

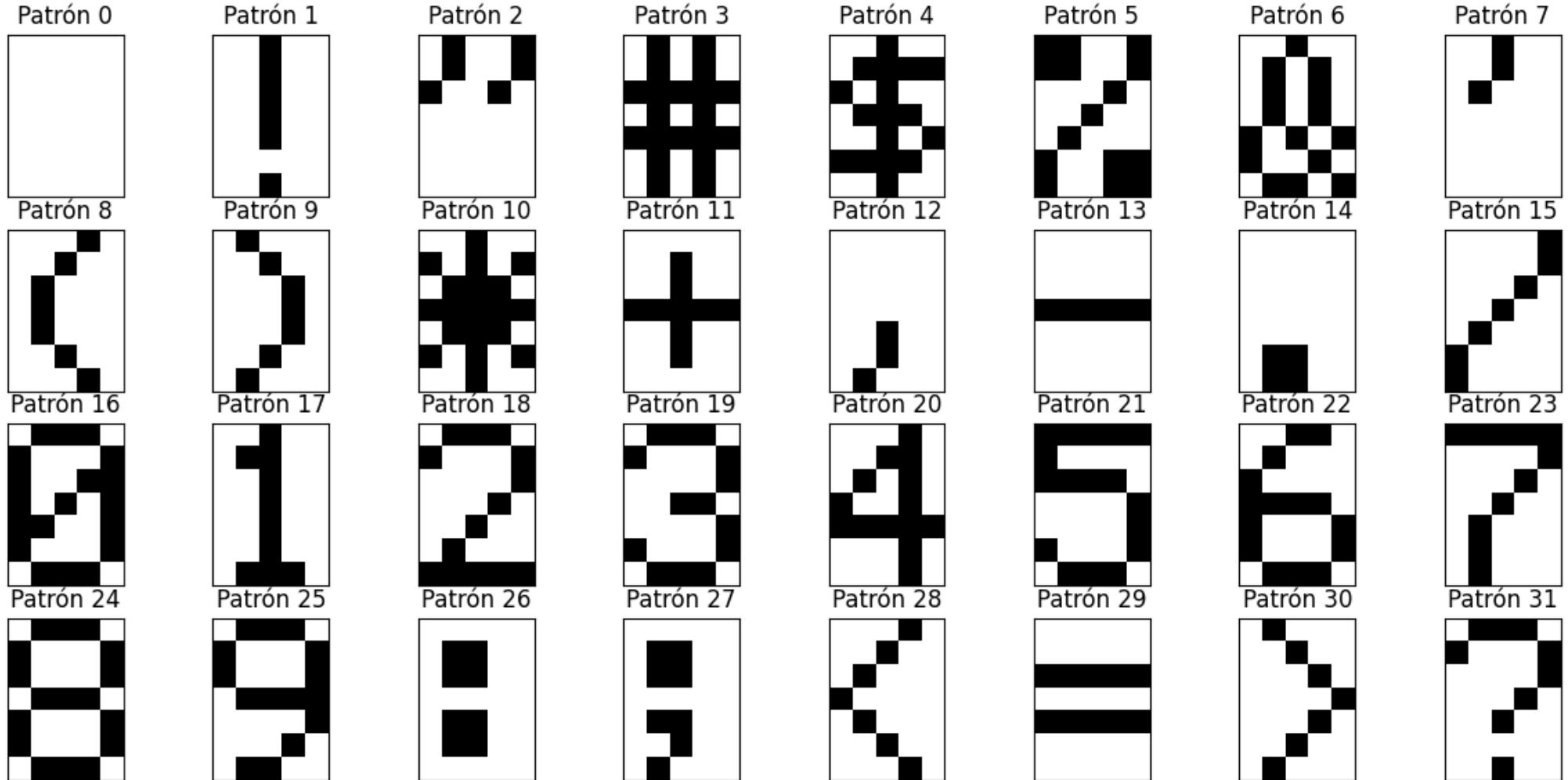
(20242Q) 72.27 - Sistemas de
Inteligencia Artificial - Comisión: S

Grupo 9

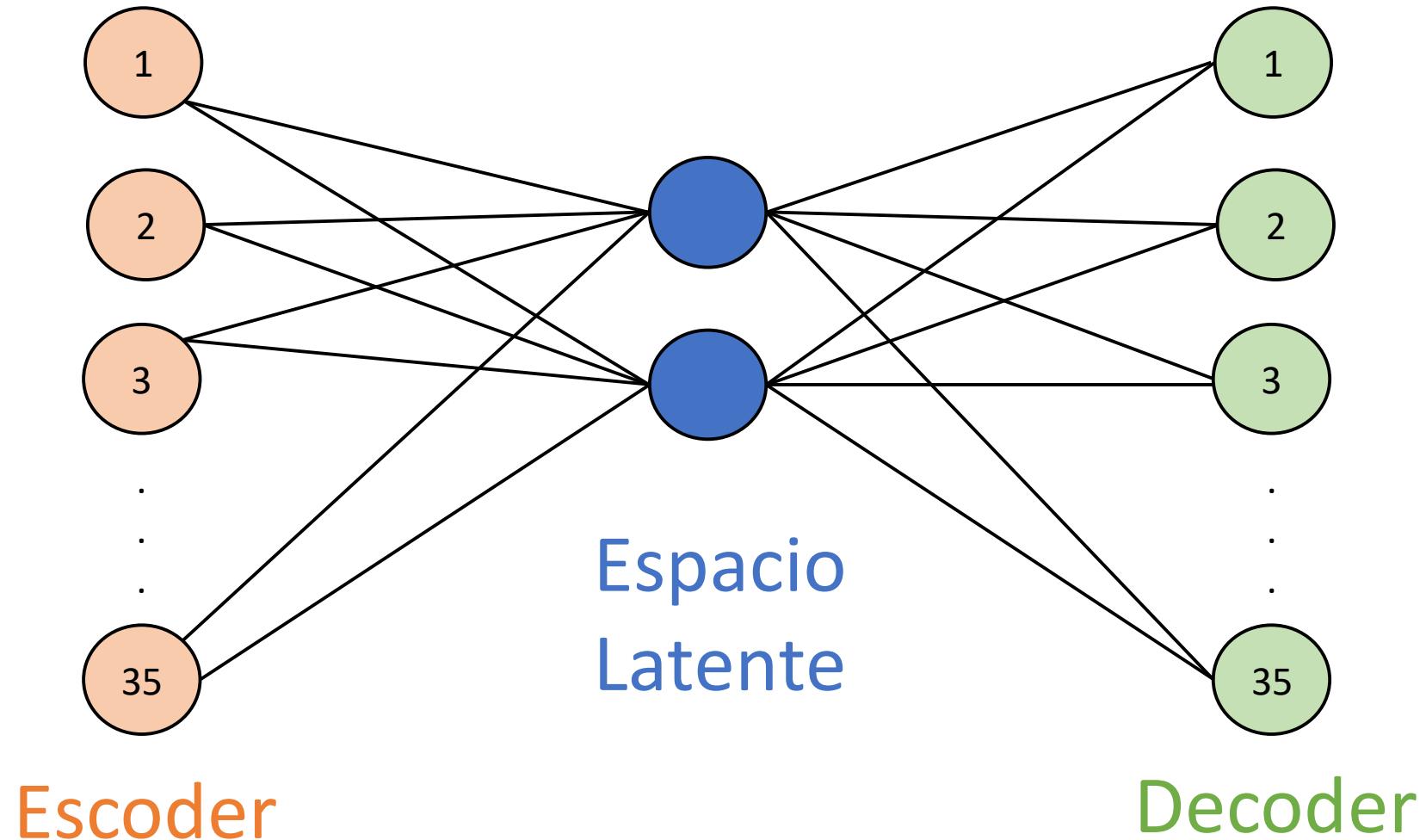
Pellegrini Jorge Orlando

Set de datos

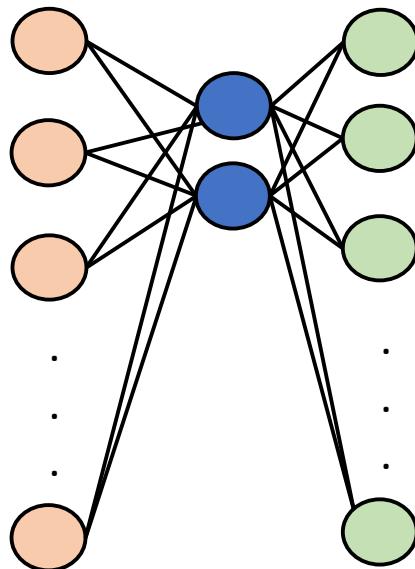
32 patrones de $7 \times 5 = 35$ atributos



Autoencoder



Estructura del Autoencoder



Definido

Dimensión del espacio latente

A definir

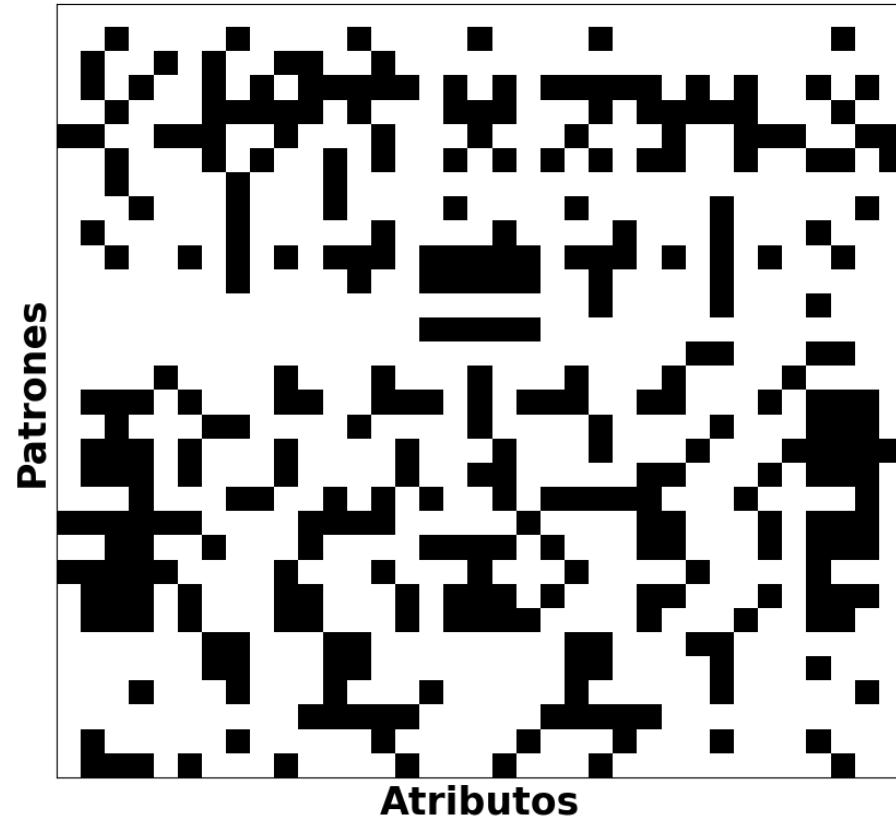
Threshold de la predicción
Profundidad (capas y neuronas) del encoder
Profundidad (capas y neuronas) del decoder
Inclusión del bias
Función de activación
Cada capa puede tener su configuración

Optimización Heurística

Simulated Annealing

- Limitada dimensionalidad del problema
- Facilidad de implementación
- Versatilidad en la estructura de la red
- Flexibilidad en armar la Función Objetivo
- La convergencia abierta beneficia la evaluación en el espacio latente

Matriz de datos



Estrategia para elegir la arquitectura

- Inicialización aleatoria uniforme
- Comenzar con una arquitectura básica
- Emplear la función objetivo:

$$\text{Función Objetivo} = \sum_{\text{patrón}} \sum_{\text{atributo}} |y_{\text{modelo}} - y_{\text{dato}}|$$

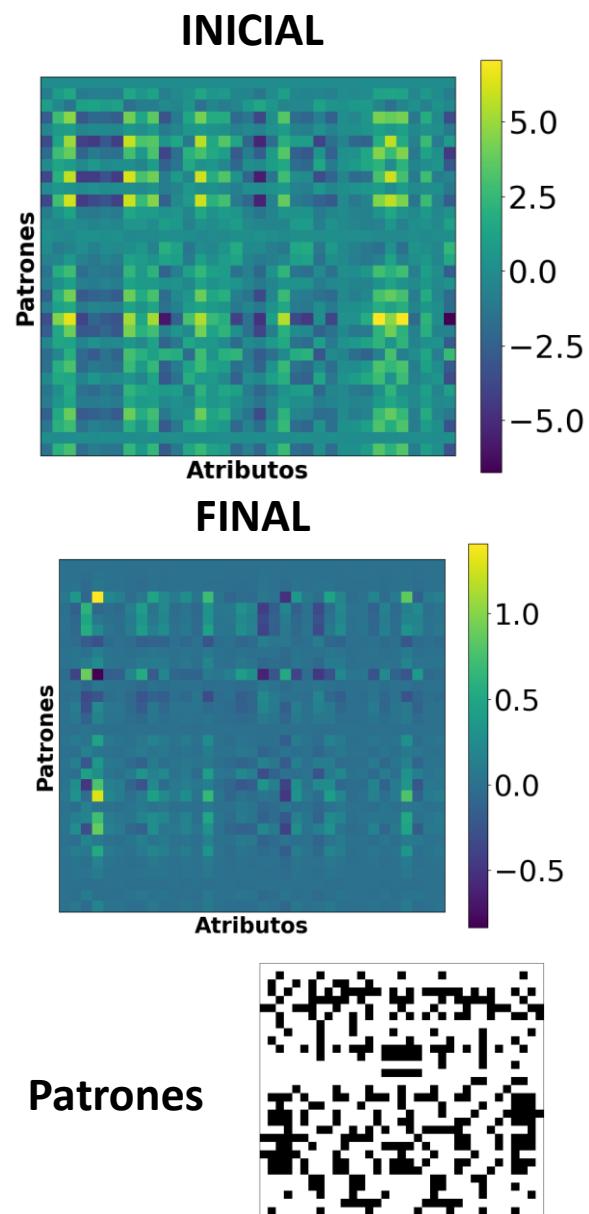
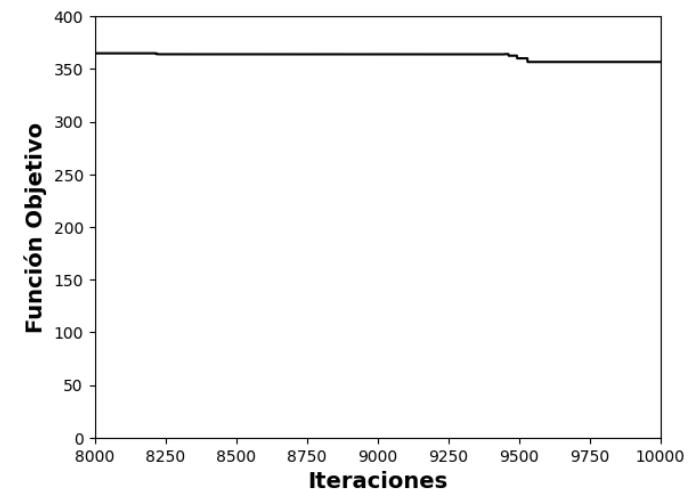
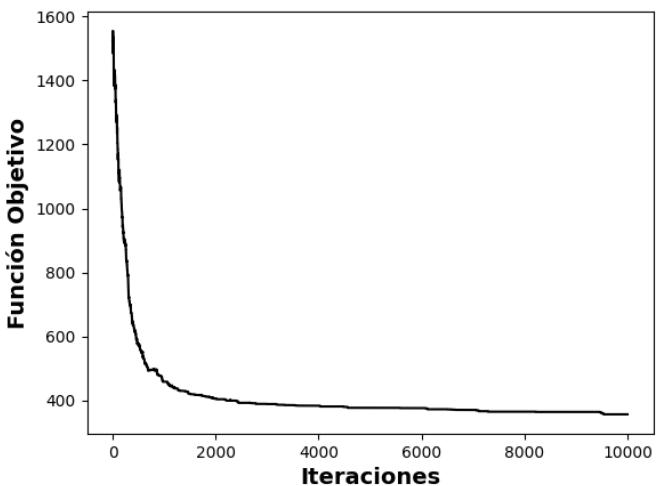
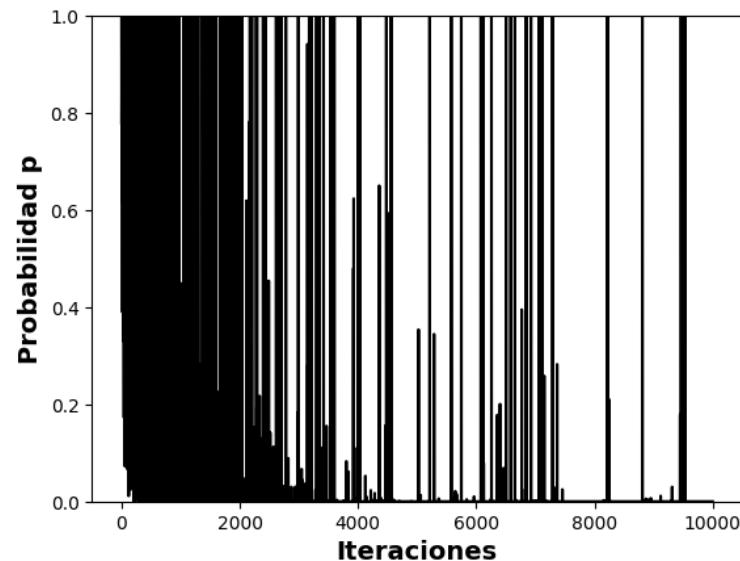
$$P = p_0 e^{\frac{-\Delta E}{T}}$$

ΔE : Variación de la función objetivo
 T : $f(\text{iteraciones})$

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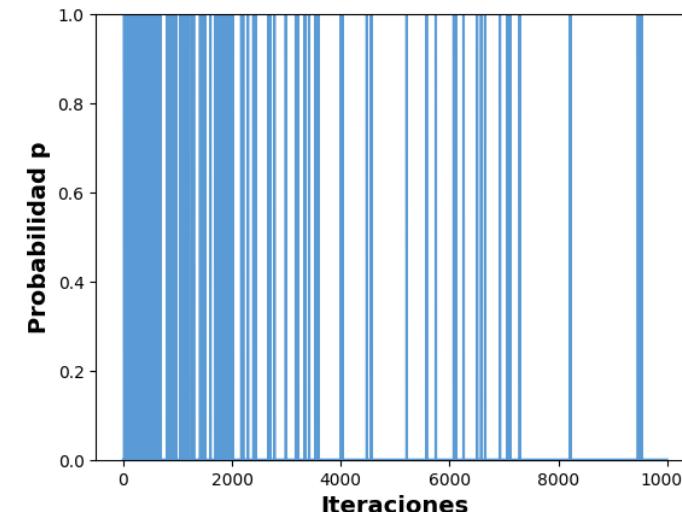
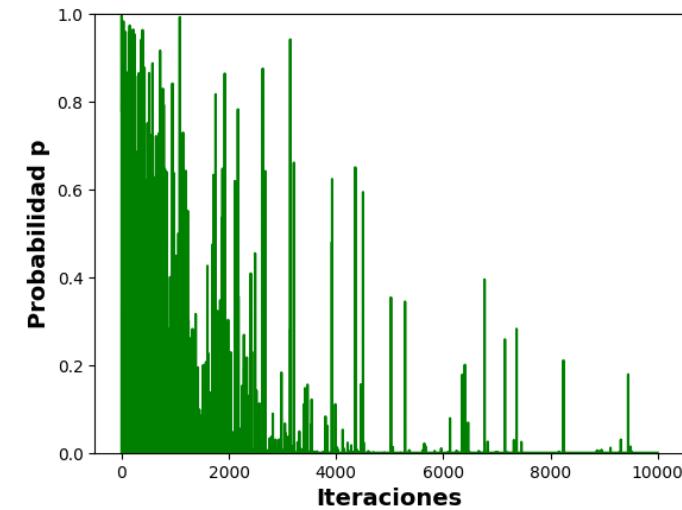
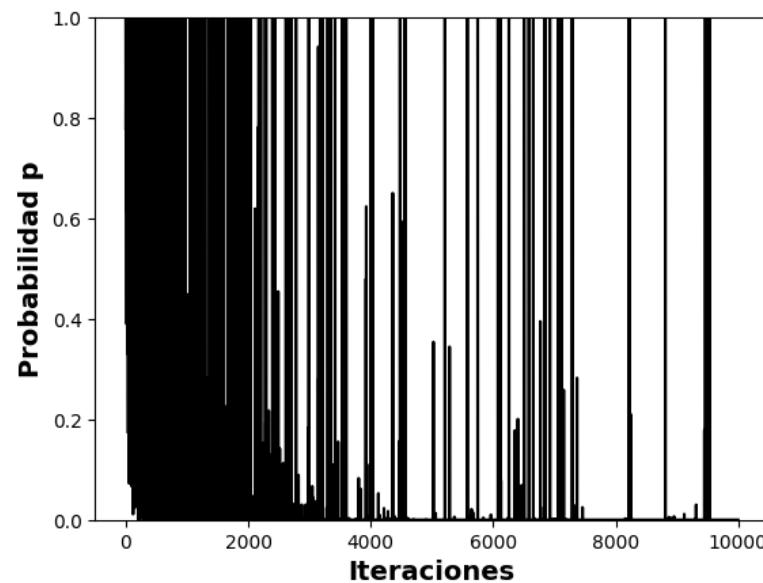
	Función Activación	Profundidad
Encoder	-	1 capa-35 neuronas
Decoder	Lineal	1 capa-35 neuronas
Espacio latente	Lineal	2 neuronas

Actualización	Temperatura	Tamaño de paso
$T = T_i/(iter + 1)$	10000	0.05

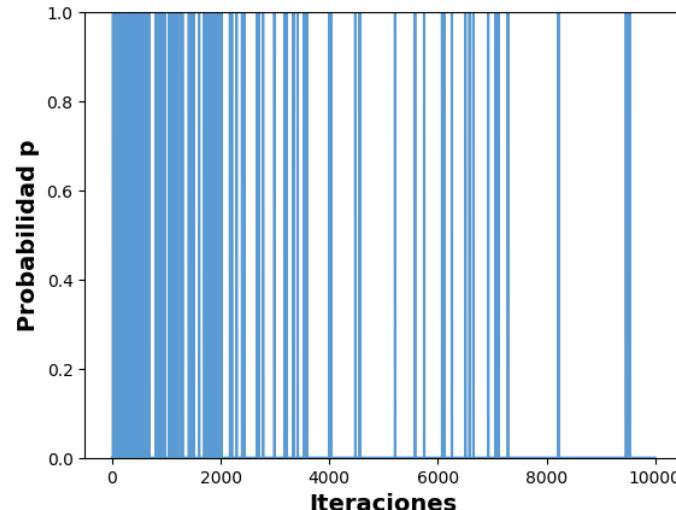
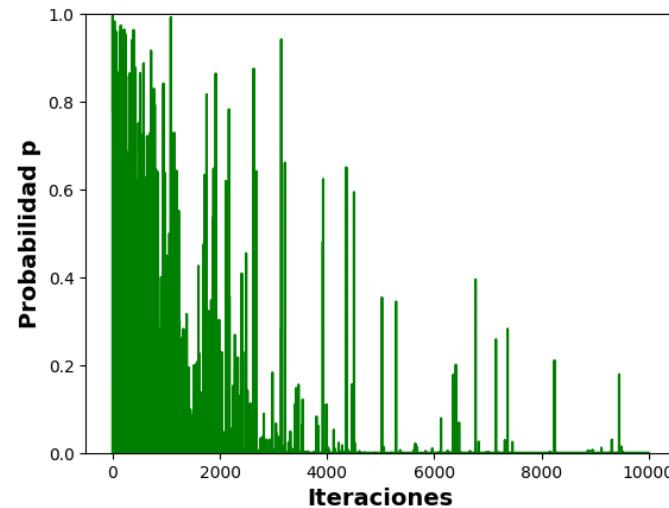


$$P = p_0 e^{\frac{-\Delta E}{T}}$$

F.O aumenta
F.O disminuye



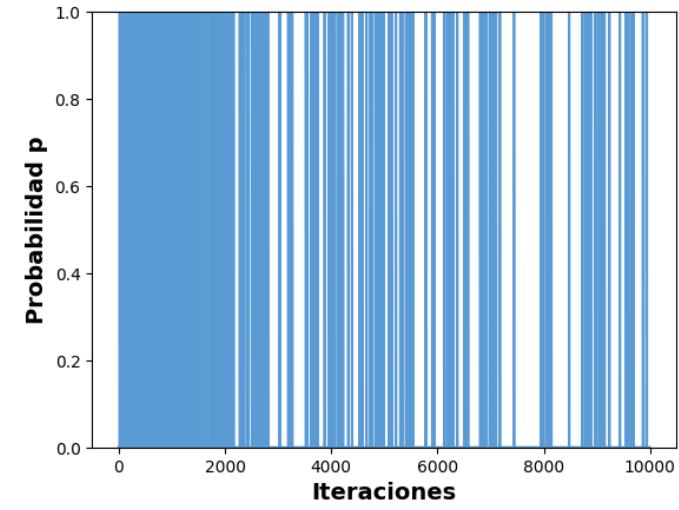
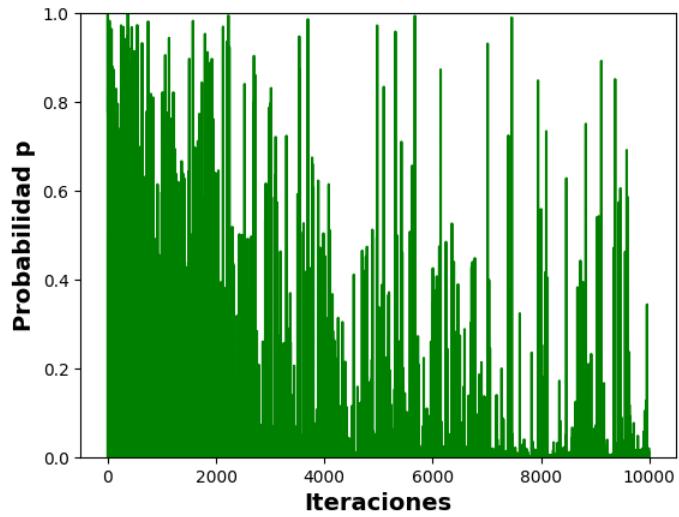
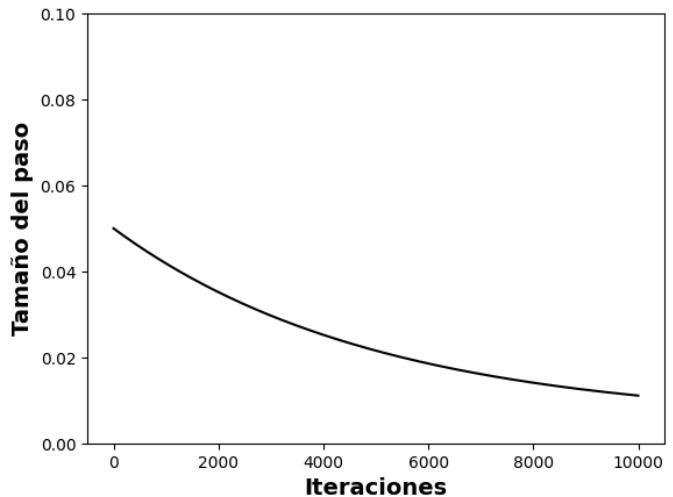
Tamaño de paso constante 0.05



FO=356.60

Tamaño de paso variable

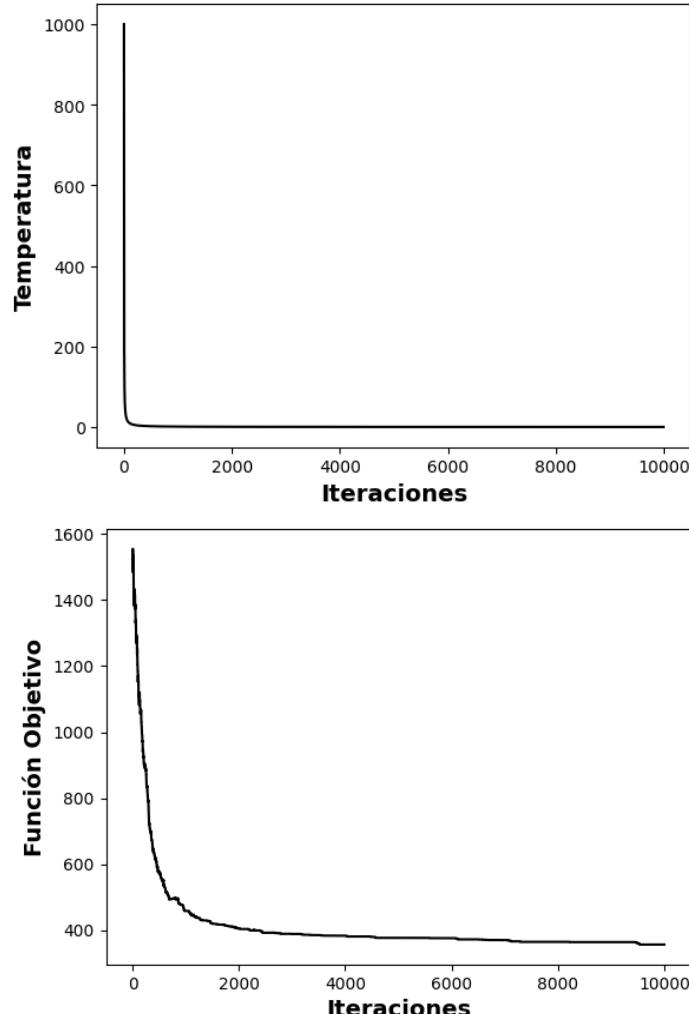
F.O aumenta
F.O disminuye



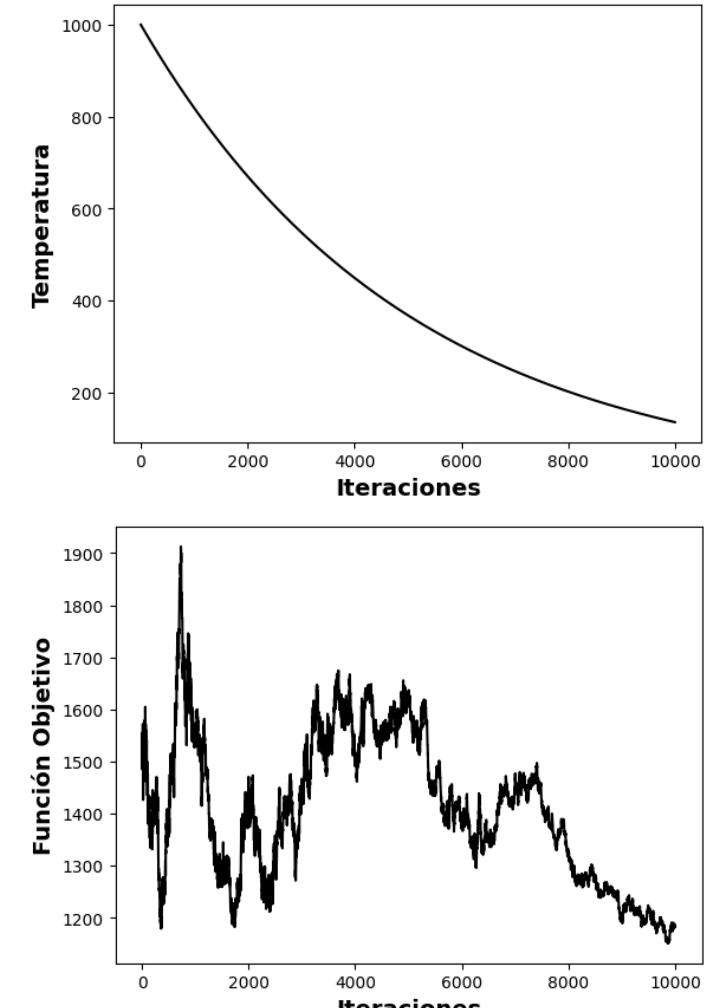
FO=300.70

Función Temperatura

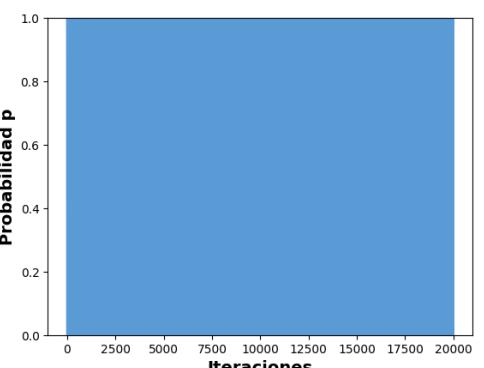
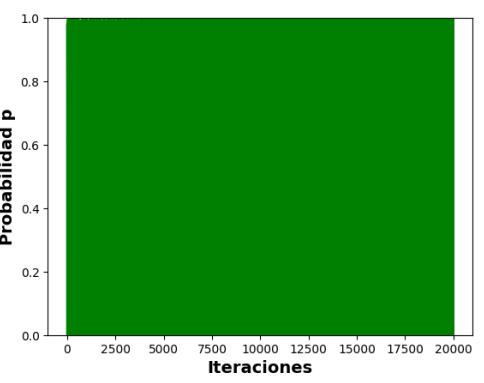
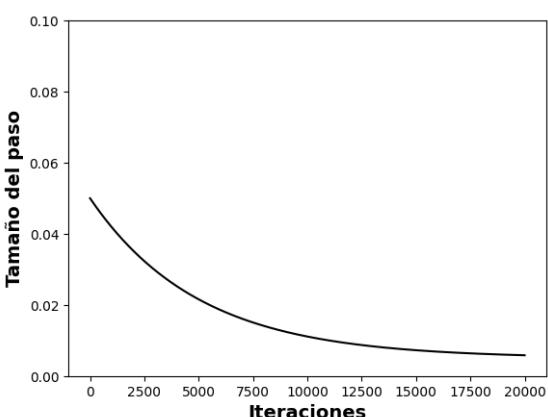
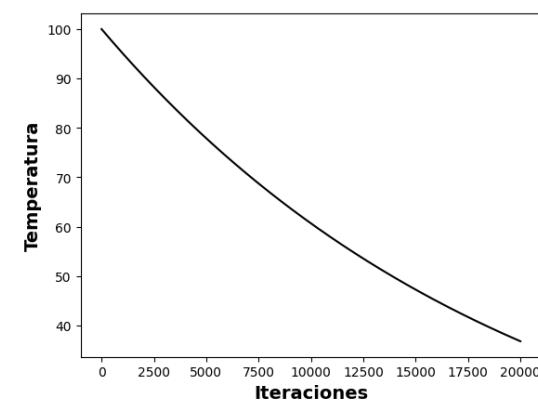
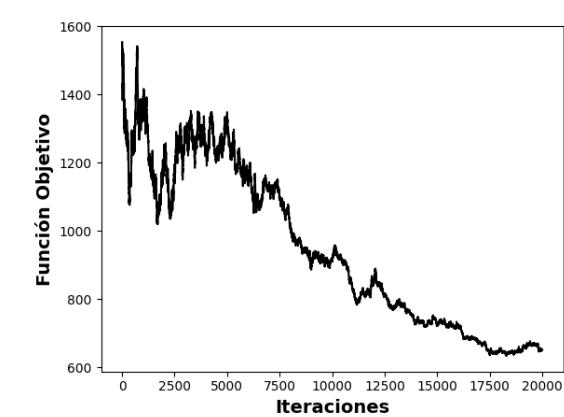
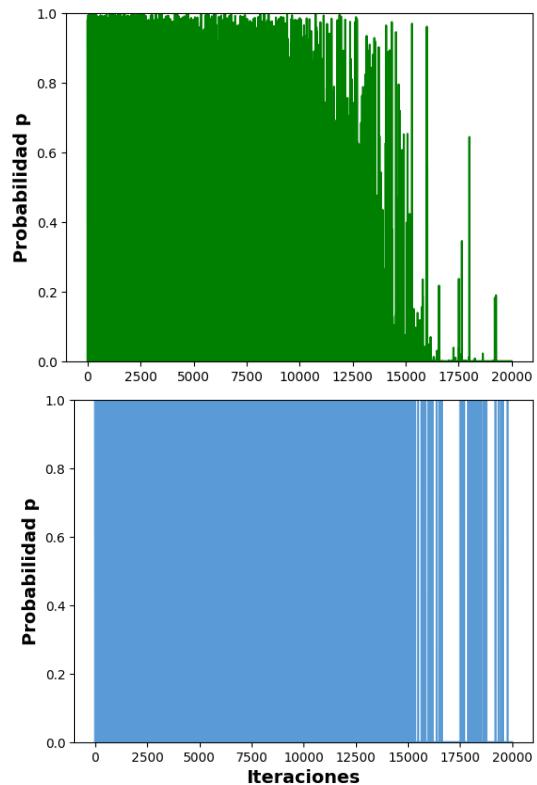
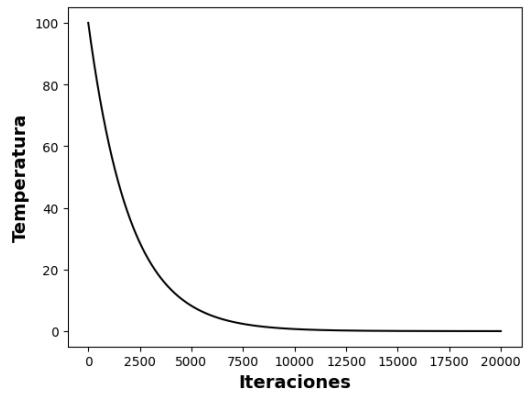
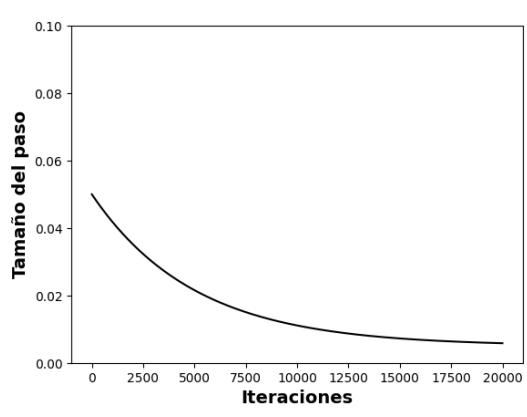
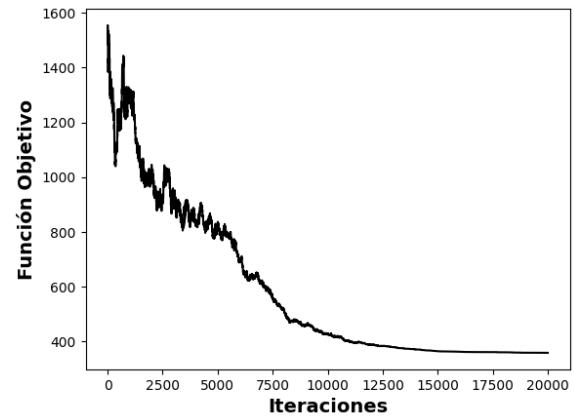
$$T = \frac{T_i}{iter + 1}$$



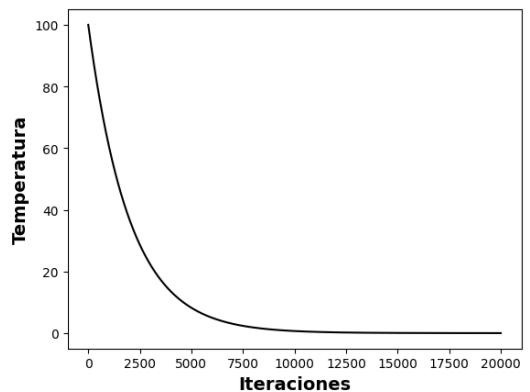
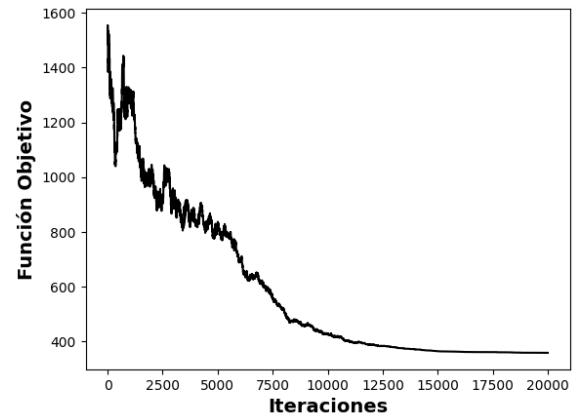
$$T = T_i e^{-\frac{iter}{5000}}$$



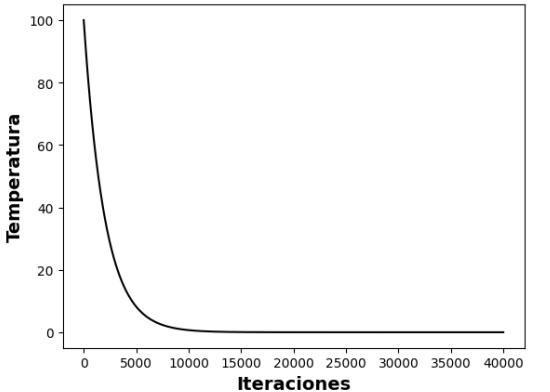
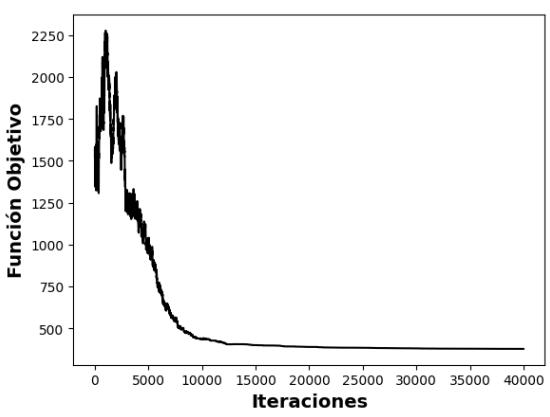
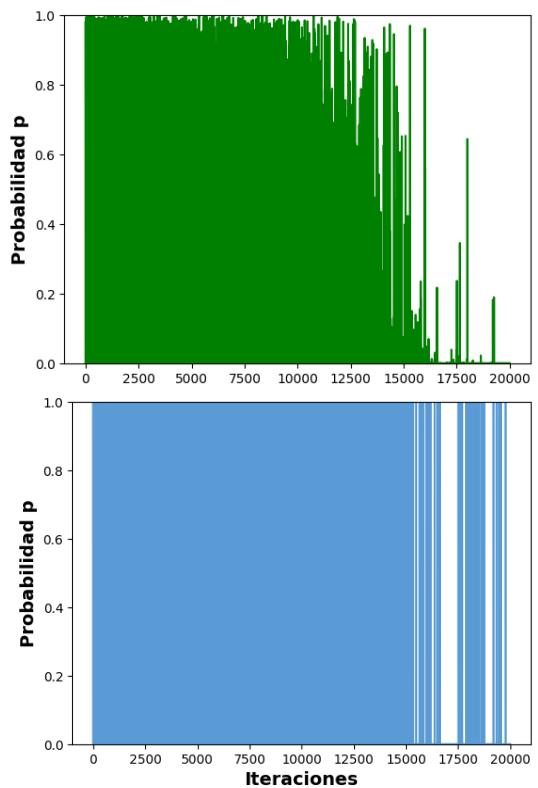
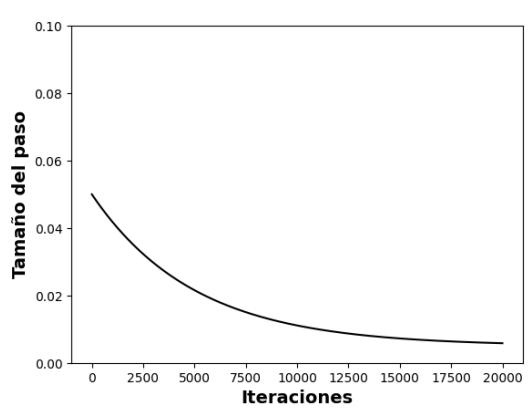
Sistemas de Inteligencia Artificial 2024 2Q



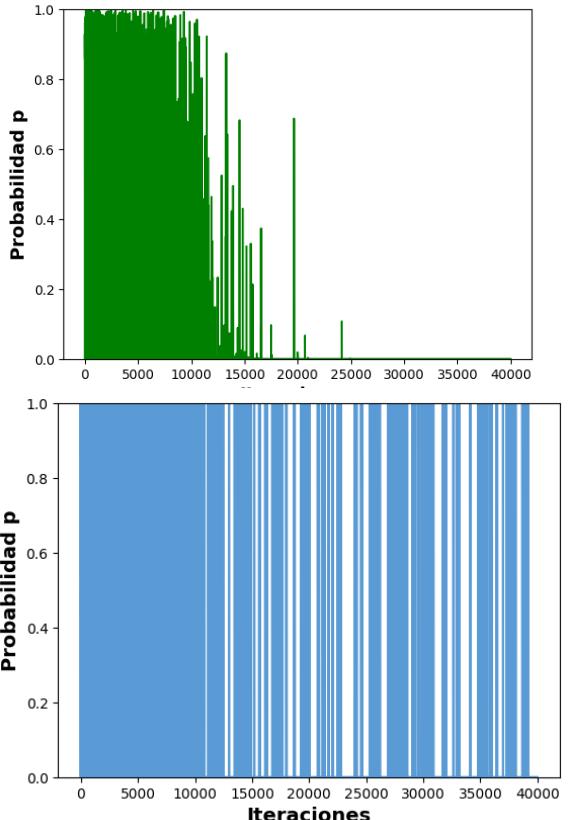
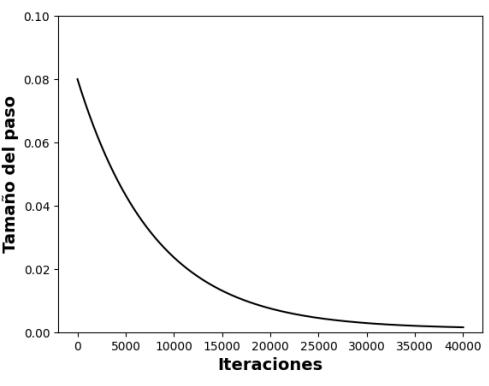
Sistemas de Inteligencia Artificial 2024 2Q



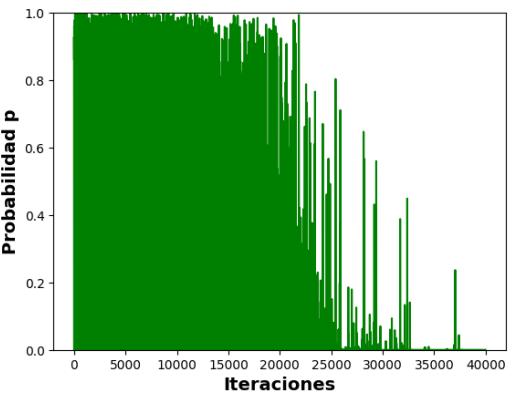
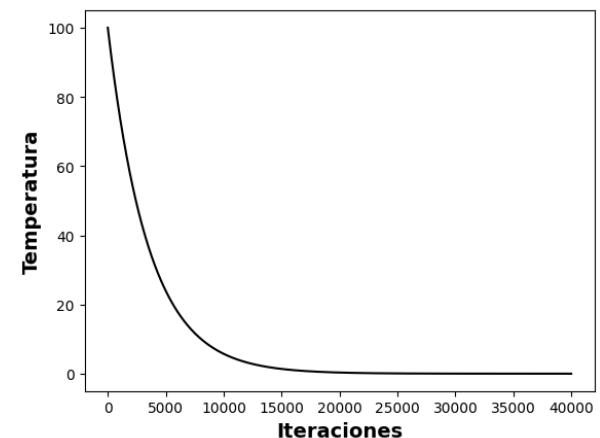
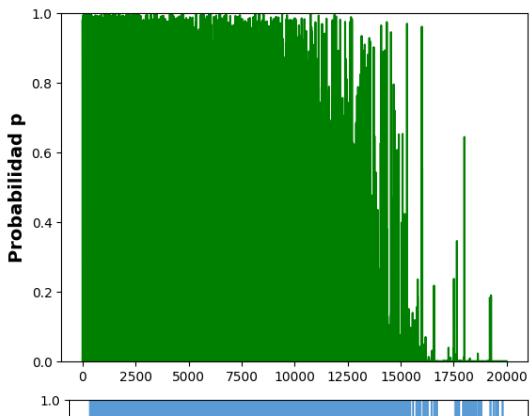
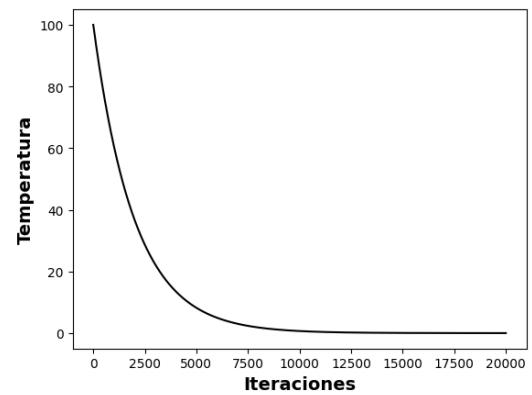
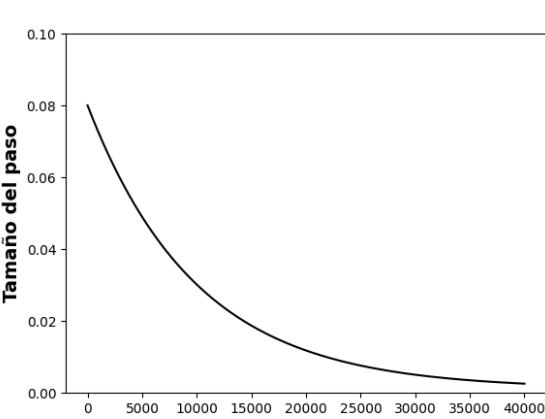
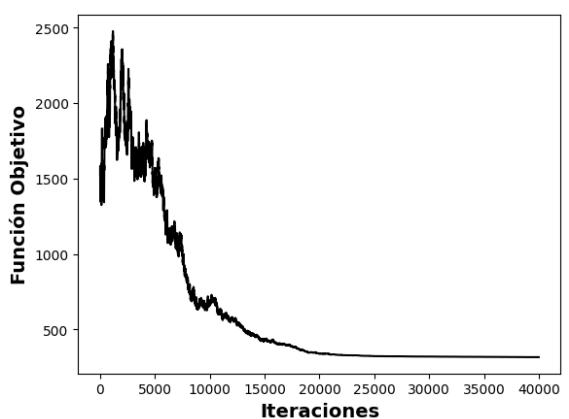
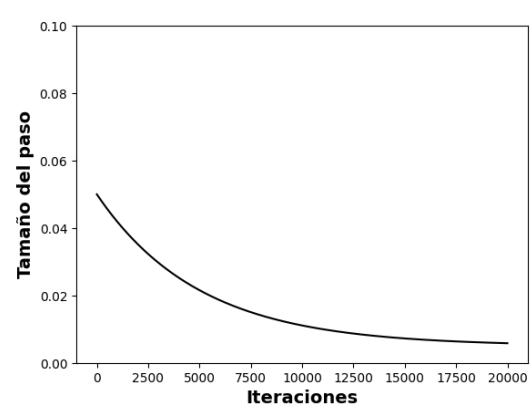
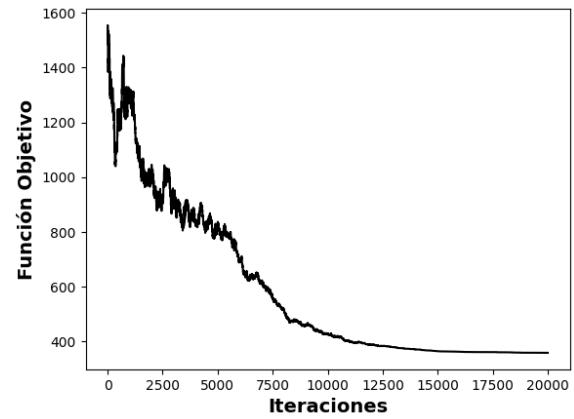
FO=357.64



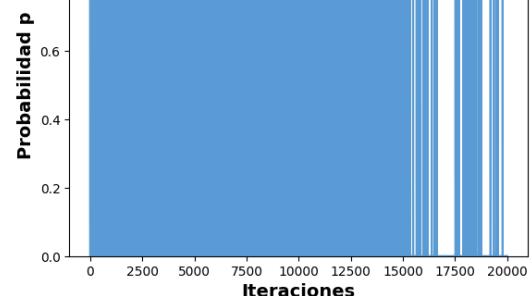
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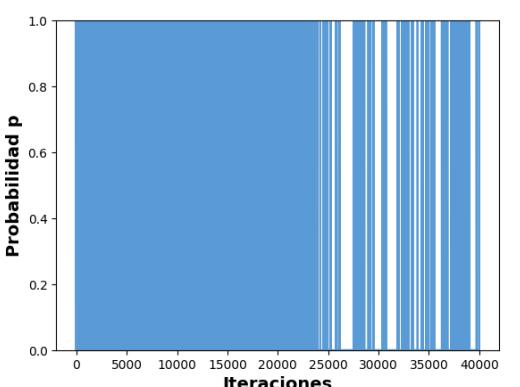
Sistemas de Inteligencia Artificial 2024 2Q



FO=357.64



FO=316.13

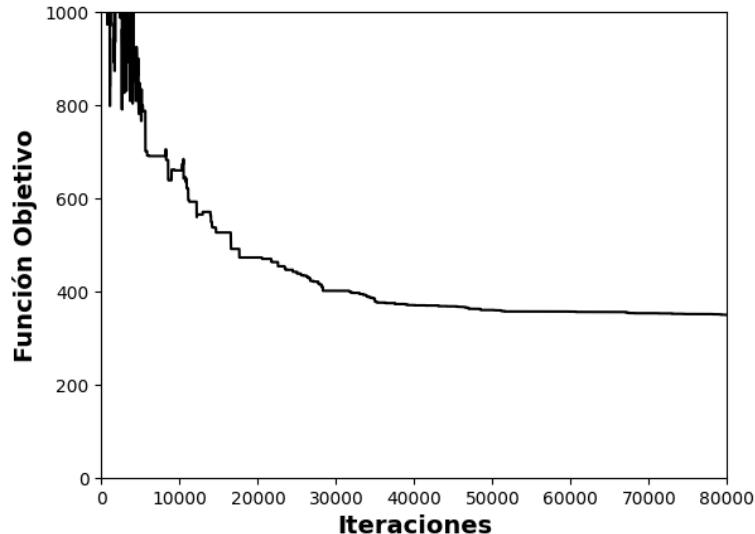
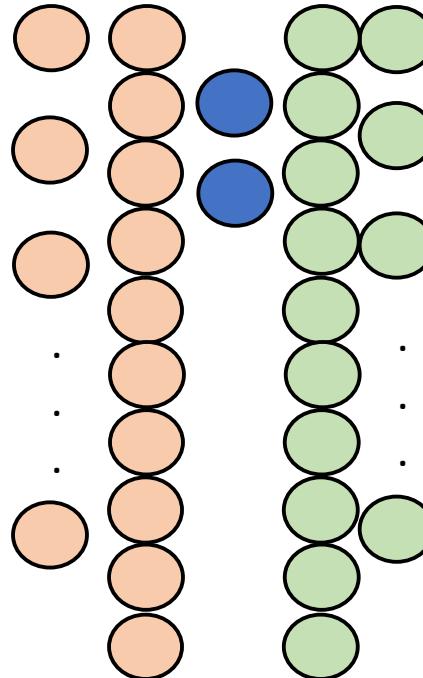
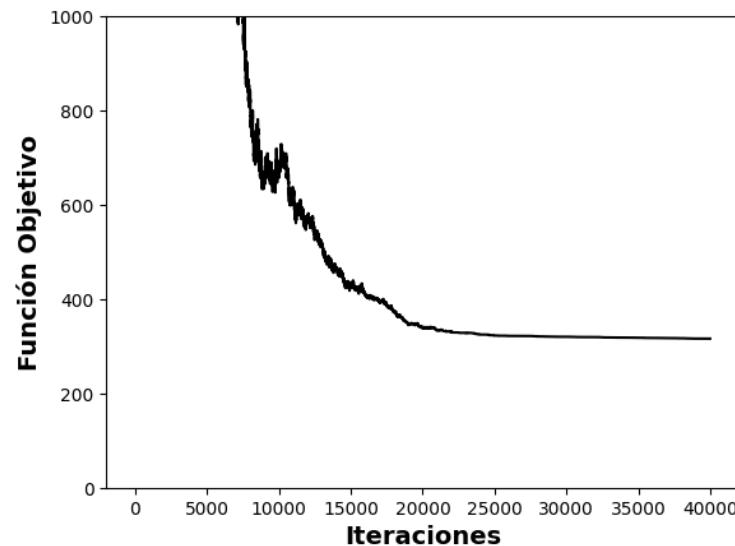
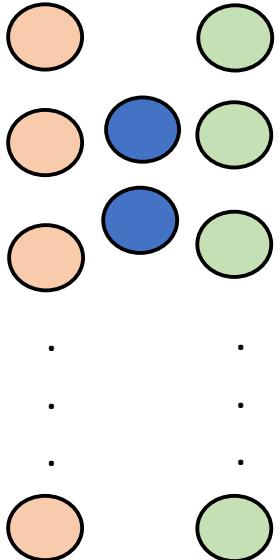


Tiempo de ejecución

	Función Activación	Profundidad
Encoder	-	1 capa-35 neuronas
Decoder	Lineal	1 capa-35 neuronas
Espacio latente	Lineal	2 neuronas

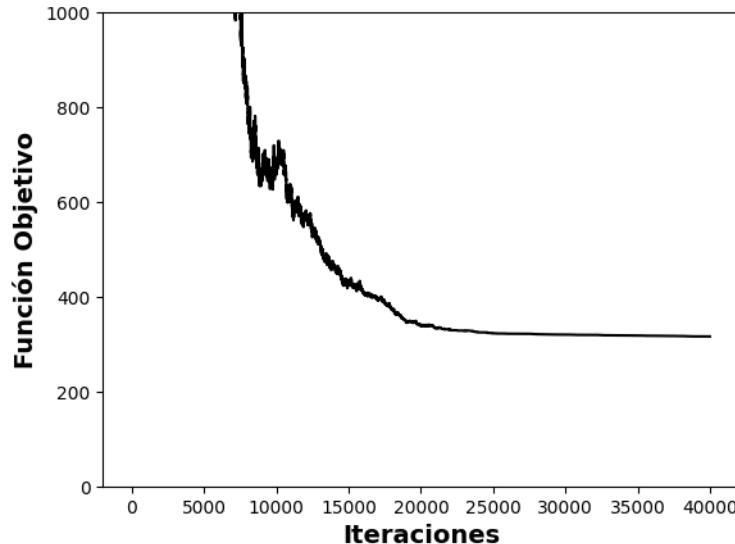
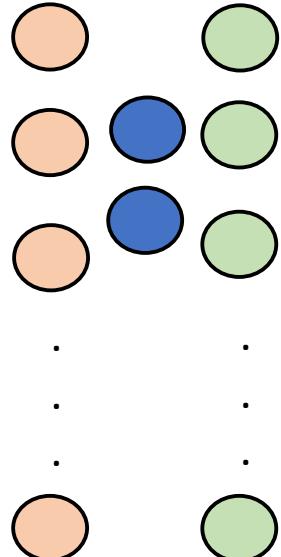
Tamaño de paso	Temperatura	Iteraciones	Tiempo
Fijo	$T = \frac{T_i}{iter + 1}$	10000	0.6 +/- 0.2 seg
Variable	$T = T_i e^{-\frac{iter}{5000}}$	40000	2.2 +/- 0.3 seg

Arquitecturas F.A. Lineal



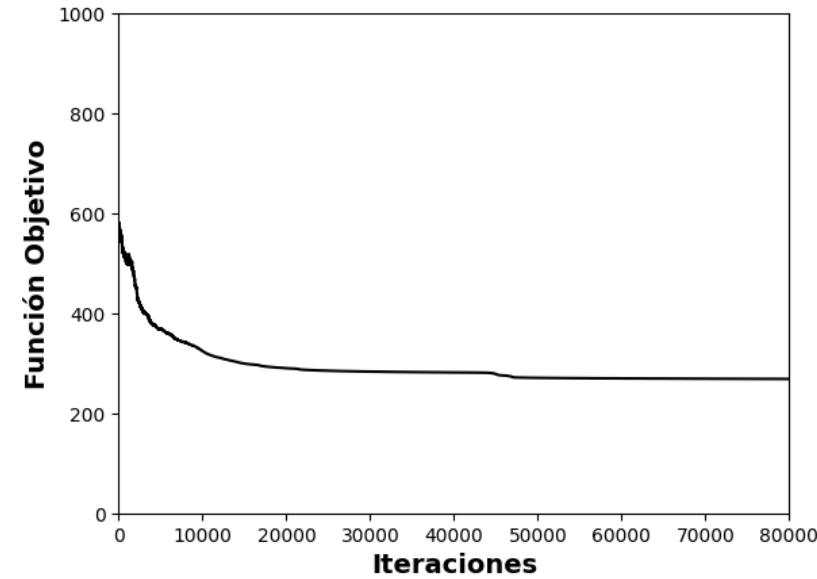
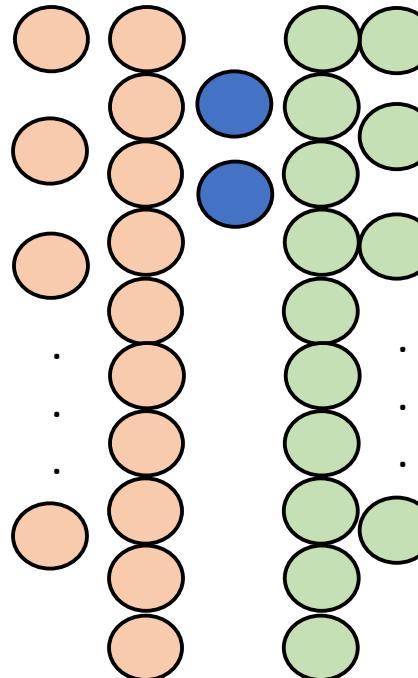
Arquitecturas

F.A. Lineal



F.O. 371

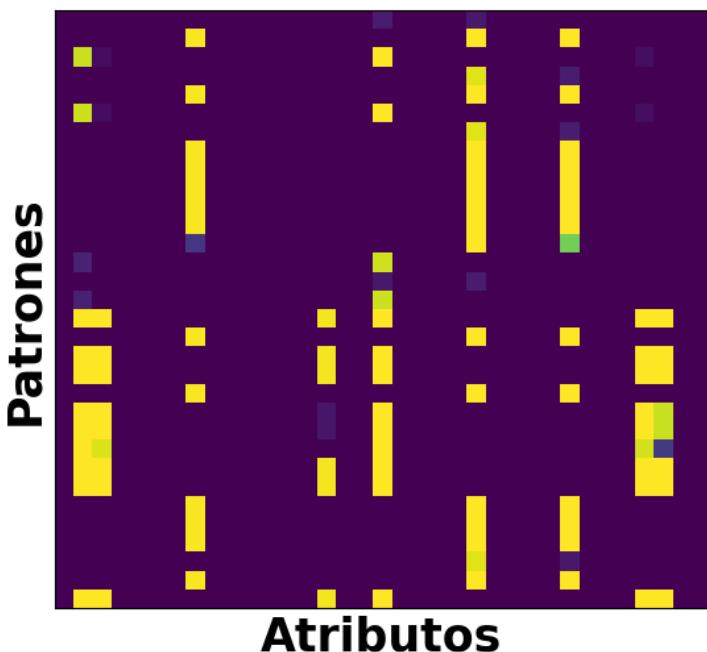
Sigmoide



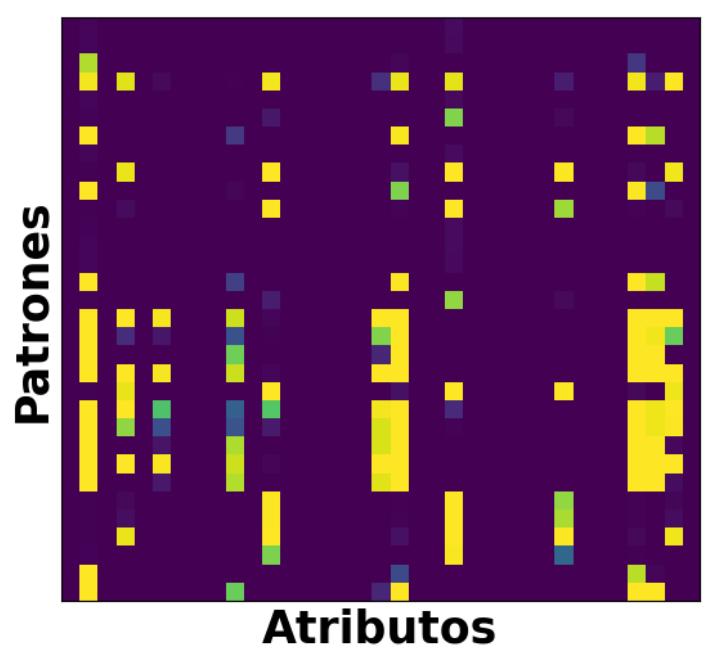
F.O. 268

	Función Activación
Encoder	-, Sigmoide
Decoder	Sigmoide, Sigmoide
Espacio latente	Sigmoide

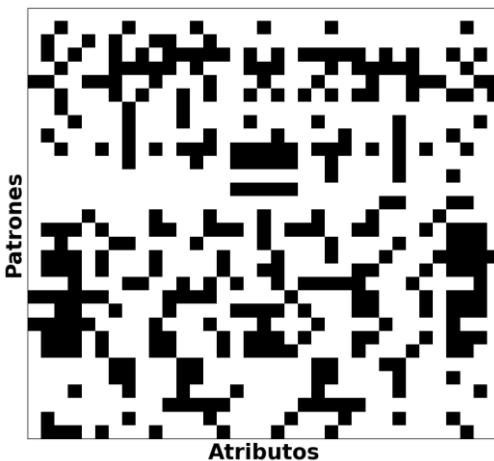
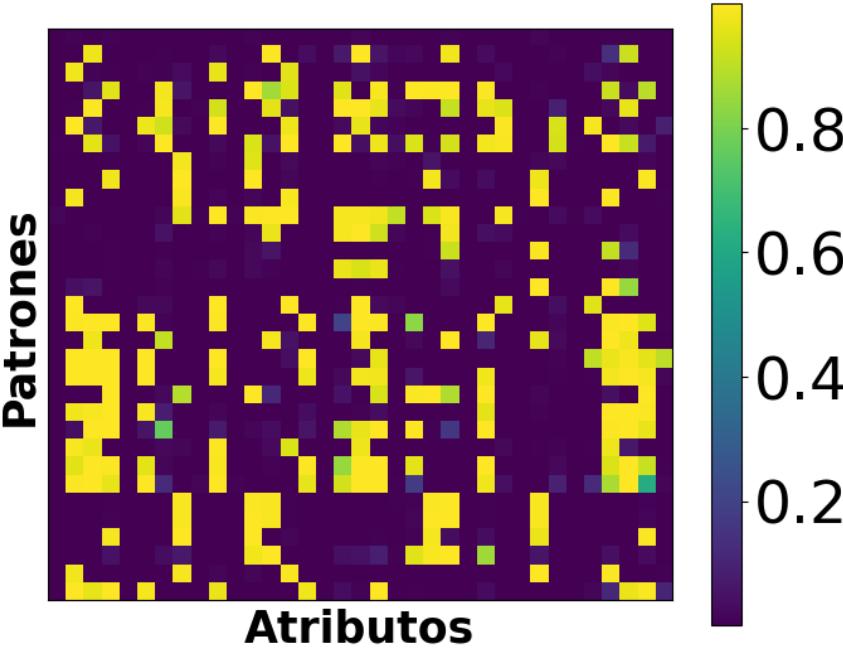
	Profundidad
Encoder	35,10
Decoder	10,35
Espacio latente	2 neuronas



	Profundidad
Encoder	35,60
Decoder	60,35
Espacio latente	2 neuronas



	Profundidad
Encoder	35,60
Decoder	60,35
Espacio latente	20 neuronas



Sistemas de Inteligencia Artificial 2024 2Q

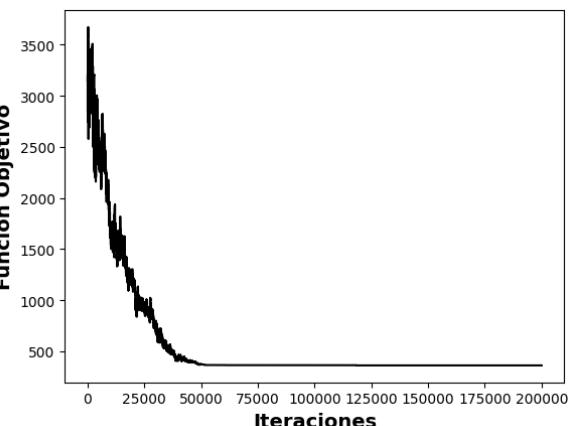
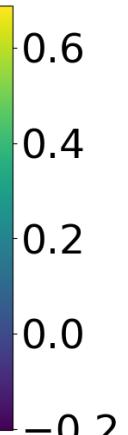
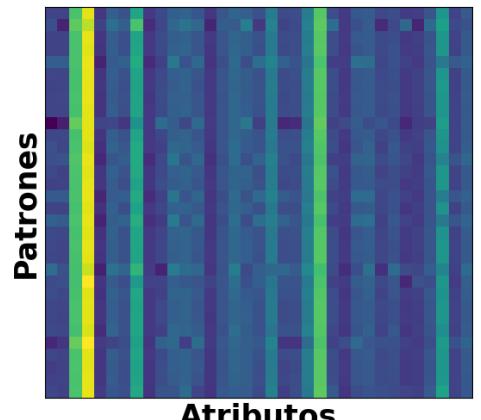
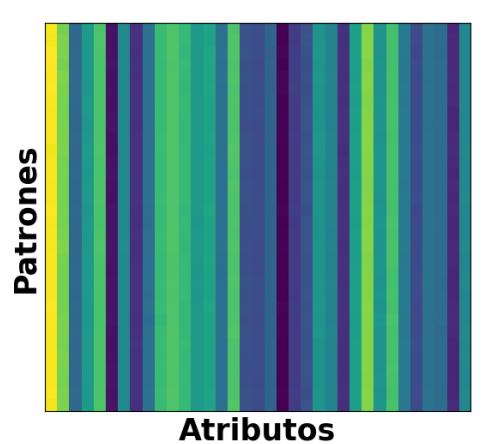
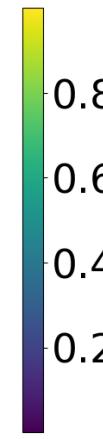
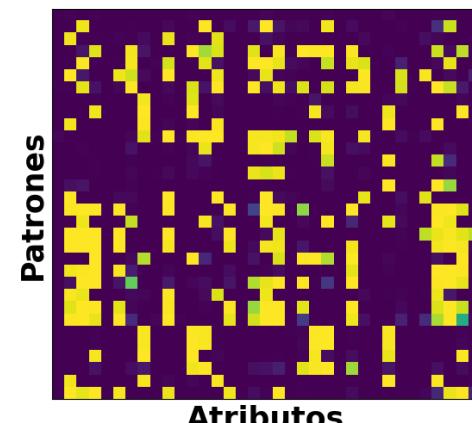
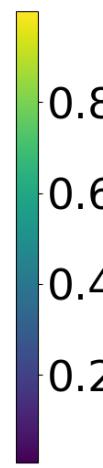
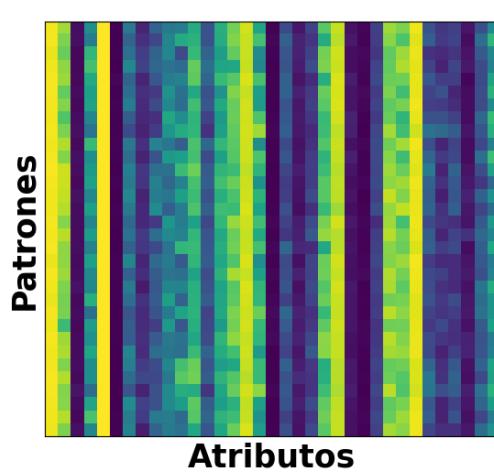
1

	Función Activación
Encoder	-, Sigmoide
Decoder	Sigmoide, Sigmoide
Espacio latente	Sigmoide

	Profundidad
Encoder	35,60
Decoder	60,35
Espacio latente	20 neuronas

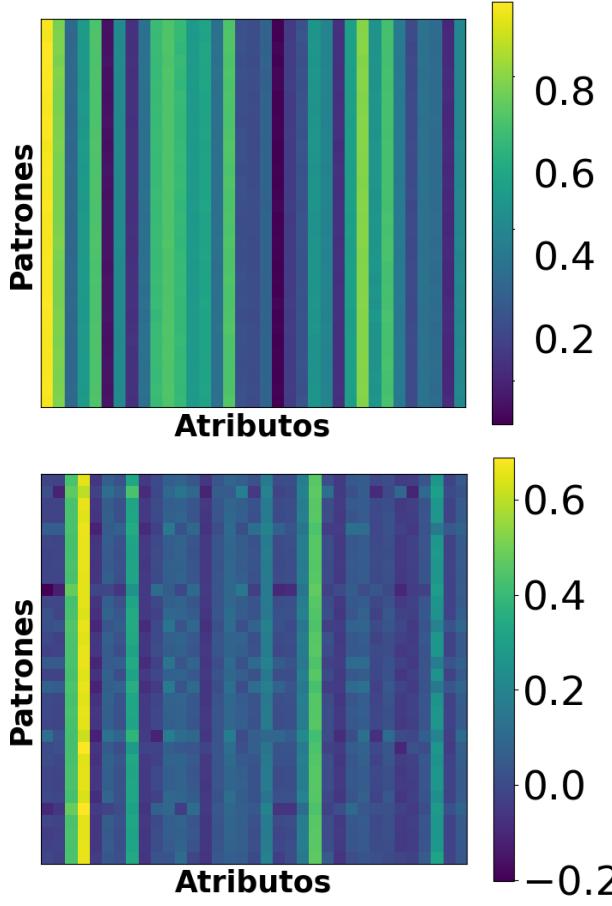
	Función Activación
Encoder	-, Sigmoide, Sigmoidem, Sigmoide
Decoder	Sigmoide, Sigmoide, , Sigmoide, Sigmoide
Espacio latente	Sigmoide

Profundidad
35,60,60,60
60,60,60,35
20 neuronas

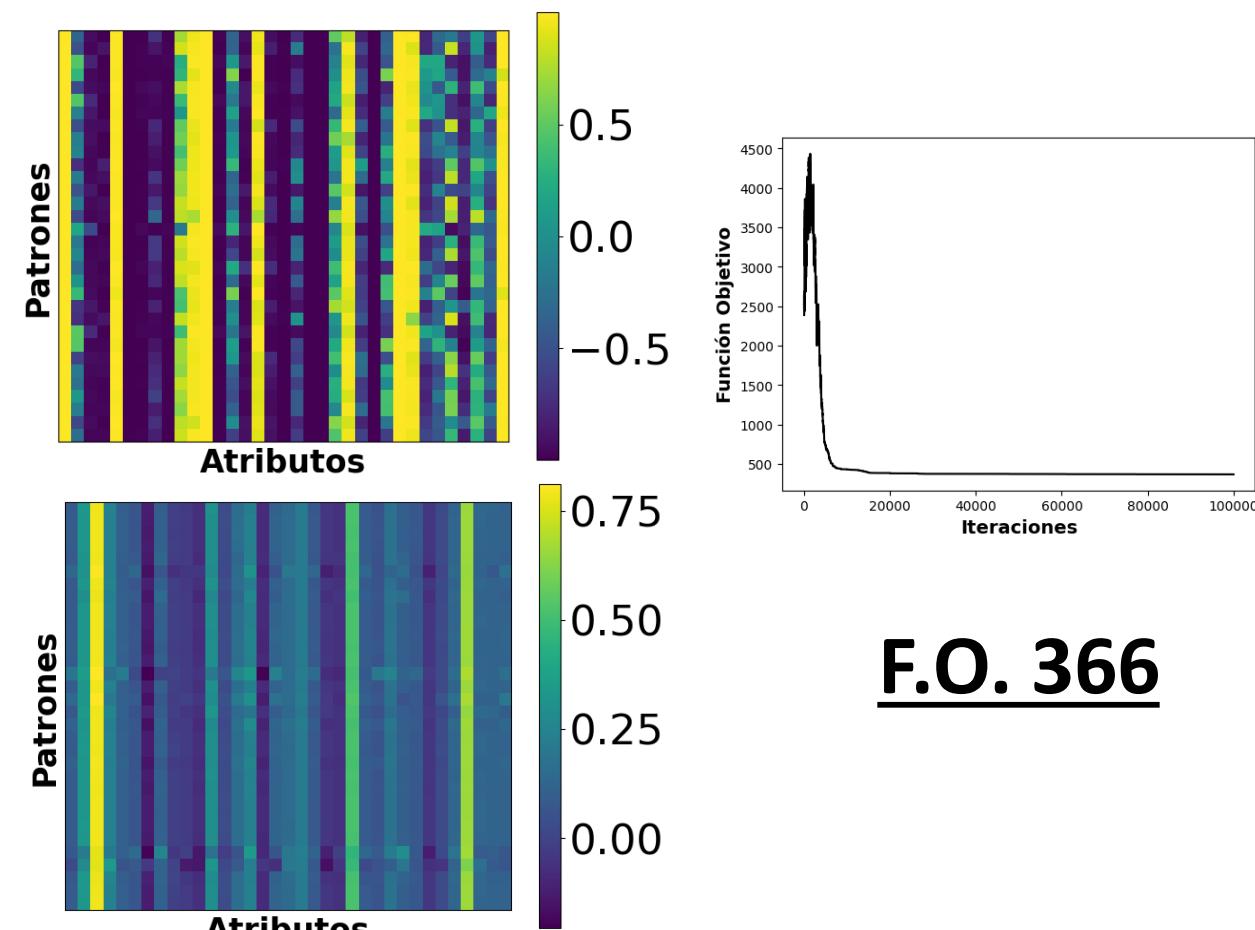


Sistemas de Inteligencia Artificial 2024 2Q

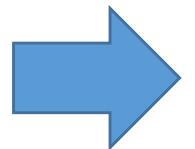
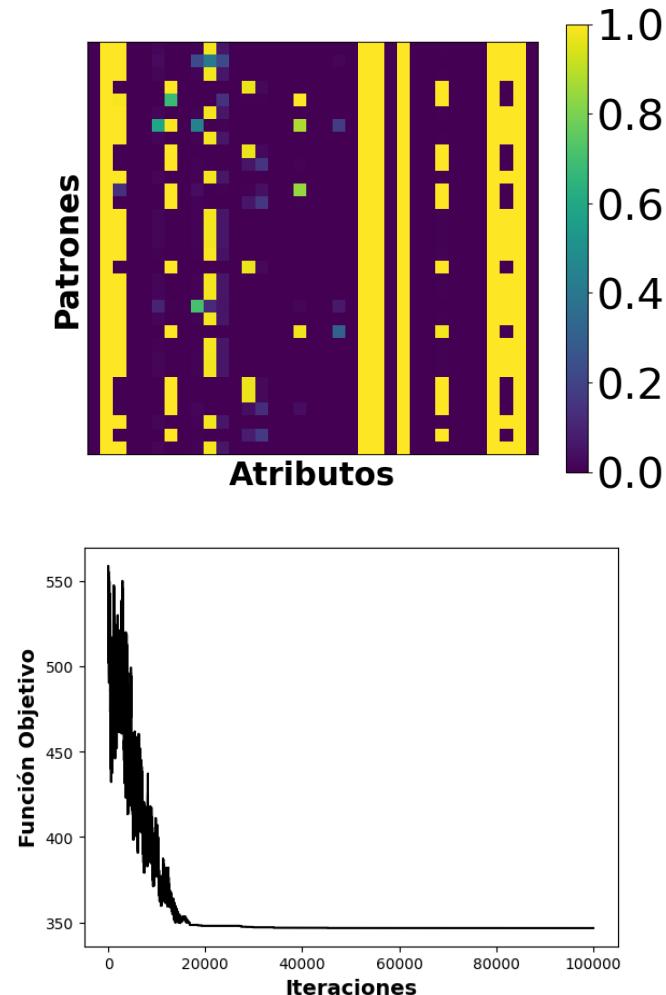
	Función Activación	Profundidad
Encoder	-, Sigmoide, Sigmoide, Sigmoide	
Decoder	Sigmoide, Sigmoide, , Sigmoide, Sigmoide	35,60,60,60 60,60,60,35
Espacio latente	Sigmoide	20 neuronas



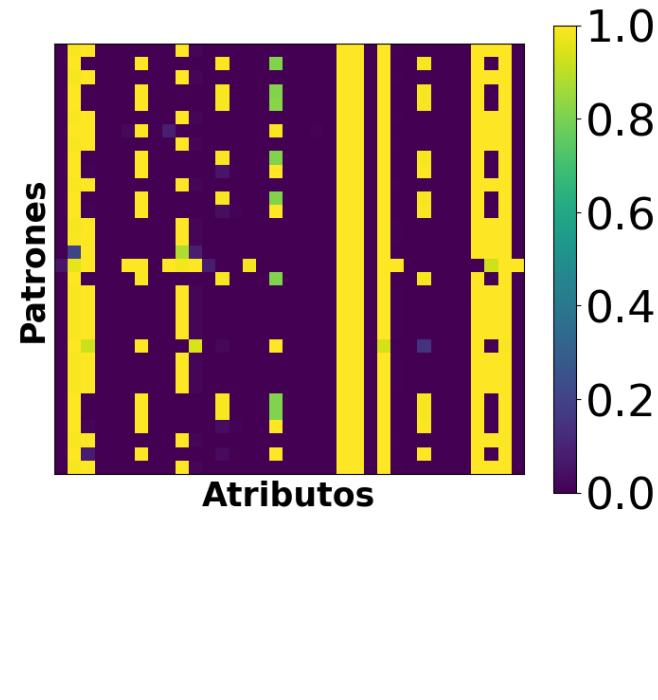
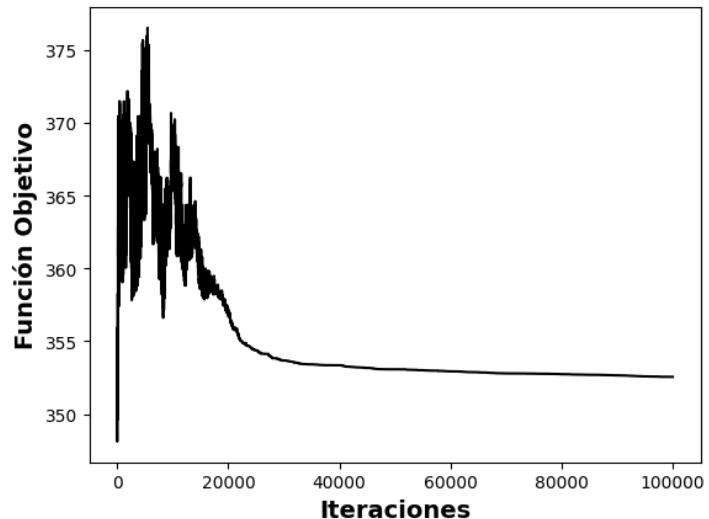
	Función Activación	Profundidad
Encoder	-, Sigmoide, tanh, Sigmoide	
Decoder	Sigmoide, tanh, , Sigmoide, tanhe	35,60,60,60 60,60,60,35
Espacio latente	tanh	20 neuronas



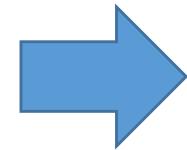
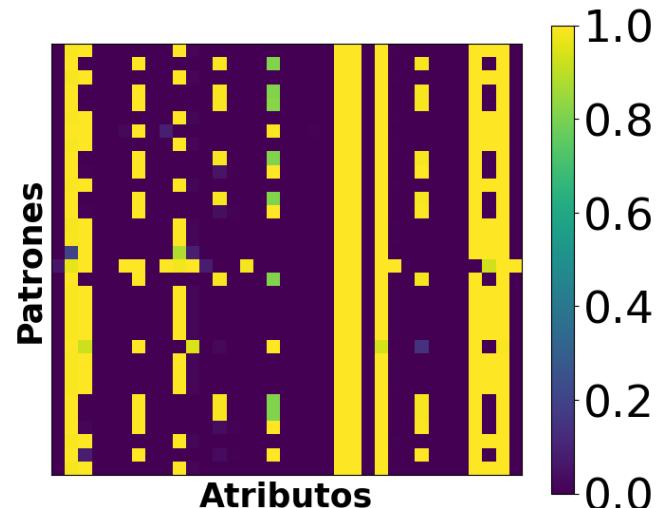
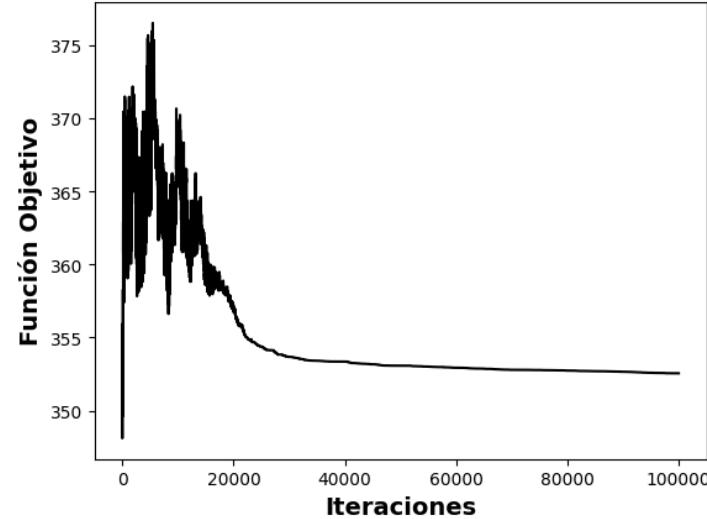
Se propone la optimización por dos pasos



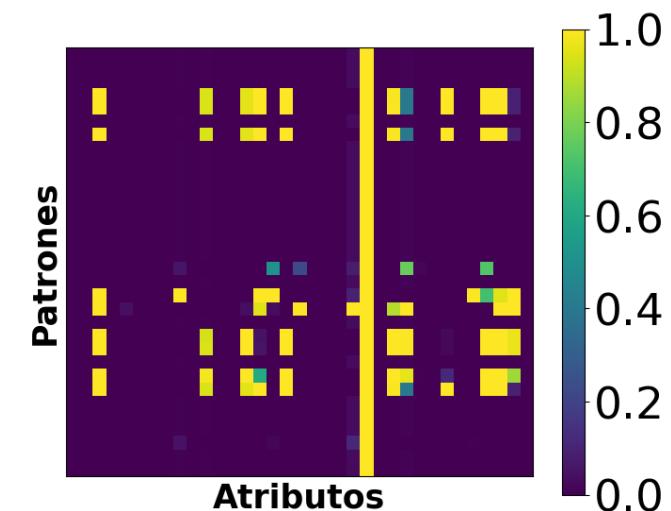
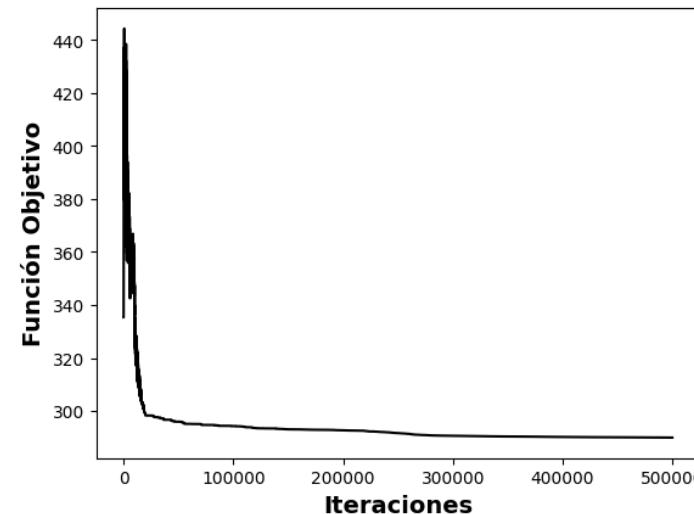
	Función Activación	Profundidad
Encoder	-, Sigmoide, tanh, Sigmoide	35,64,32,16
Decoder	Sigmoide, tanh, , Sigmoide, Sigmoide	16,32,64,35
Espacio latente	tanh	2 neuronas



Un segundo paso



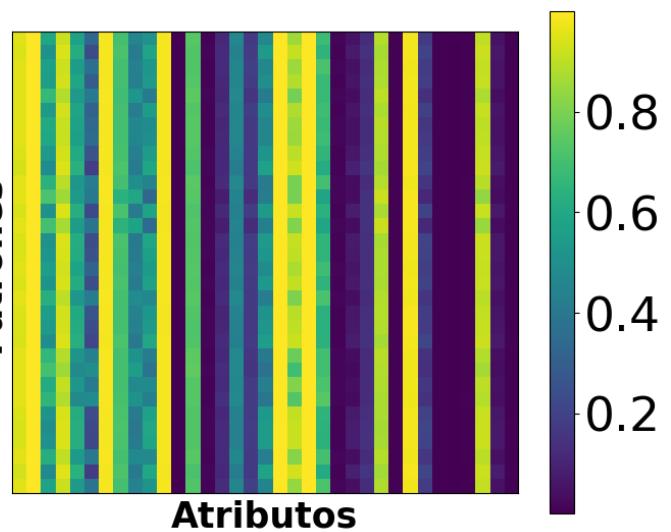
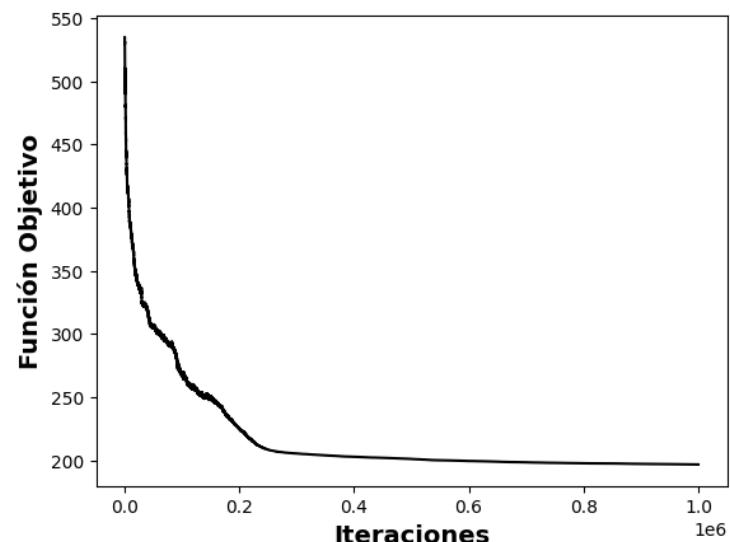
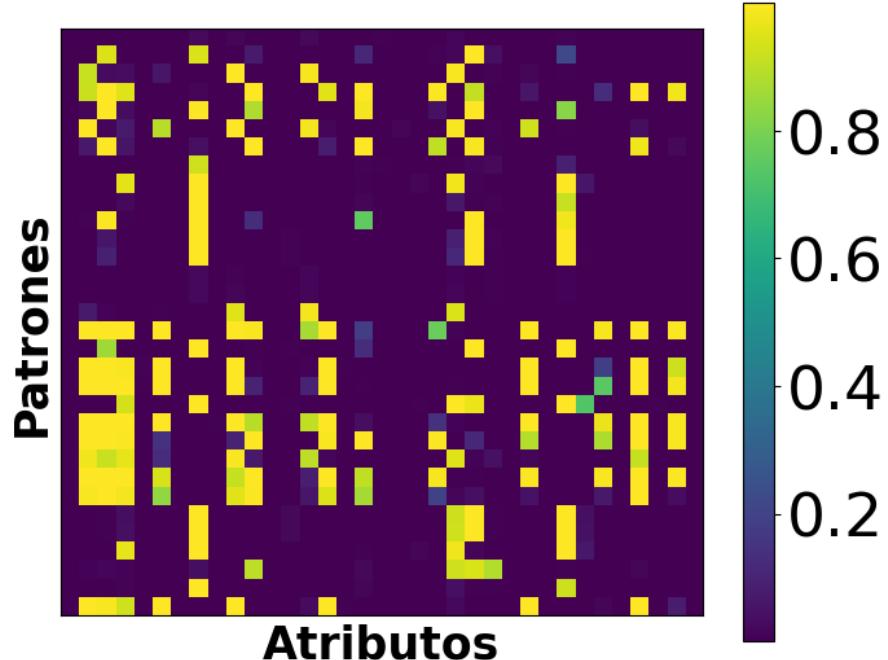
	Función Activación
Encoder	-, Sigmoide, tanh, Sigmoide
Decoder	Sigmoide, tanh, , Sigmoide, Sigmoide
Espacio latente	tanh



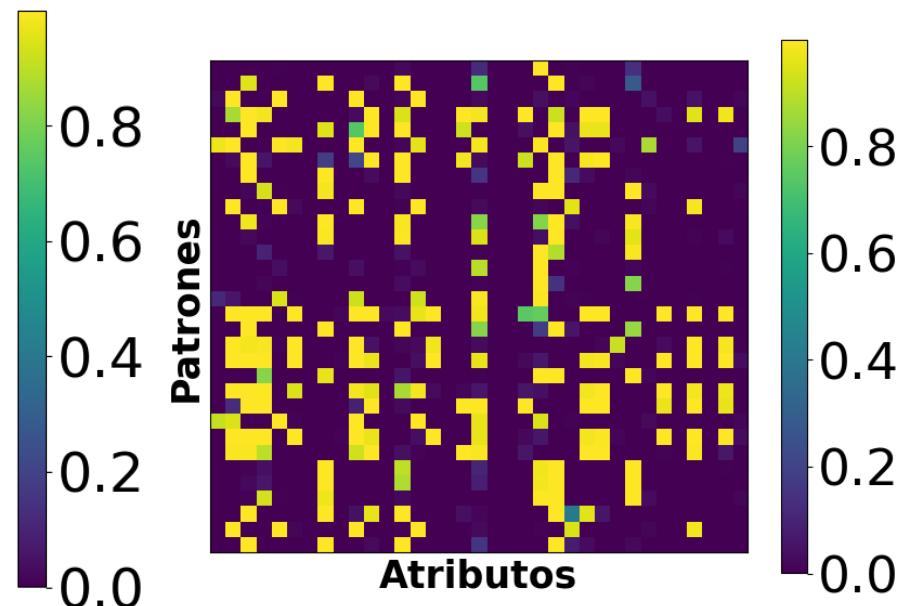
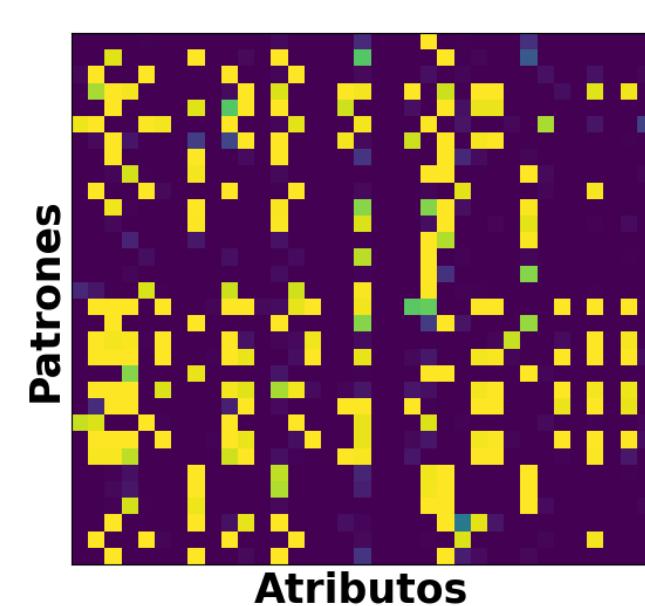
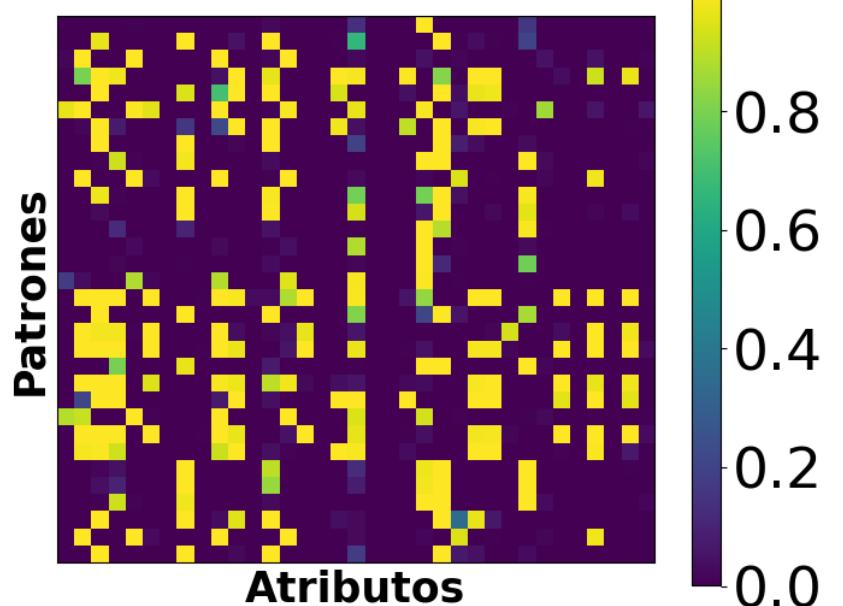
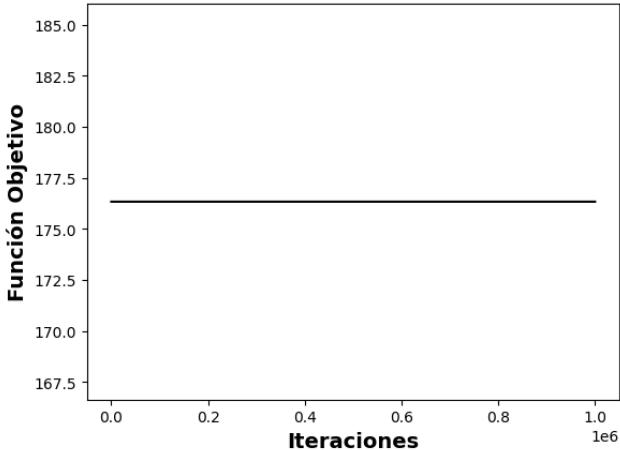
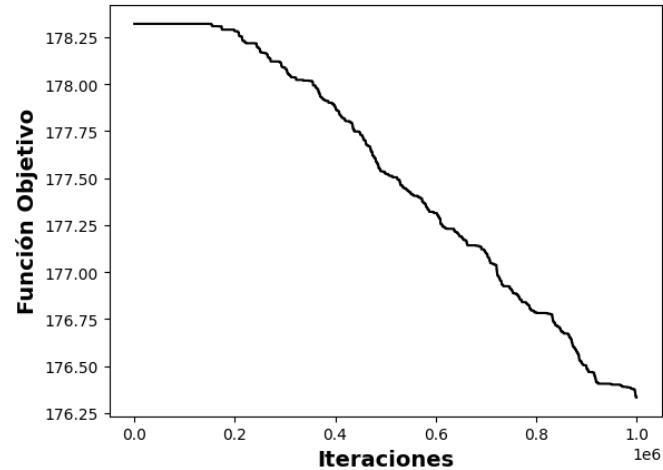
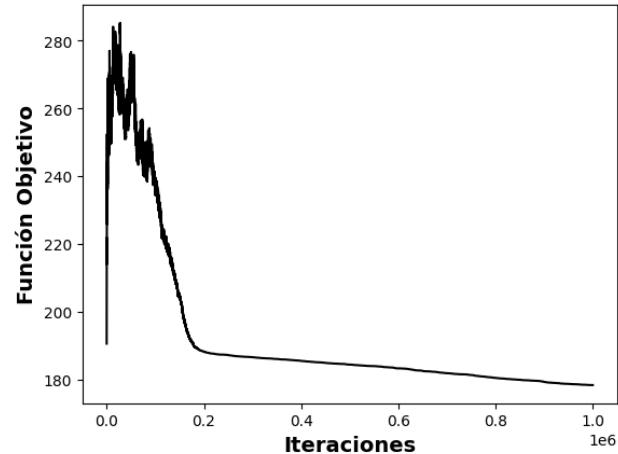
Se añade bias

	Función Activación
Encoder	-,tanh, Sigmoide, tanh
Decoder	tanh, Sigmoide, tanh, Sigmoide
Espacio latente	Sigmoide

Profundidad
35,64,32,16
16,32,64,35
2 neuronas



Pasos sucesivos



Se realiza el Finetuning

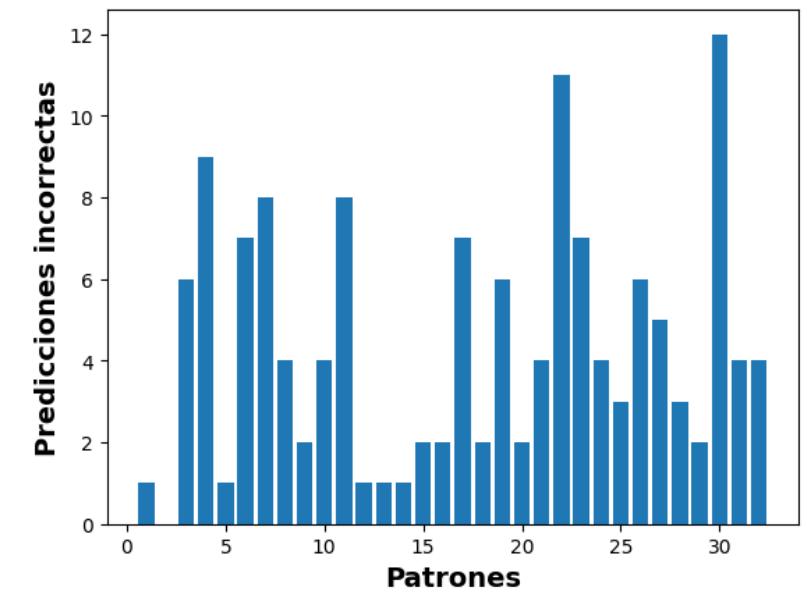
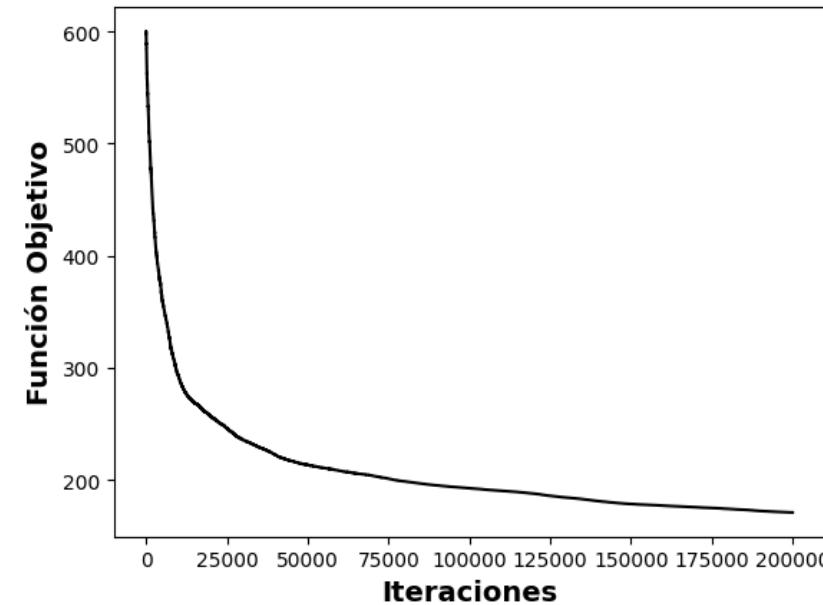
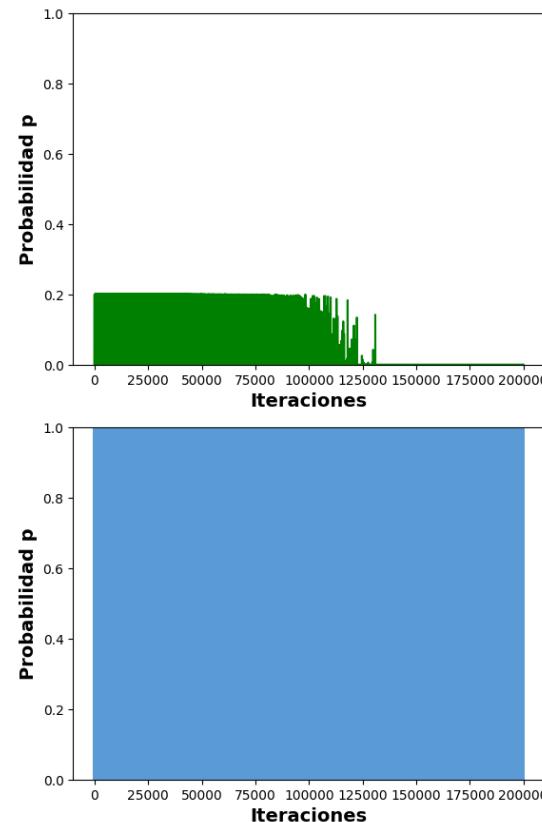
Inicialización de los bias en valores cercanos a 0

Threshold de 0.5

Función de activación lineal para el espacio latente

Profundidad
Encoder: 35,40,30,8
Decoder: 8,20,40,35
Espacio Latente: 2 neuronas

Tiempo: 30 +/- 4 min



Estrategia

Inicialización de los bias en valores cercanos a 0

Definir diferentes tamaños de paso para los pesos y el bias

El tamaño del paso es proporcionar al valor actual del parámetro

Se modifica la función objetivo: se introduce el error de los pixeles mal clasificados. Se introduce el contador de pixeles mal clasificados

Se varia la probabilidad po

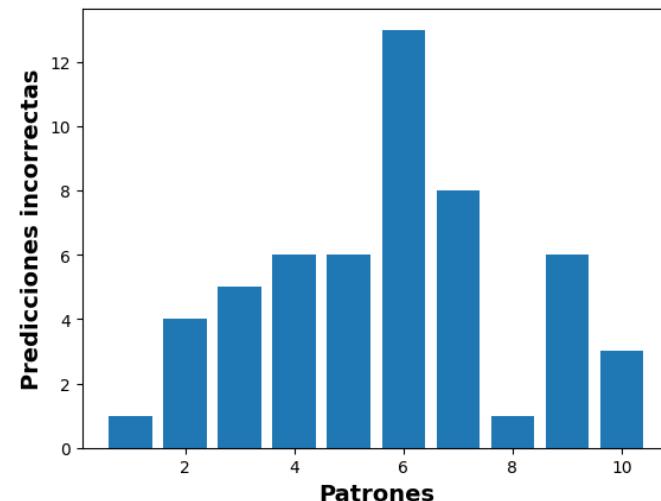
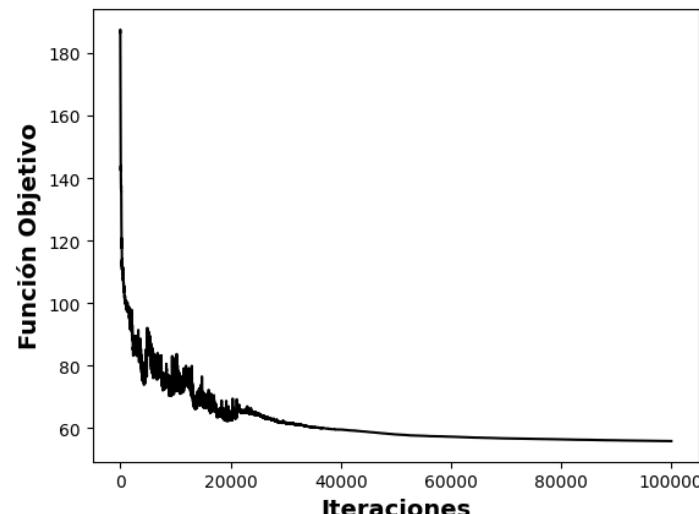
Se modifica la semilla

No se logra mejores resultados respecto al caso anterior

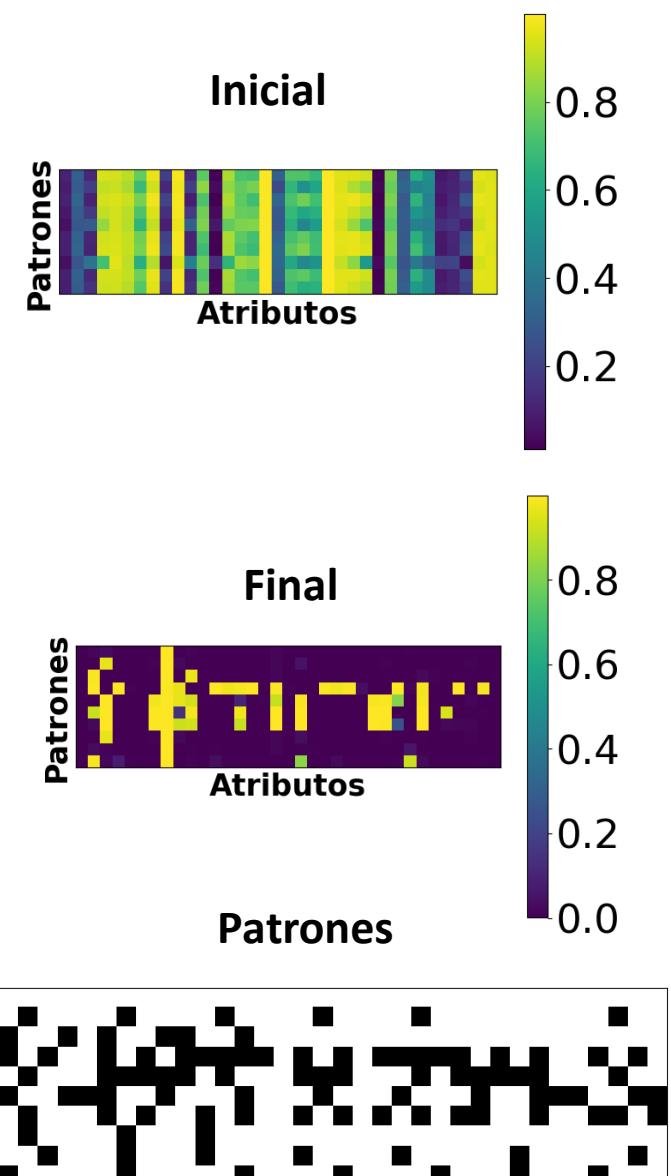
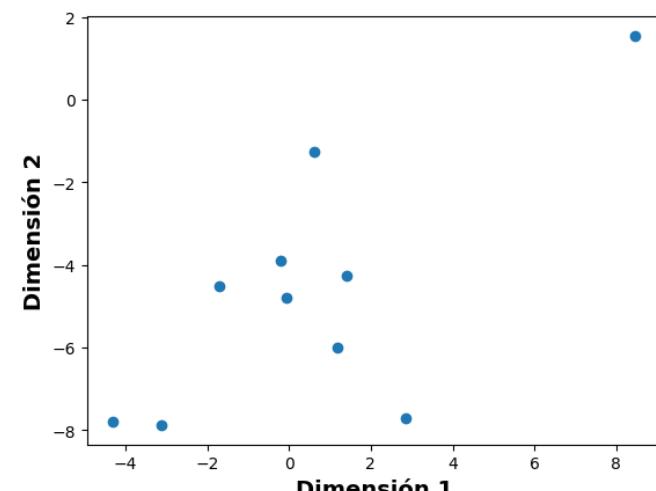


Se reduce el set de datos

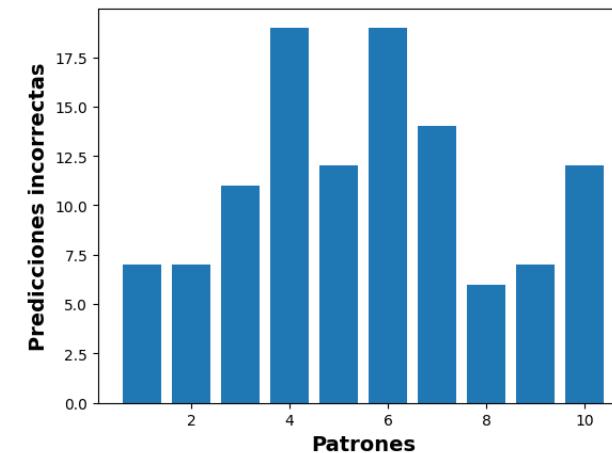
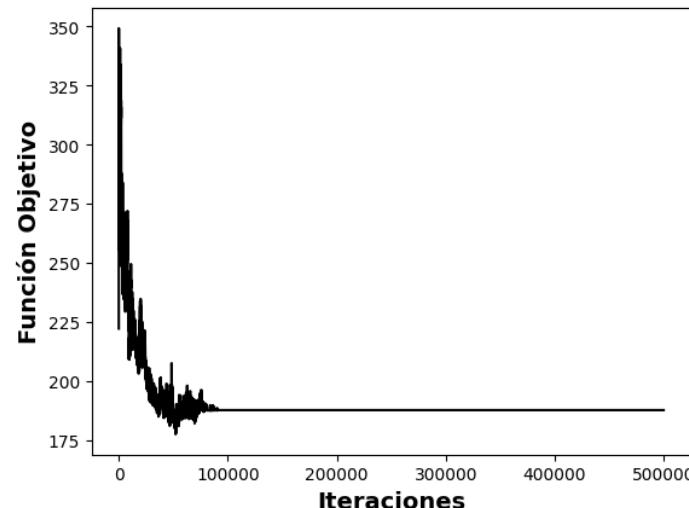
Se disminuye los patrones a 10



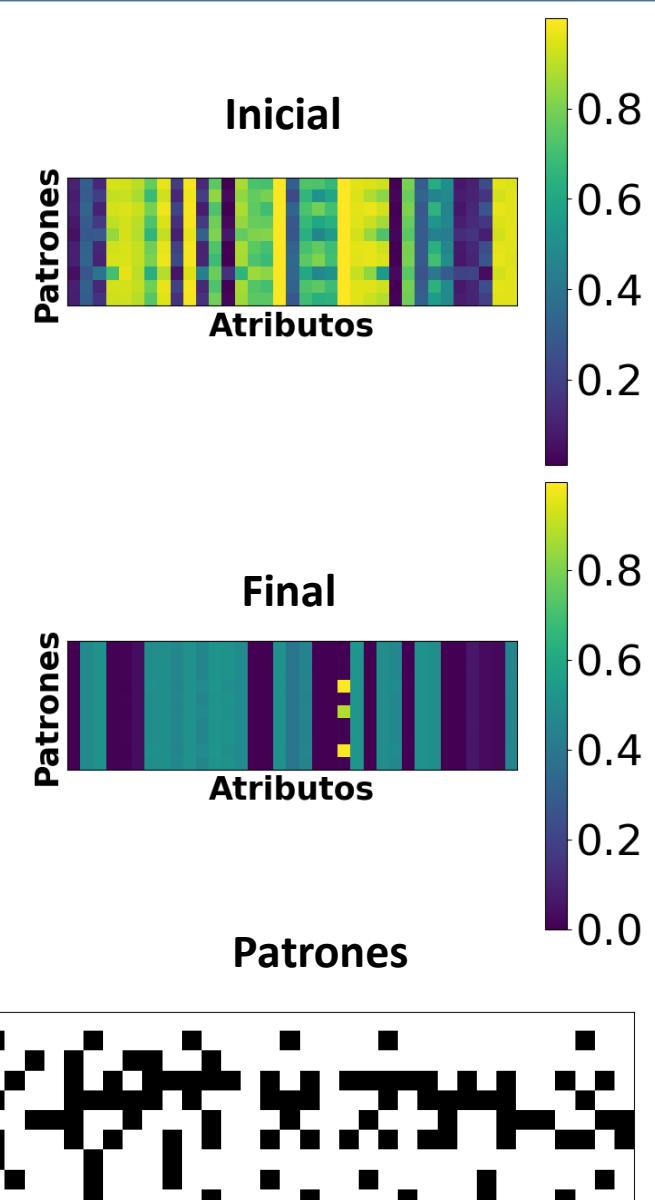
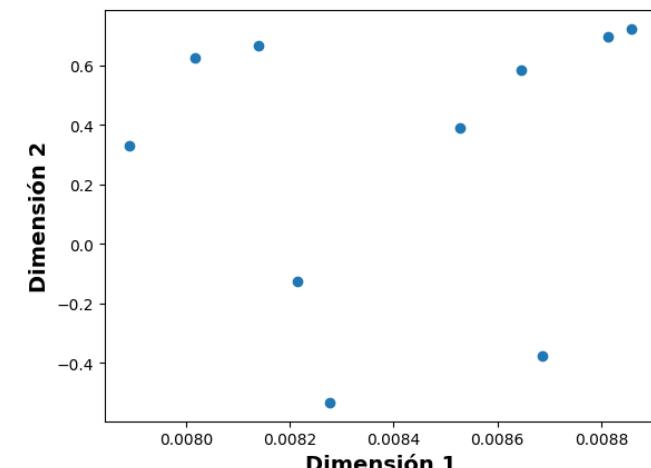
Espacio
Latente



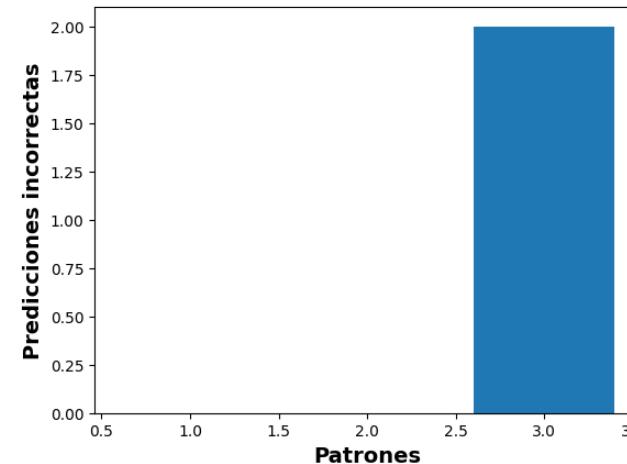
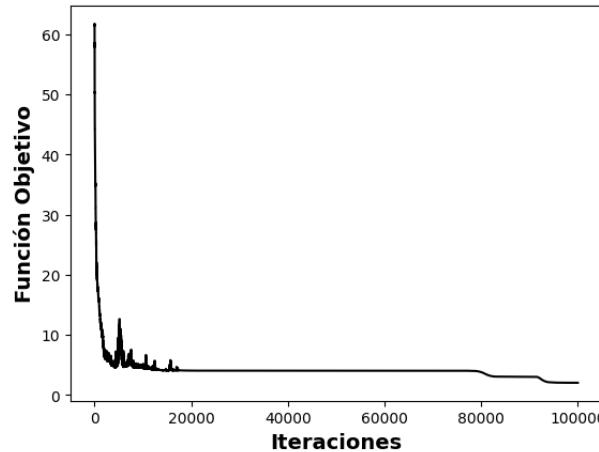
Se disminuye los patrones a 10



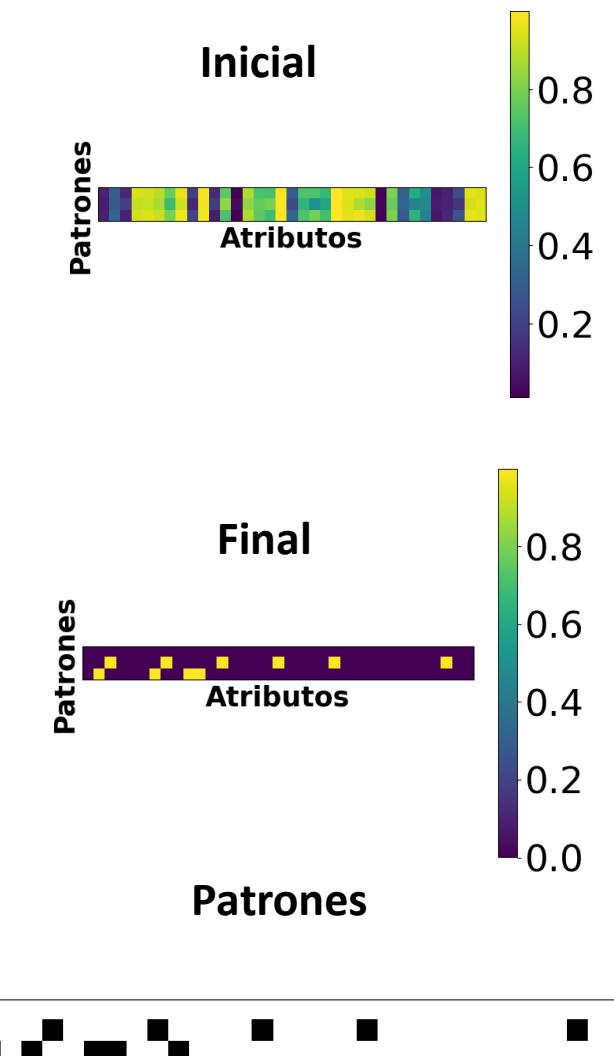
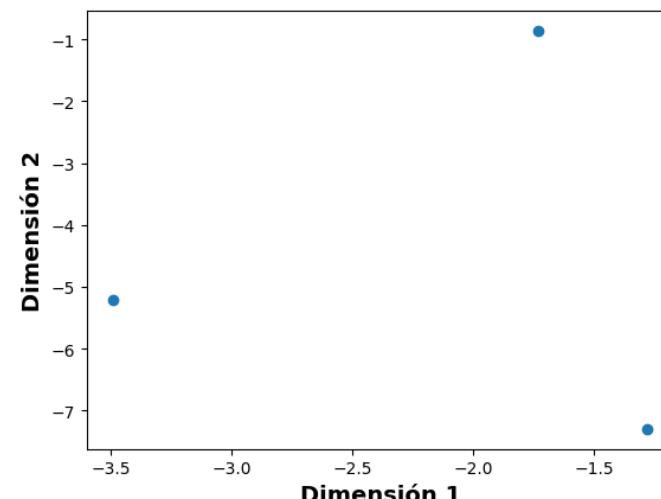
Espacio
Latente



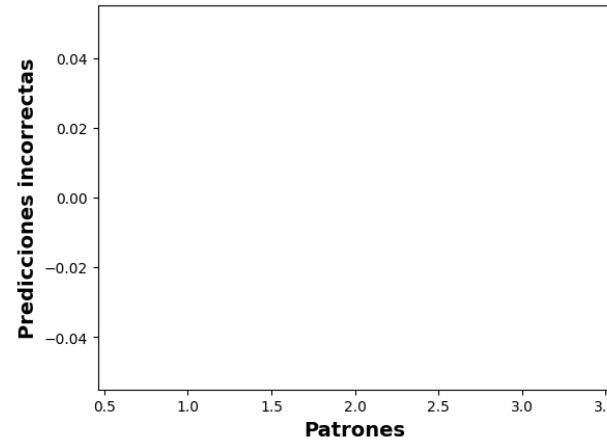
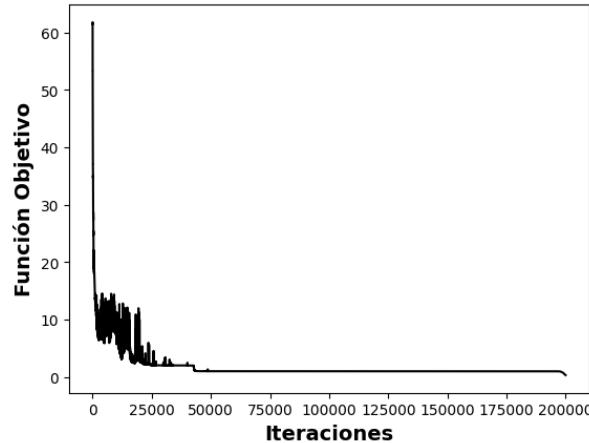
Se disminuye los patrones a 3



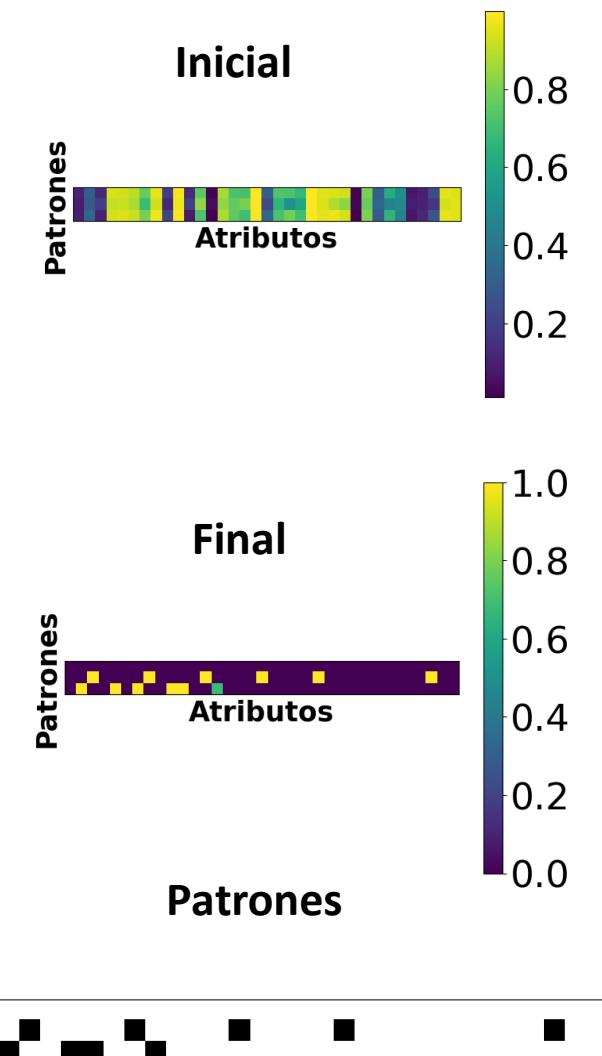
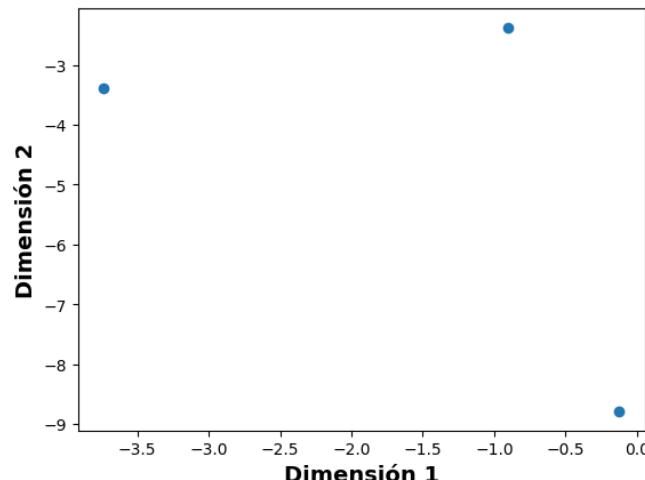
Espacio
Latente



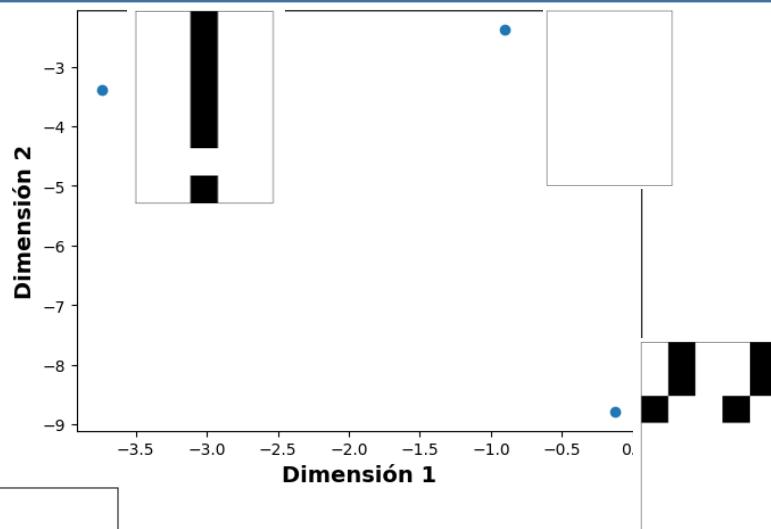
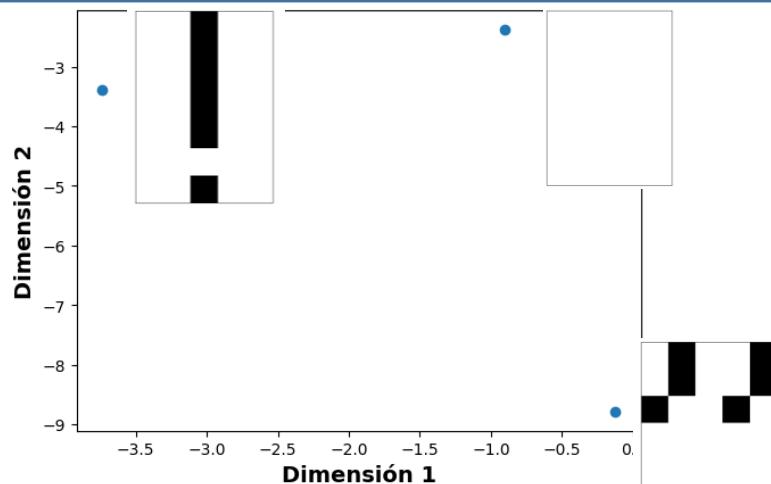
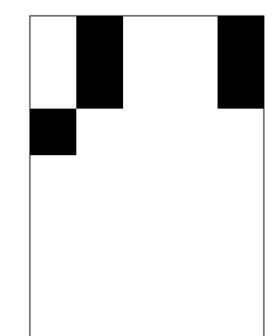
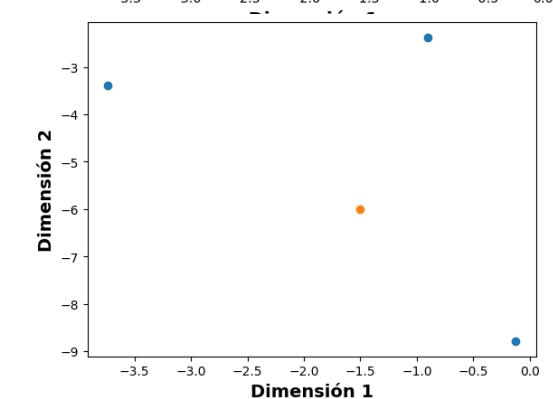
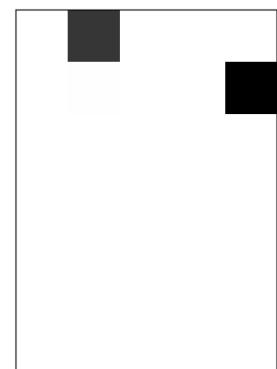
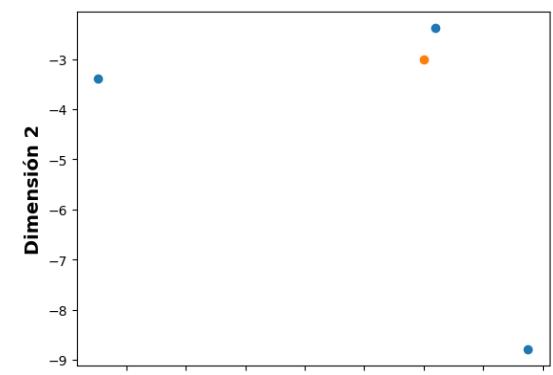
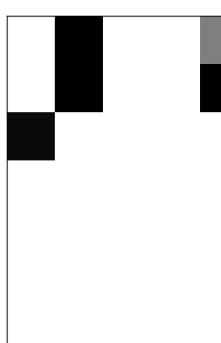
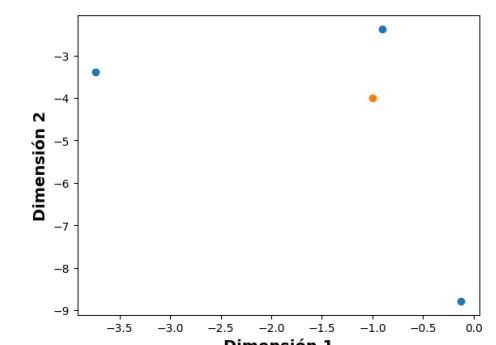
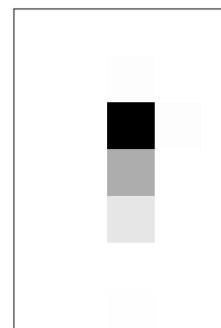
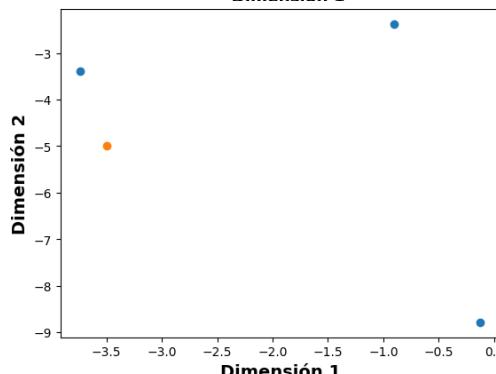
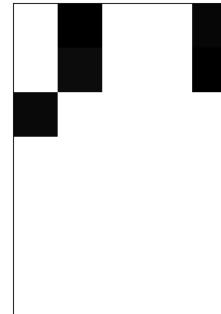
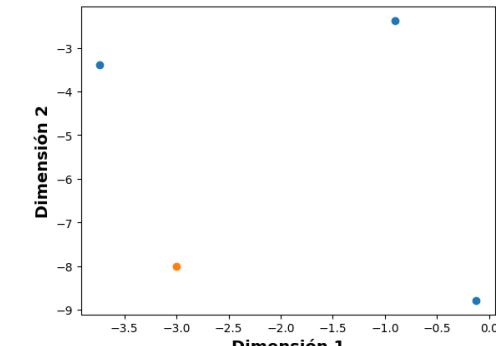
Se disminuye los patrones a 3



Espacio
Latente

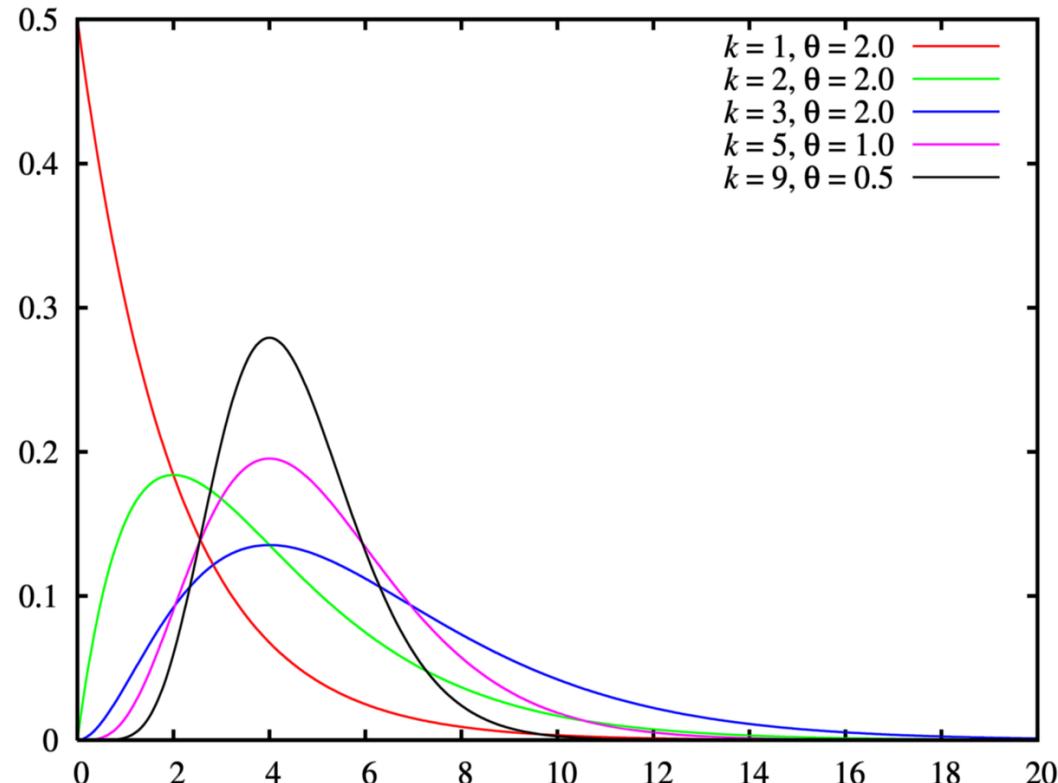


Se evalúa el espacio latente



Propuesta

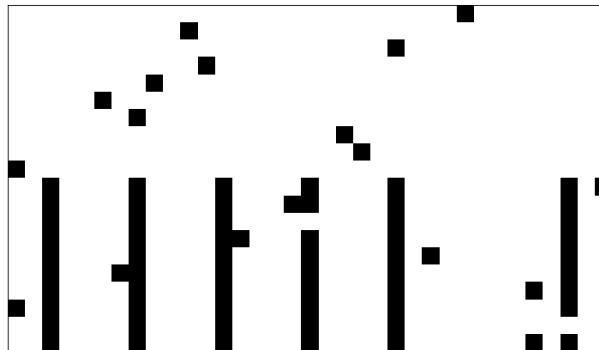
Que p siga una distribución Gamma



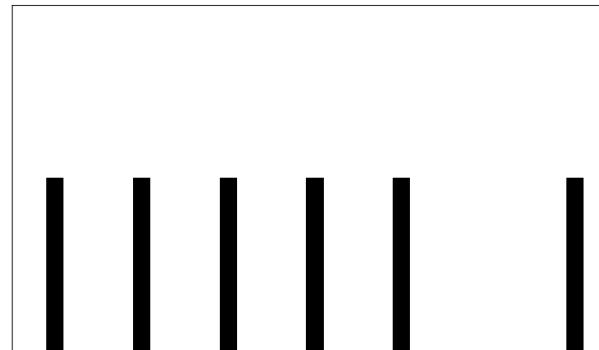
No se llegó a realizar

Denoising Autoencoder

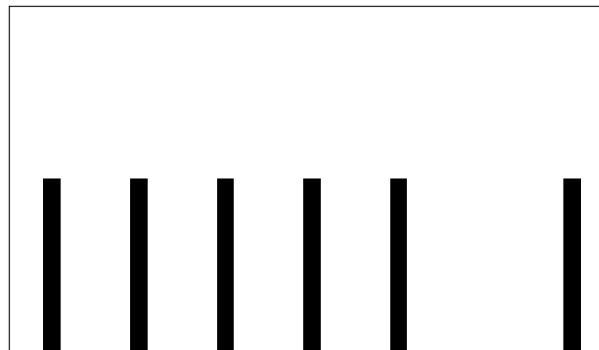
Entrada



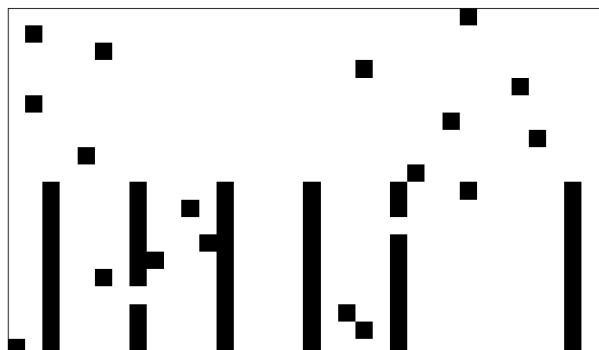
Referencia



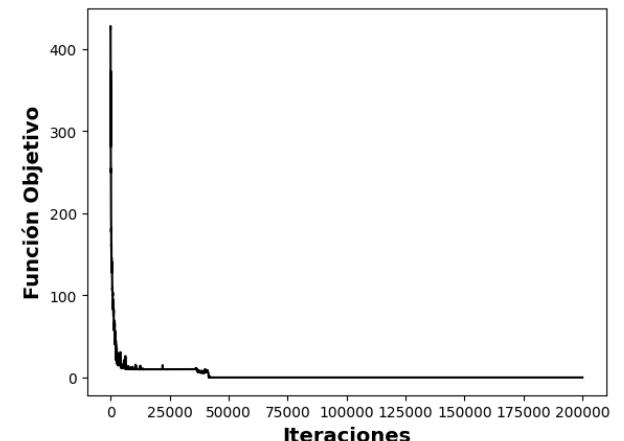
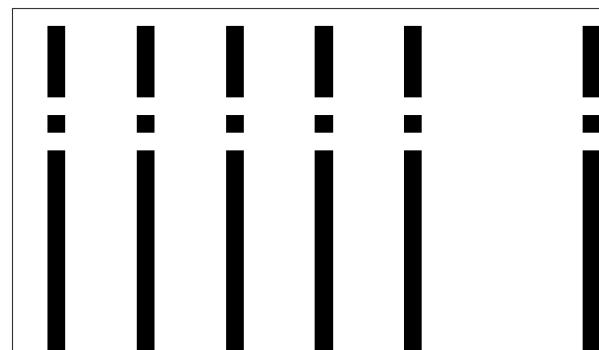
Salida



Validación entrada



Validación salida



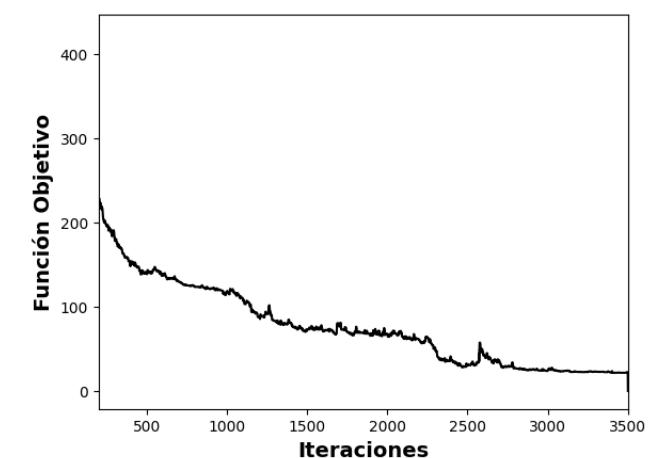
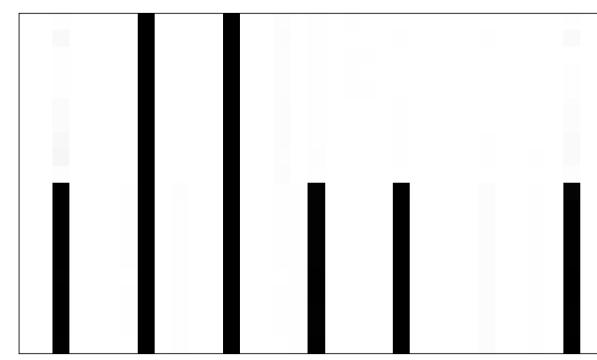
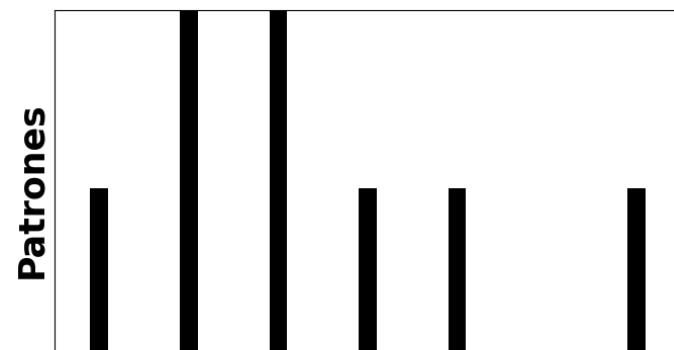
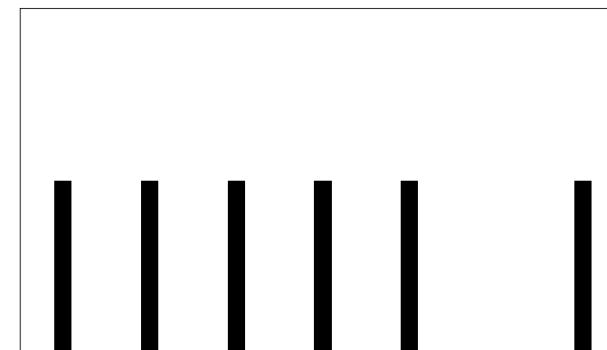
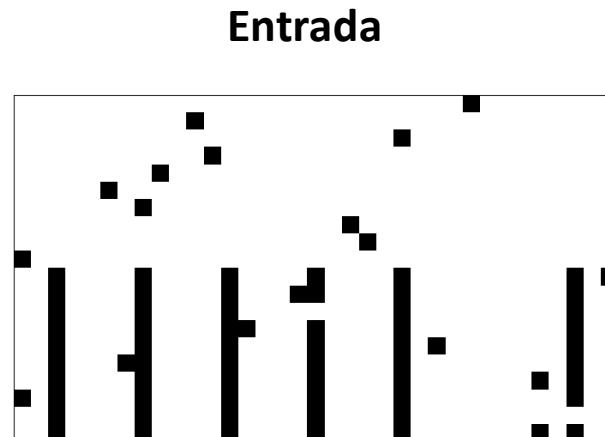
	Función Activación
Encoder	-, tanh, Sigmoide, tanh
Decoder	tanh, Sigmoide , tanh, Sigmoide
Espacio latente	lineal

Profundidad
35,40,20,8
8,20,40,35
2 neuronas

Denoising Autoencoder Early stop

	Función Activación
Encoder	-, tanh, Sigmoide, tanh
Decoder	tanh, Sigmoide , tanh, Sigmoide
Espacio latente	lineal

Profundidad
35,40,20,8
8,20,40,35
2 neuronas



VAE

Capa Latente:

- Media
- Desviación estándar

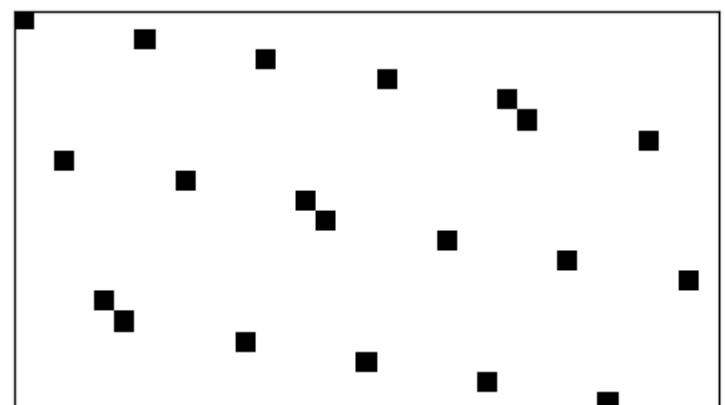
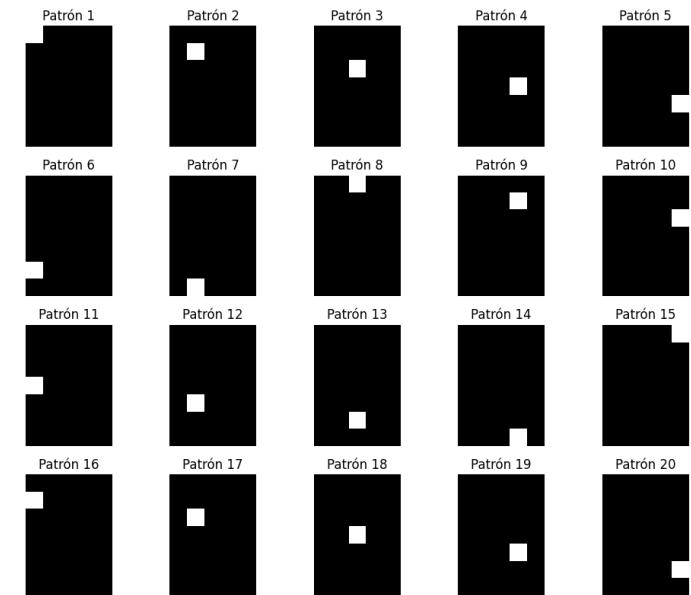
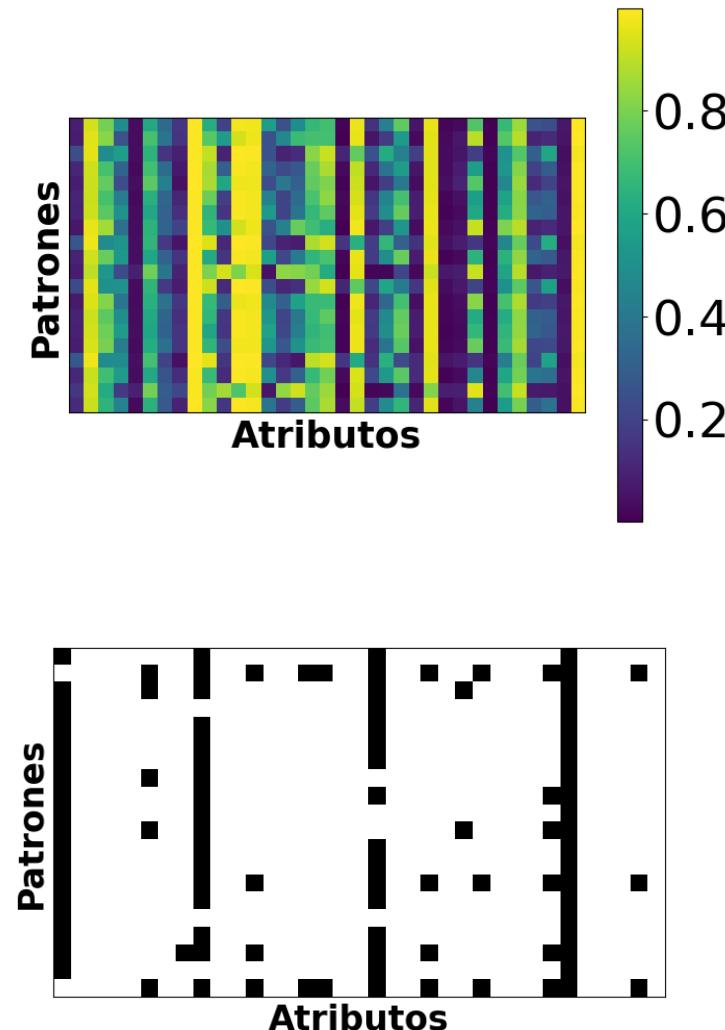
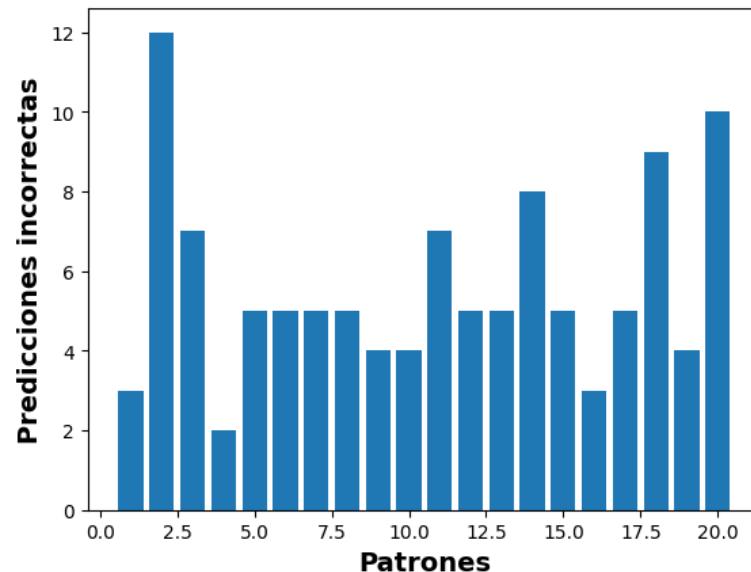
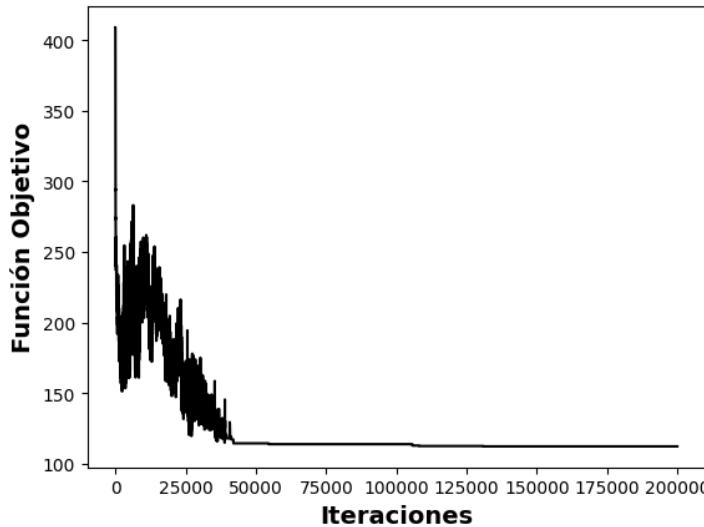
Muestreo Latente:

$$z = \mu + \sigma \cdot \varepsilon \quad \varepsilon \in N(0,1)$$

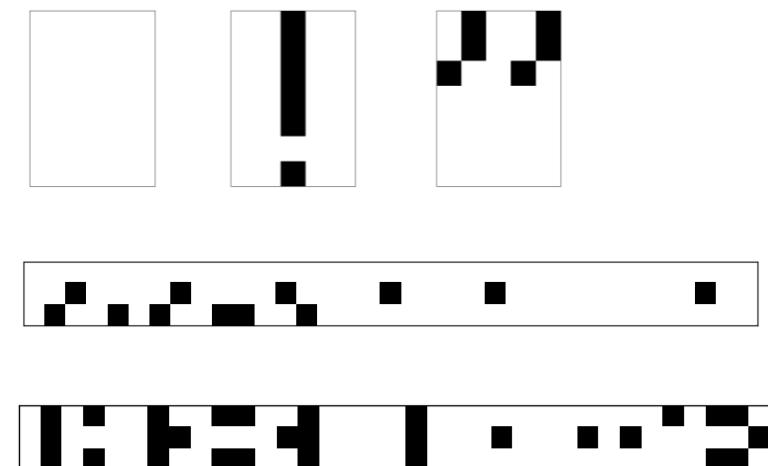
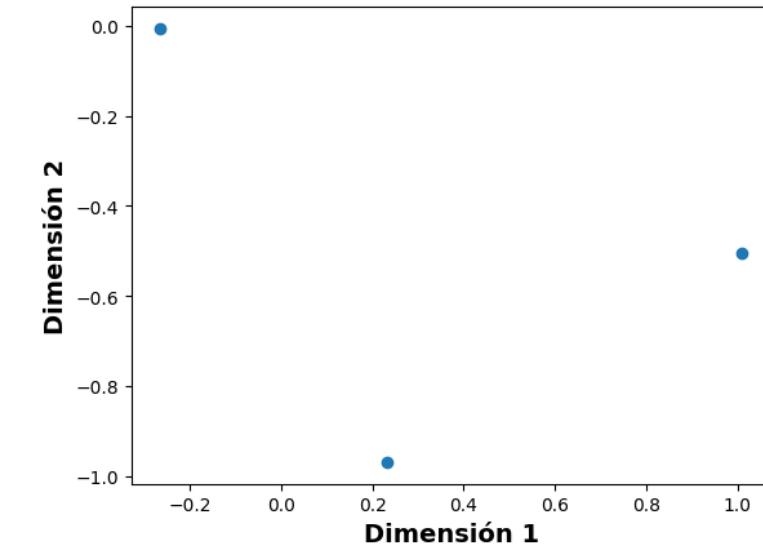
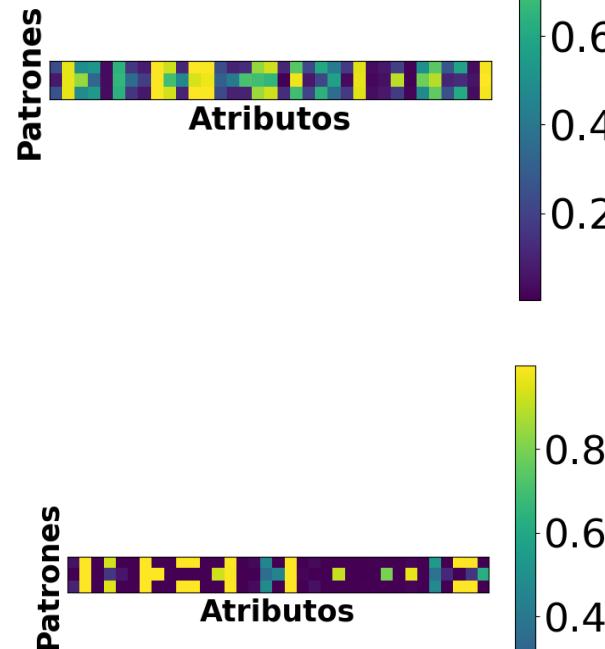
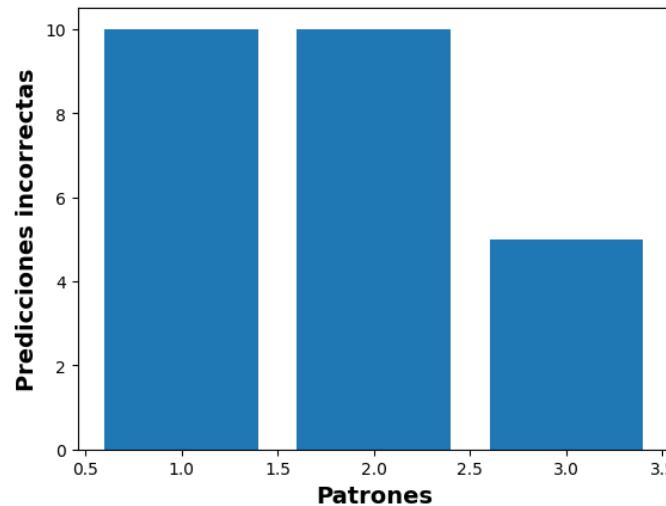
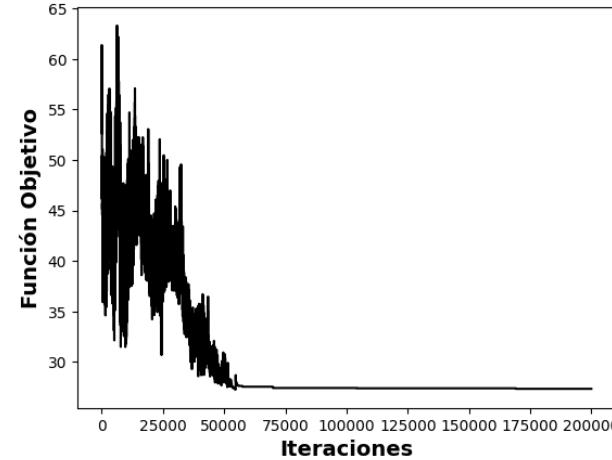
Función objetivo:

- Error de reconstrucción
- Divergencia

VAE- Resultados



VAE



Gracias por la
atención