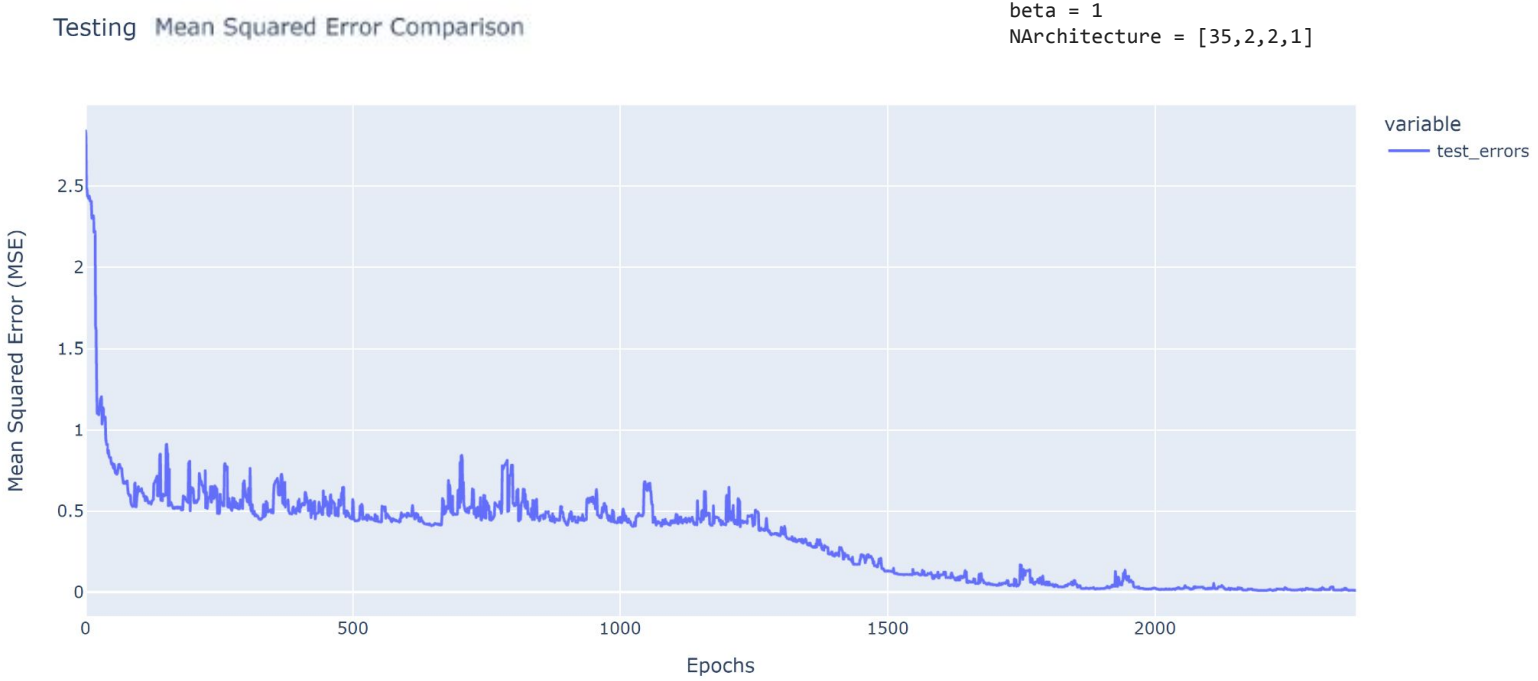


Perceptrón Multicapa: Pares

Perceptrón Multicapa: Pares

Ejercicio 2

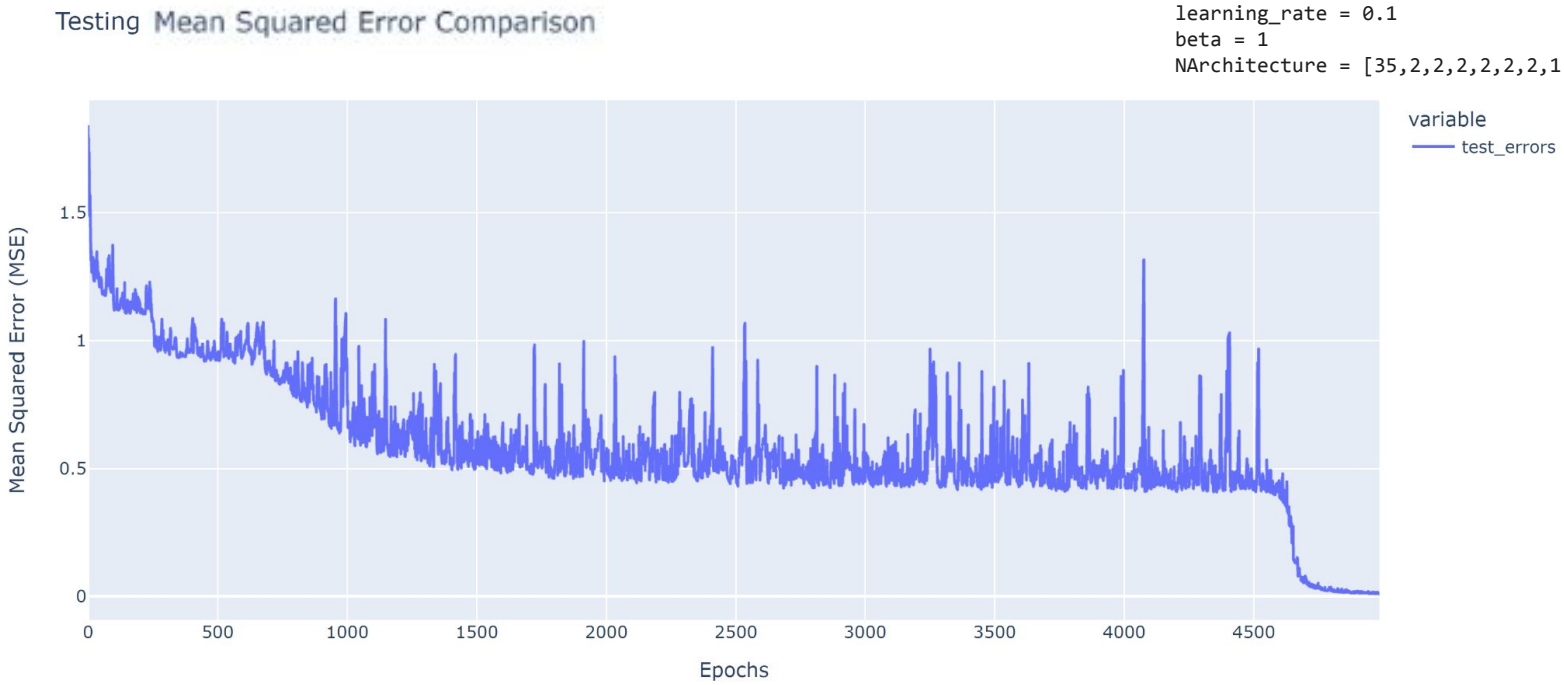
```
dataset: TP3-ej3-digitos.txt
activation_function = TAN_H
learning_rate = 0.1
beta = 1
NArchitecture = [35,2,2,1]
```



Perceptrón Multicapa: Pares (múltiples capas)

Ejercicio 2

```
dataset: TP3-ej3-digitos.txt
activation_function = TAN_H
learning_rate = 0.1
beta = 1
NArchitecture = [35,2,2,2,2,2,2,1]
```

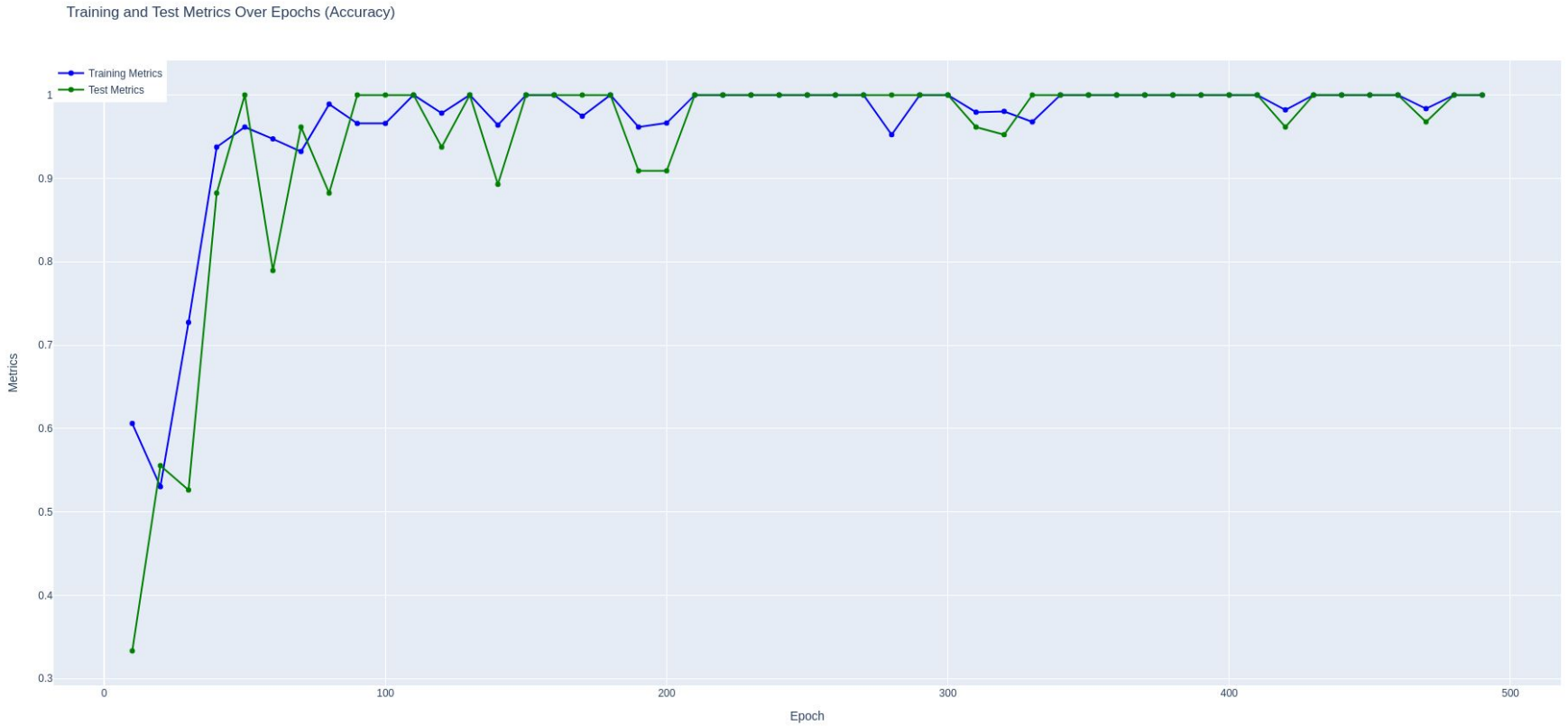


Perceptrón Multicapa: Reconocimiento de números

Perceptrón Multicapa: Reconocimiento de números

```
dataset: TP3-ej3-digits.txt
activation_function = TAN_H
learning_rate = 0.2
beta = 1
noise = 0.2
normalized (-1, 1)
architecture = [35, 10, 10]
```

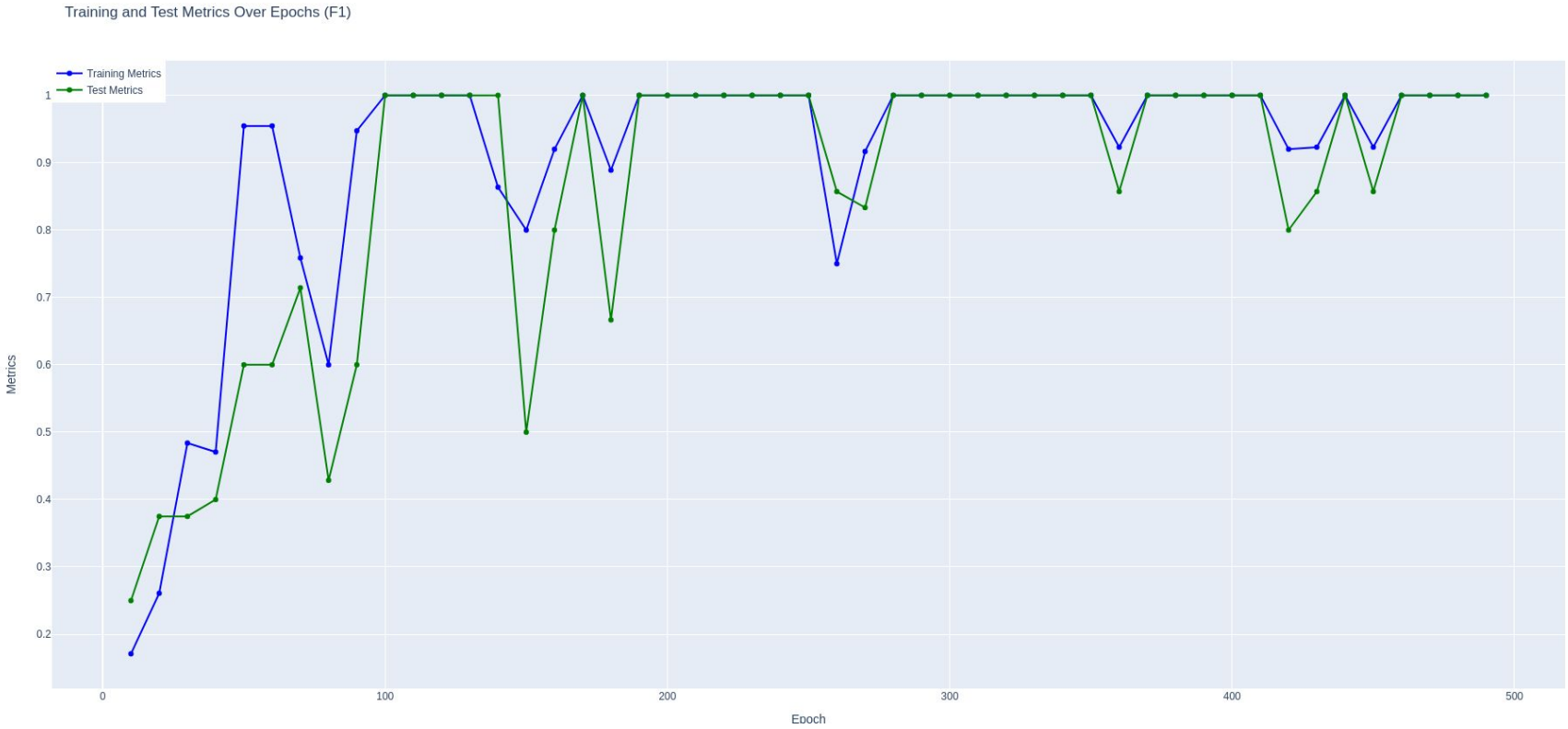
Accuracy



Perceptrón Multicapa: Reconocimiento de números

F1

```
dataset: TP3-ej3-digits.txt
activation_function = TAN_H
learning_rate = 0.2
beta = 1
noise = 0.2
normalized (-1, 1)
architecture = [35, 10, 10]
```



Perceptrón Multicapa: Reconocimiento de números

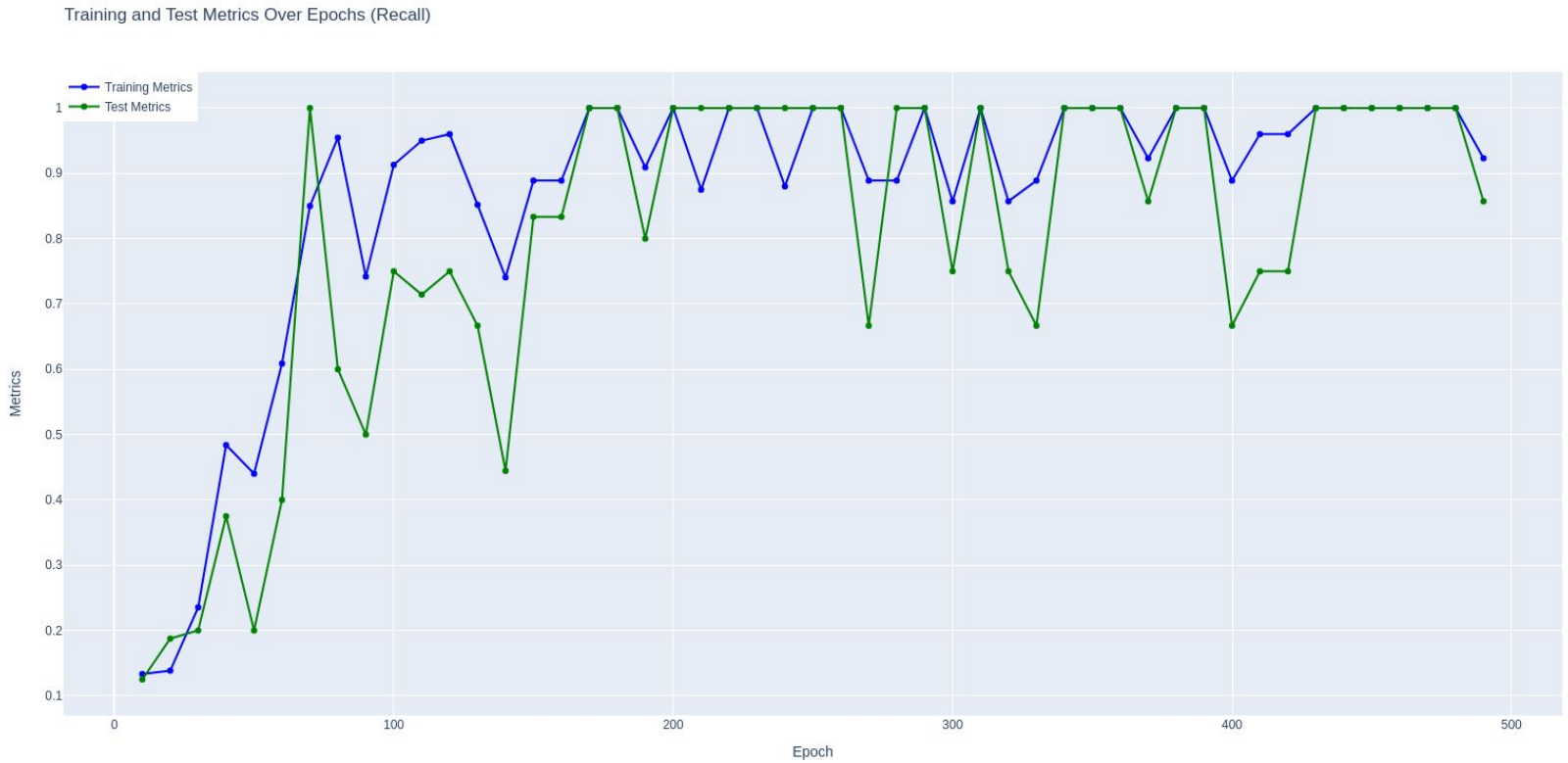
```
dataset: TP3-ej3-digits.txt
activation_function = TAN_H
learning_rate = 0.2
beta = 1
noise = 0.2
normalized (-1, 1)
architecture = [35, 10, 10]
```

Precision

Perceptrón Multicapa: Reconocimiento de números

Recall

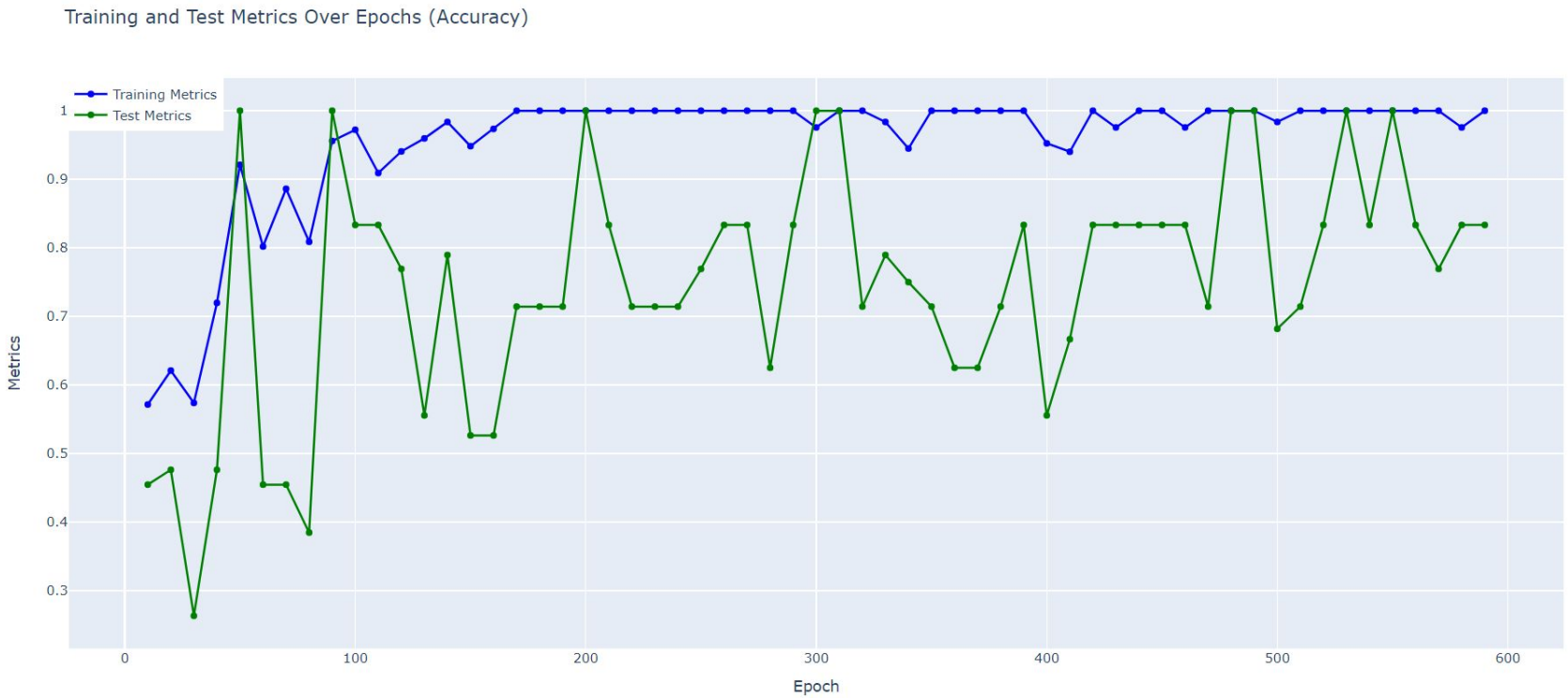
```
dataset: TP3-ej3-digits.txt
activation_function = TAN_H
learning_rate = 0.2
beta = 1
noise = 0.2
normalized (-1, 1)
architecture = [35, 10, 10]
```



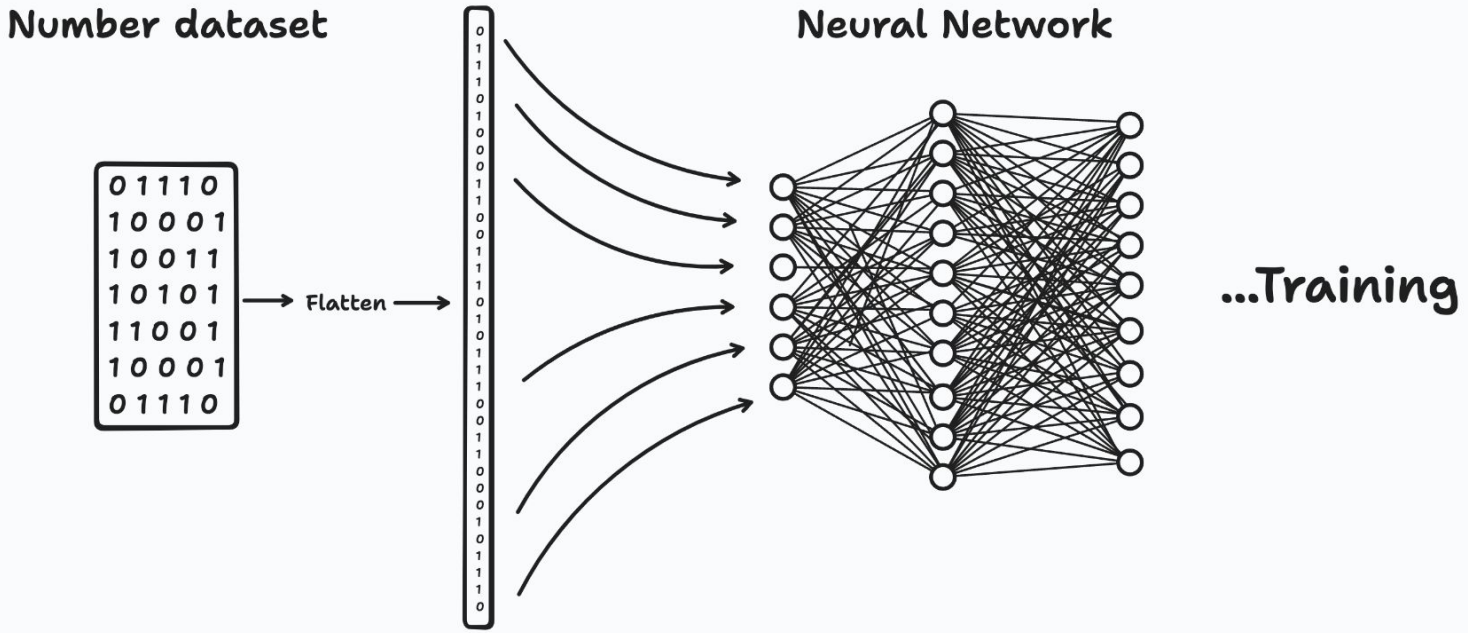
Perceptrón Multicapa: Reconocimiento de números

Accuracy

```
dataset: TP3-ej3-digits.txt
activation_function = TAN_H
learning_rate = 0.2
beta = 1
noise = 0.85
normalized (-1, 1)
architecture = [35, 10, 10]
```




One more thing...


Number dataset
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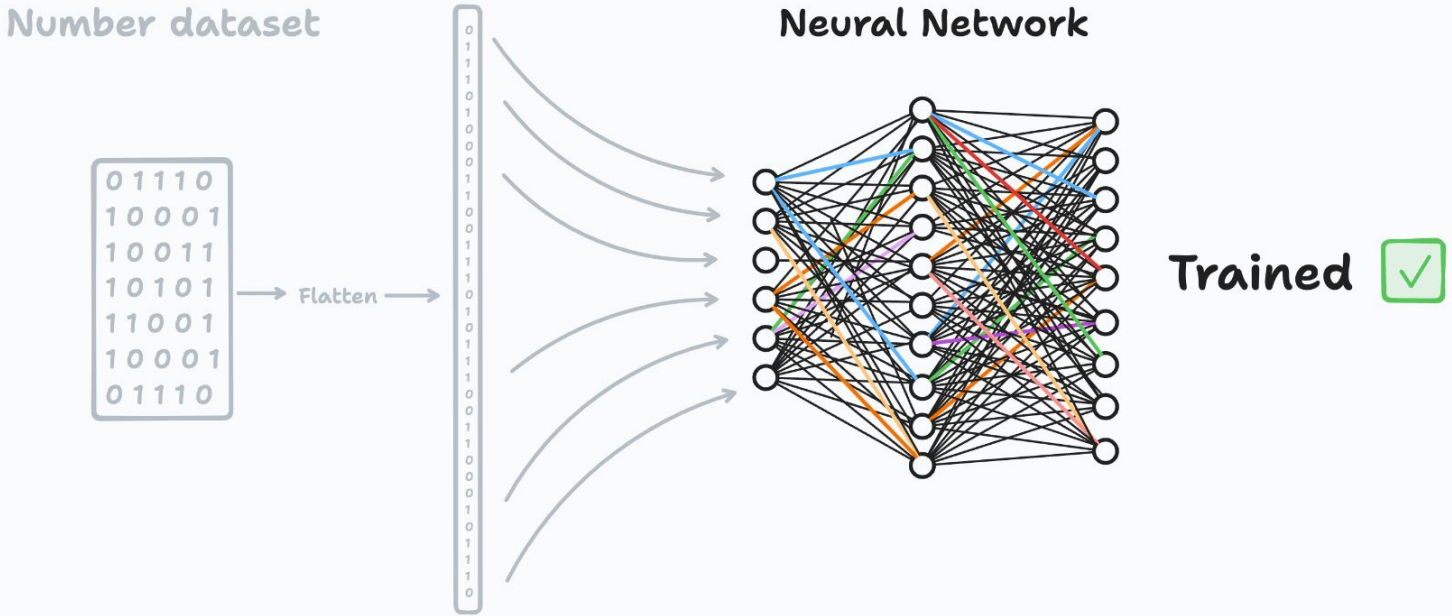
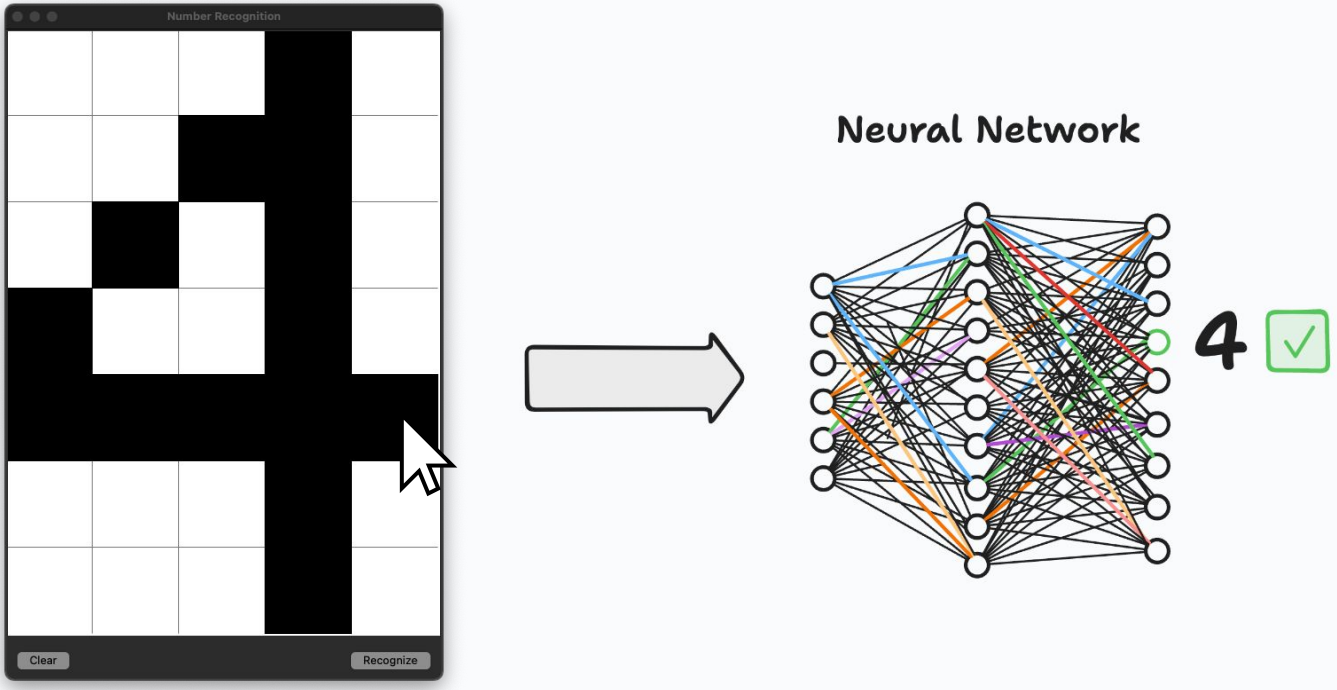
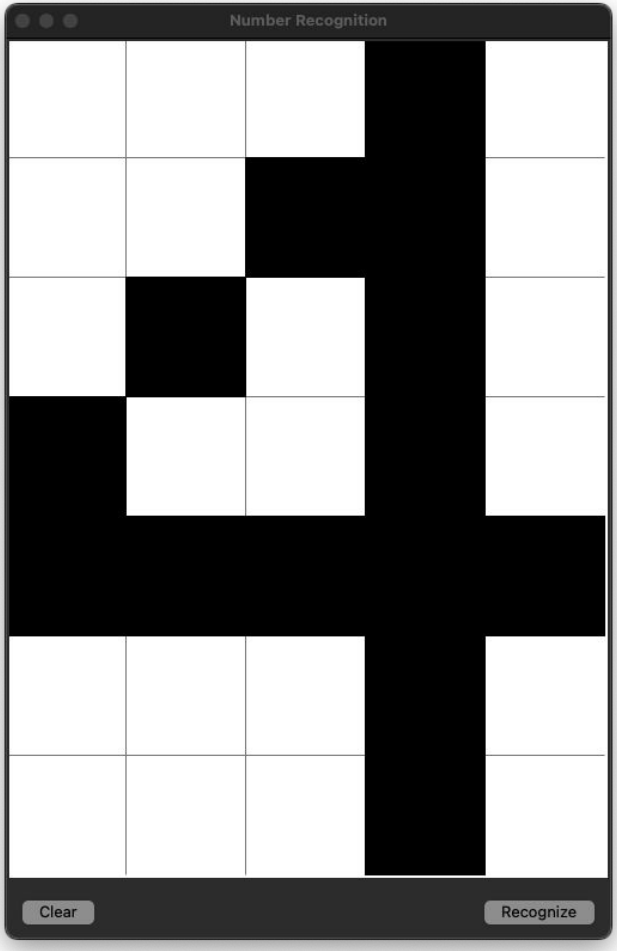
1 0 0 0 1
1 0 0 1 1
1 0 1 0 1
1 1 0 0 1
1 0 0 0 1
0 1 1 1 0
Flatten
Neural Network
...Training

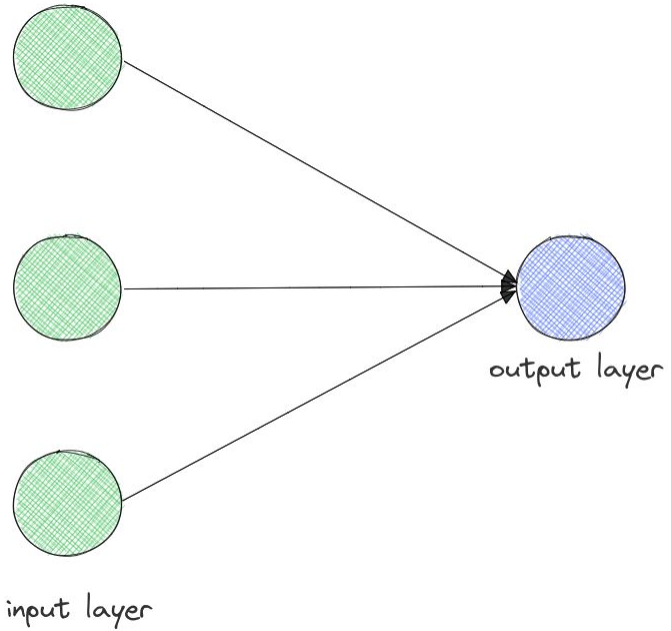

Number dataset
0 1 1 1 0
1 0 0 0 1
1 0 0 1 1
1 0 1 0 1
1 1 0 0 1
1 0 0 0 1
0 1 1 1 0
Flatten
Neural Network
Trained

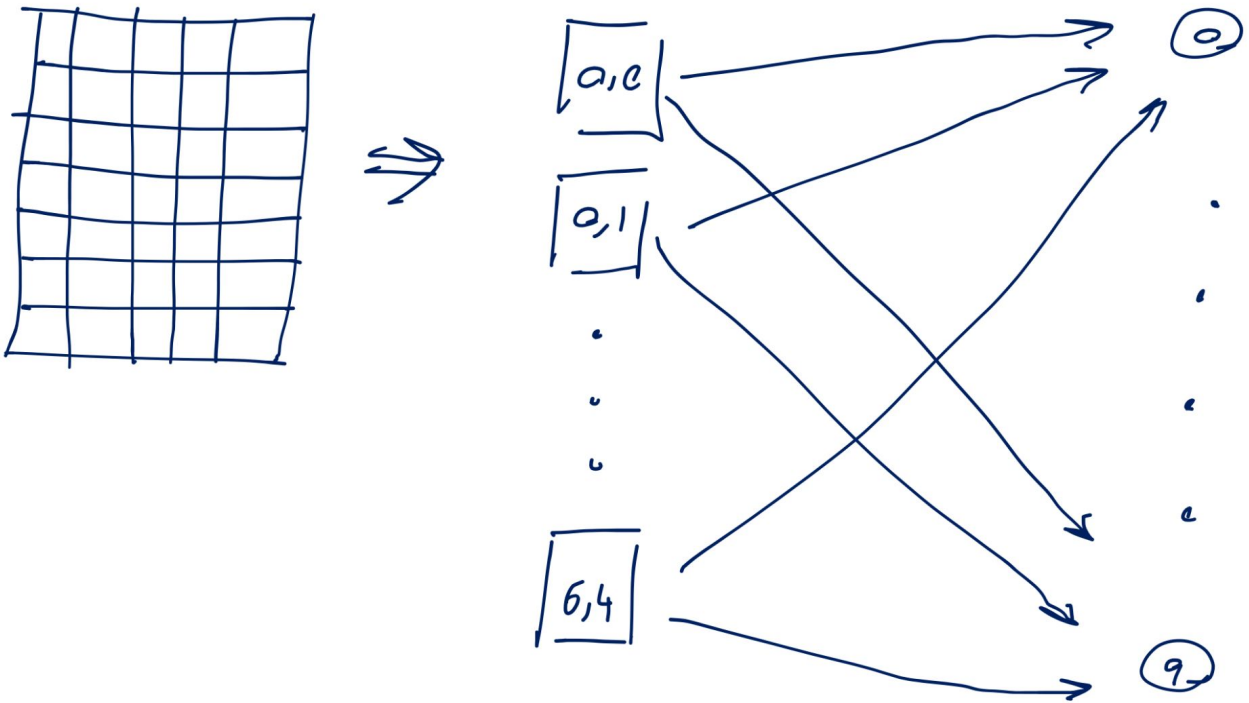

Number Recognition
Clear
Recognize
Neural Network
4

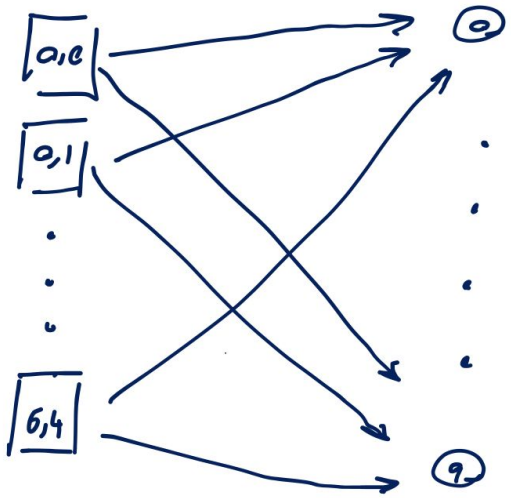



```
pipenv run python3 cli.py
~/Projects/sia/tp3 git:(main) ±16
pipenv run python3 cli.py
[0 1 1 1 0 1 0 0 0 1 1 0 0 1 1 1 0 1 0 1 1 1 0 0 1 1 0 0
 0 1 0 1 1 1 0]
Match: 0
Candidate: 3
Candidate: 6
[0 1 1 1 0 1 0 0 0 1 0 0 0 0 1 0 0 1 1 0 0 0 0 0 1 1 0 0
 0 1 0 1 1 1 0]
Match: 3
Candidate: 8
Candidate: 2
[0 1 1 1 0 1 0 0 0 1 1 0 0 0 1 0 1 1 1 1 0 0 0 0 1 0 0 0
 1 0 0 1 1 0 0]
Match: 9
Candidate: 6
Candidate: 3
[1 1 1 1 1 1 0 0 0 0 1 1 1 1 0 0 0 0 0 1 0 0 0 0 1 1 0 0
 0 1 0 1 1 1 0]
Match: 5
Candidate: 3
Candidate: 6
[0 1 1 1 0 1 0 0 0 1 0 0 0 0 1 0 0 1 1 0 0 0 0 0 1 1 0 0
 0 1 0 1 1 1 0]
Match: 3
Candidate: 8
Candidate: 2
[0 1 1 1 0 1 0 0 0 1 1 0 0 0 1 0 1 1 1 1 0 0 0 0 1 0 0 0
 1 0 0 1 1 0 0]
Match: 9
Candidate: 6
Candidate: 3
[0 0 0 1 0 0 0 1 1 0 0 1 0 1 0 1 0 0 1 0 1 1 1 1 1 0 0 0
 1 0 0 0 0 1 0]
Match: 4
Candidate: 8
Candidate: 1
```

Red neuronal sin hidden layers

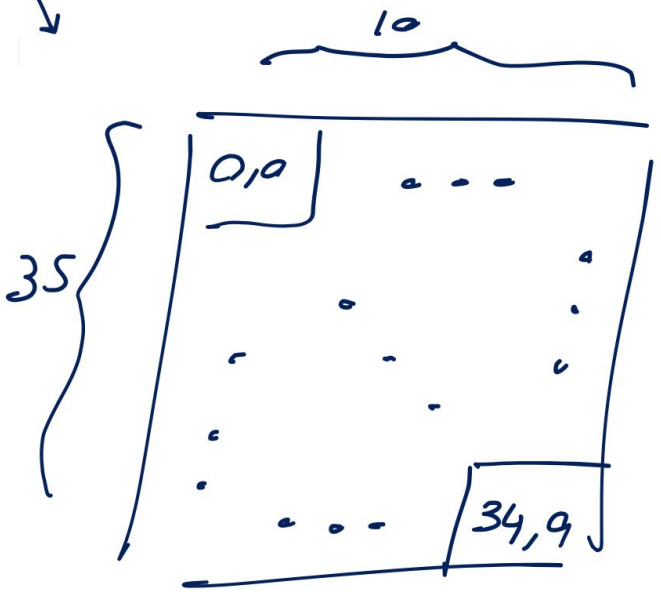



0,0
0,1
6,4
0
9



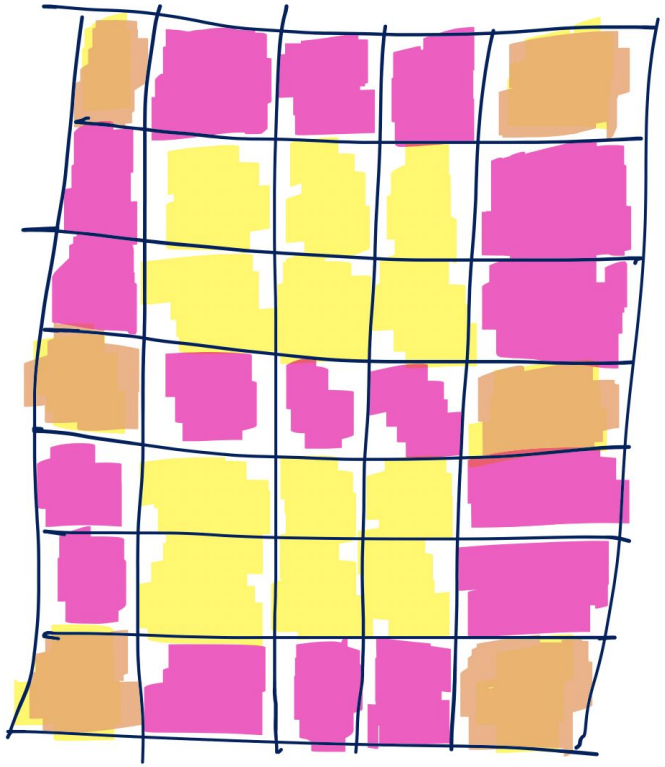
3500 weights

350 per neurone

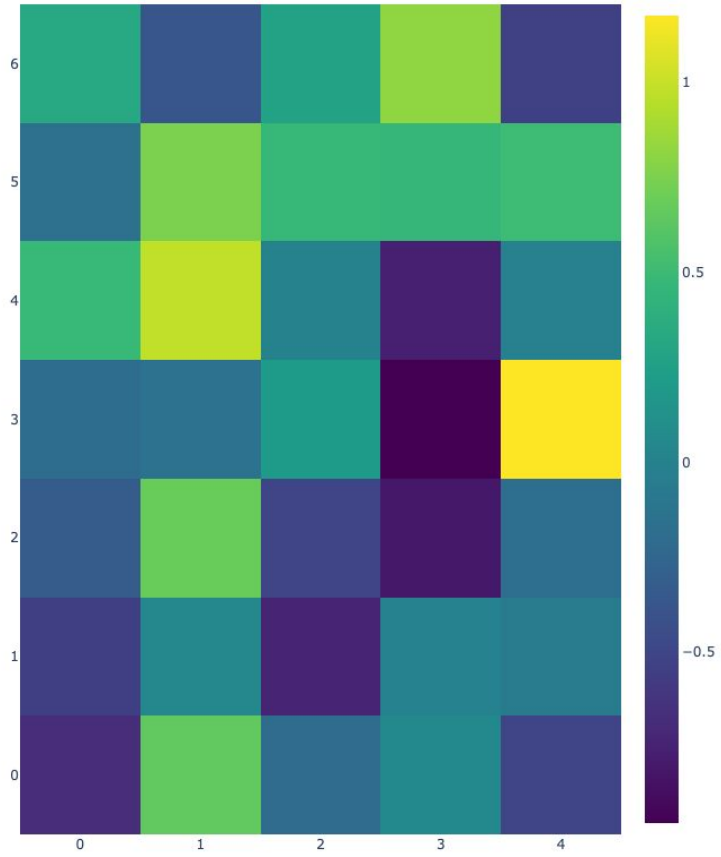


Y si dibujamos los pesos relacionados con cada neurona?

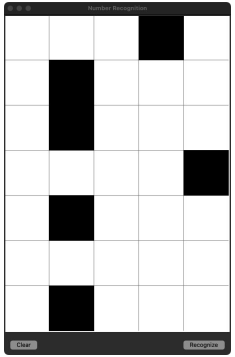
Expectativa

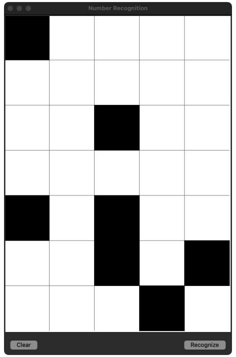


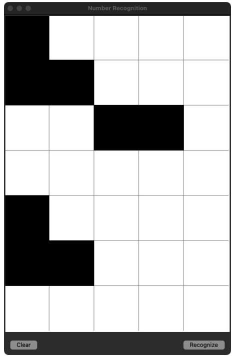
Realidad

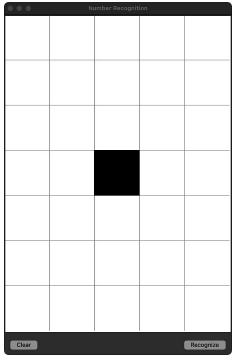

6
5
4
3
2
1
0
0
1
2
3
4
1
0.5
0
−0.5

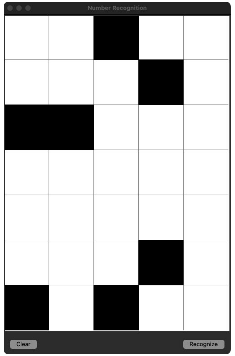
0 1 2 3 4 5

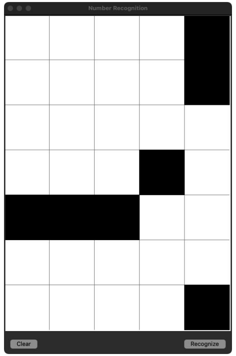




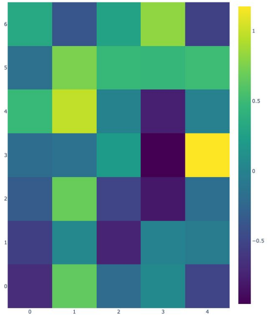




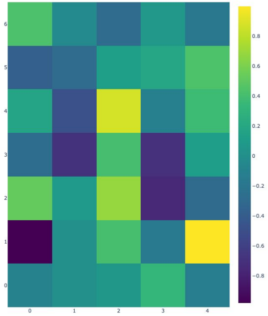




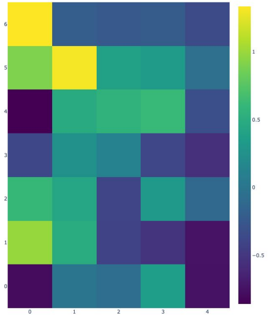
Heatmap Example Digit 0



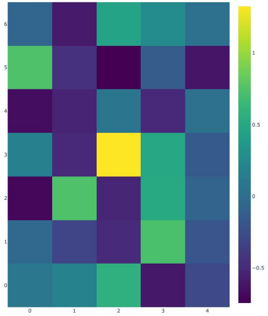
Heatmap Example Digit 1



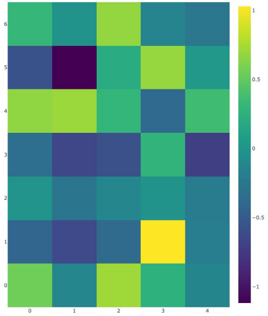
Heatmap Example Digit 2



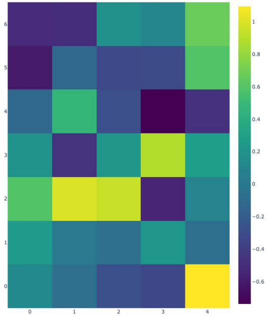
Heatmap Example Digit 3



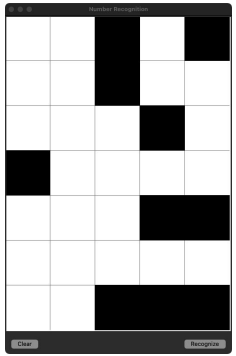
Heatmap Example Digit 4



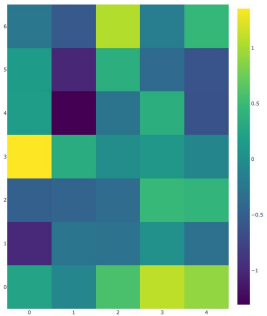
Heatmap Example Digit 5



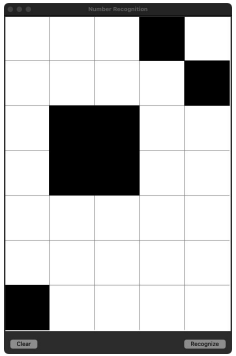
6



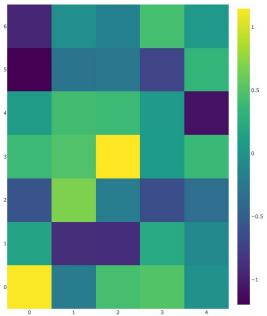
Heatmap Example Digit 6



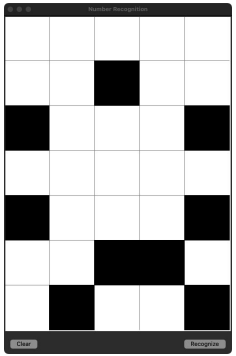
7



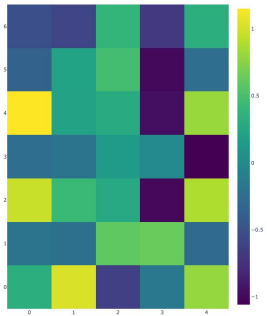
Heatmap Example Digit 7



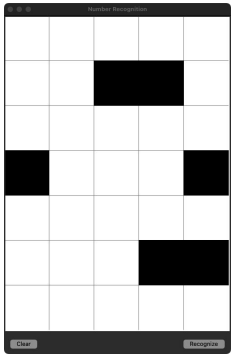
8



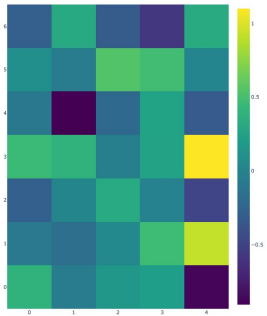
Heatmap Example Digit 8



9



Heatmap Example Digit 9



¡Muchas gracias!

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