



ESCUELA DE  
INFORMÁTICA Y  
TELECOMUNICACIONES

# ETIQUETADO DE IMAGENES PARA GOBIERNO DE CHILE

Integrantes:

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# Business Understanding

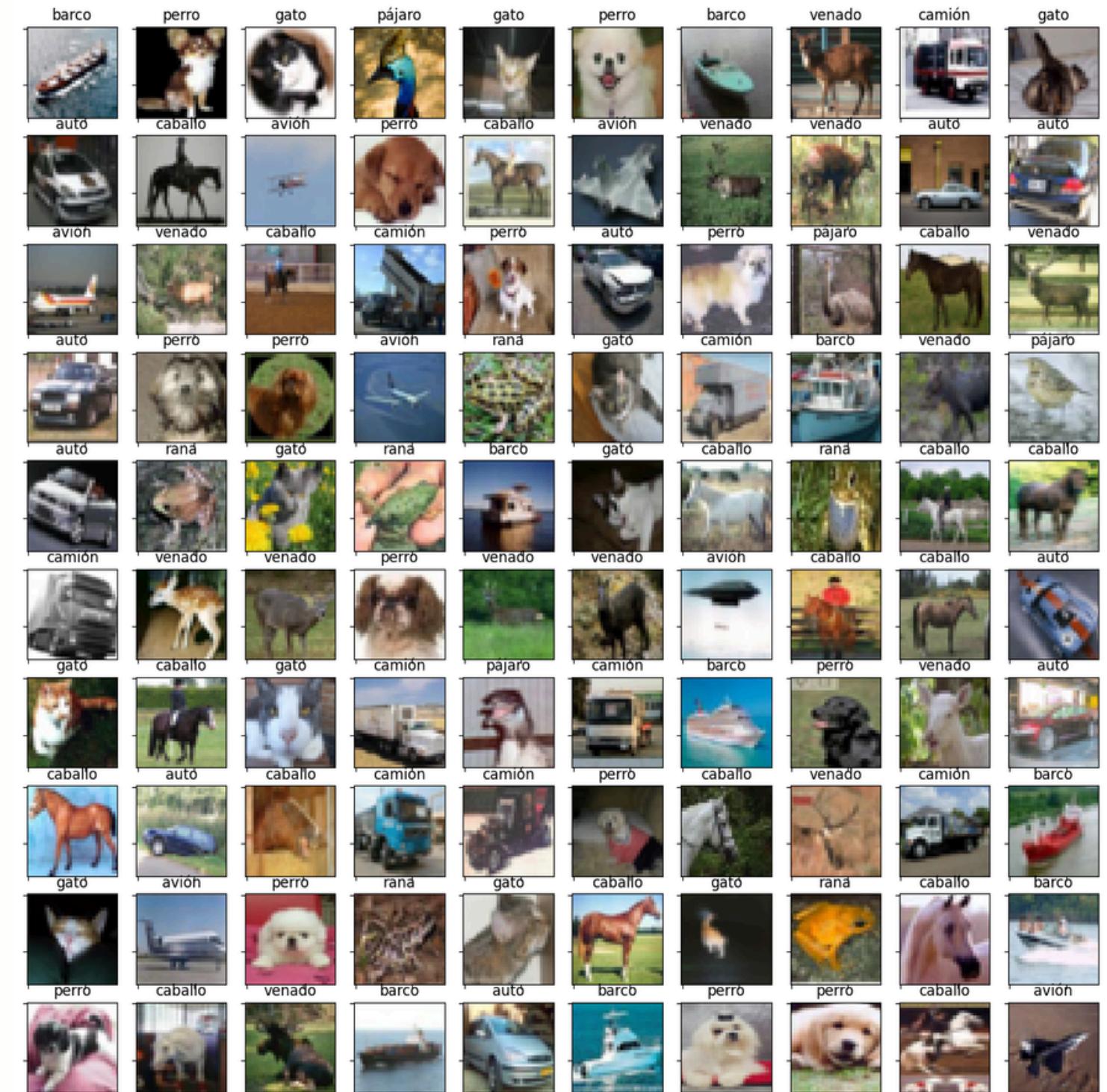
Etiquetado de imágenes CIFAR-10

El Gobierno de Chile busca implementar inteligencia artificial en su página web mediante el etiquetado de imágenes de diversos dominios. Se destaca la importancia de la Inteligencia Artificial en la actualidad para resolver problemas de clasificación, detección de objetos, estados de ánimo y reconocimiento facial, especialmente en un contexto de gran cantidad de datos.

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# Data Understanding

- 60000 imágenes en color
- 32x32 píxeles
- Divididas en 10 clases (etiquetas),
- 6000 imágenes por clase para entrenamiento y  
10000 para pruebas



# Data Preparation:

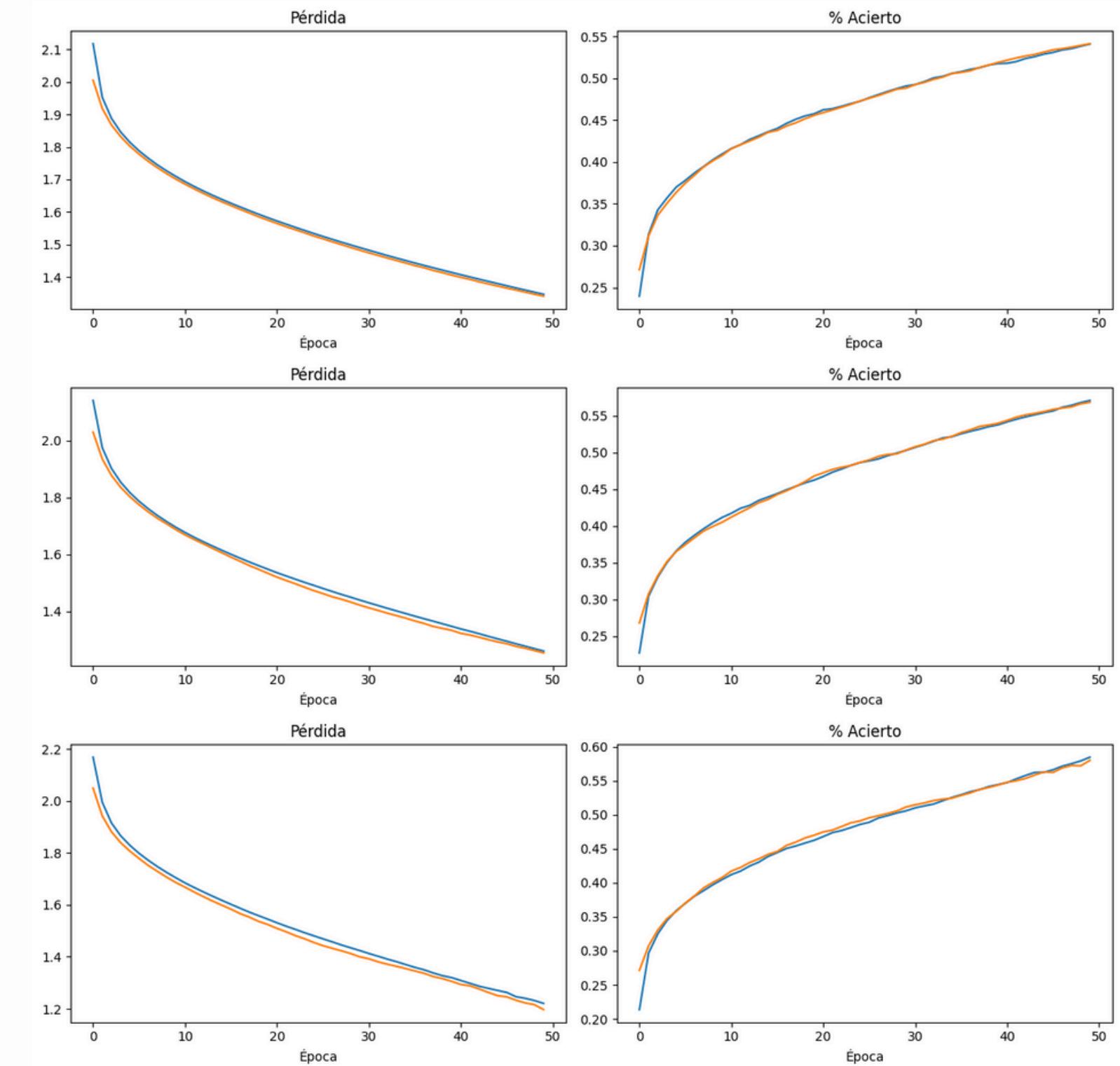
- Transformación de datos para entrenamiento
  - reshape
  - to\_categorical
- Se definen 3 capas:
  - Capa 1 --> 512 neuronas
  - Capa 2 --> 256 neuronas
  - Capa 3 --> 256 neuronas



# Modeling

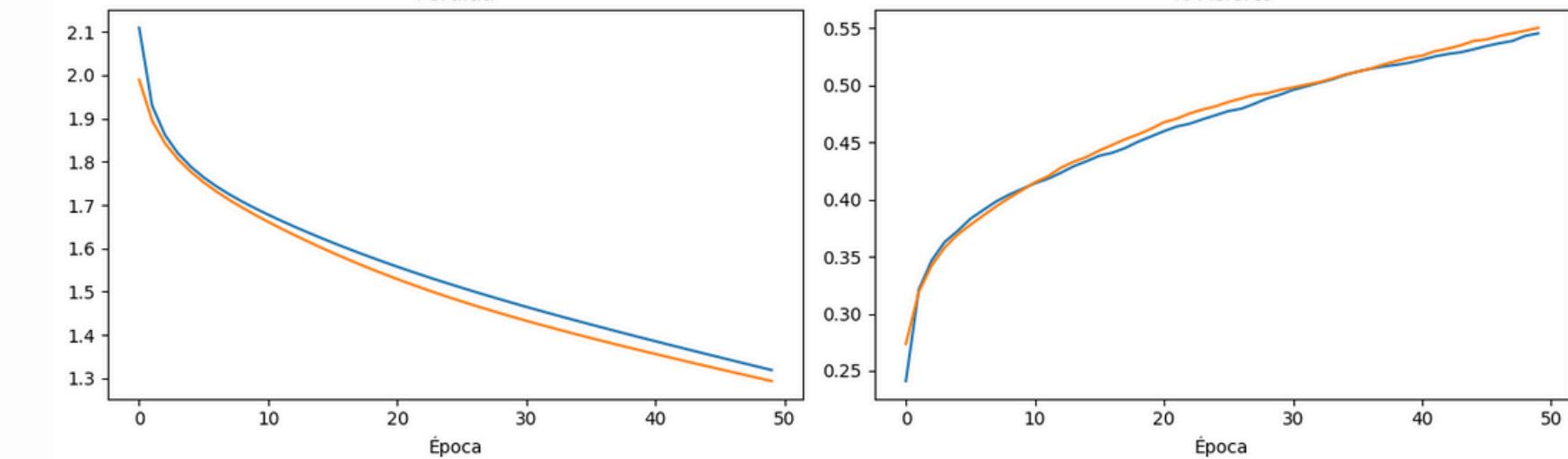
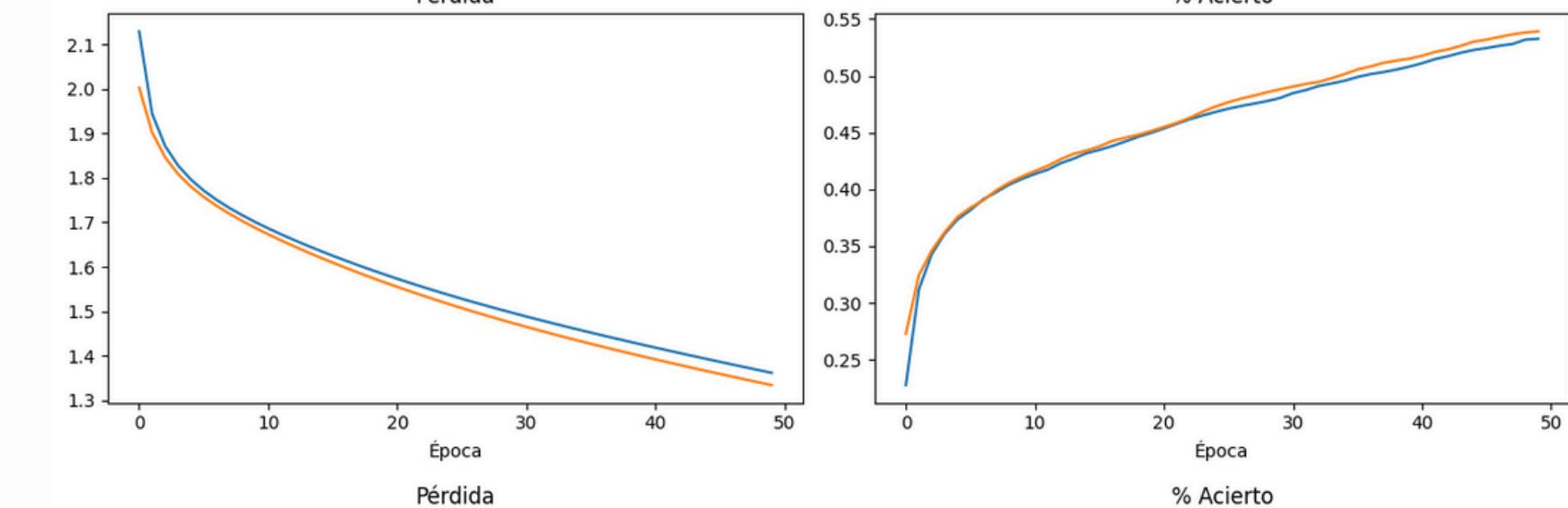
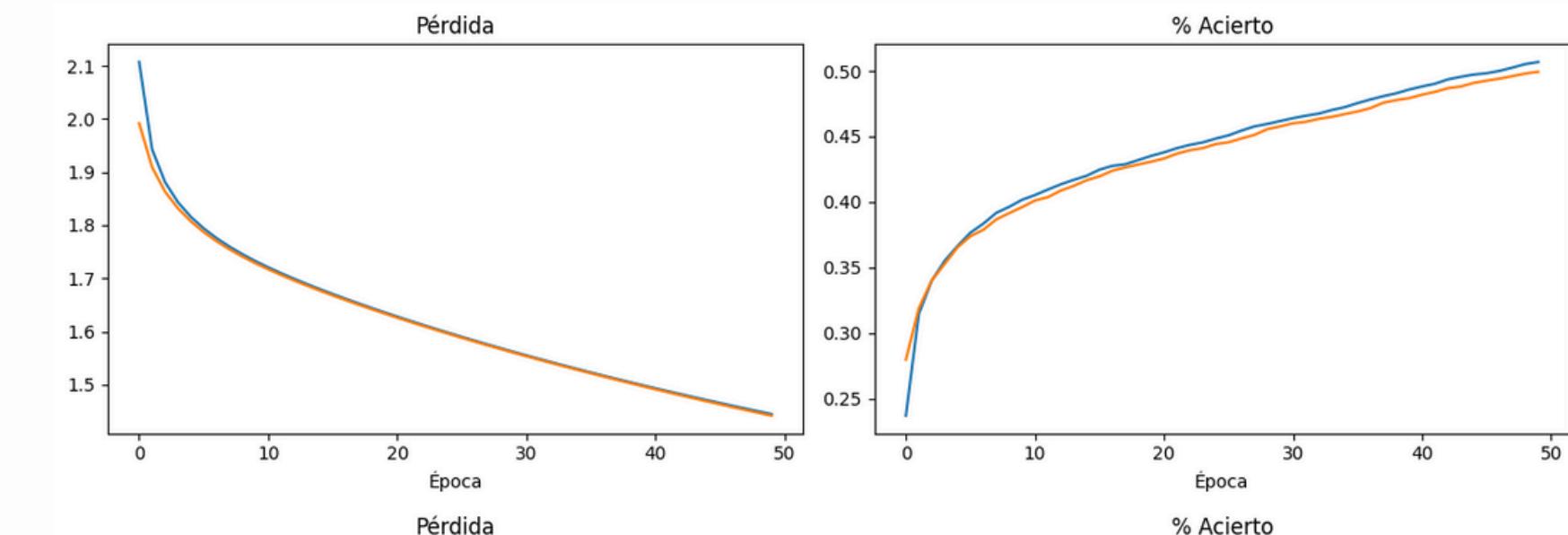
# SGD + ReLu

Relu					
Capas	accuracy	loss	val_accur acy	val_loss	tiempo
1	0,5448	1,3521	0,5414	1,3416	82
2	0,5731	1,2609	0,5685	1,2531	60
3	<b>0,59</b>	<b>1,2237</b>	<b>0,5802</b>	<b>1,1967</b>	<b>60</b>



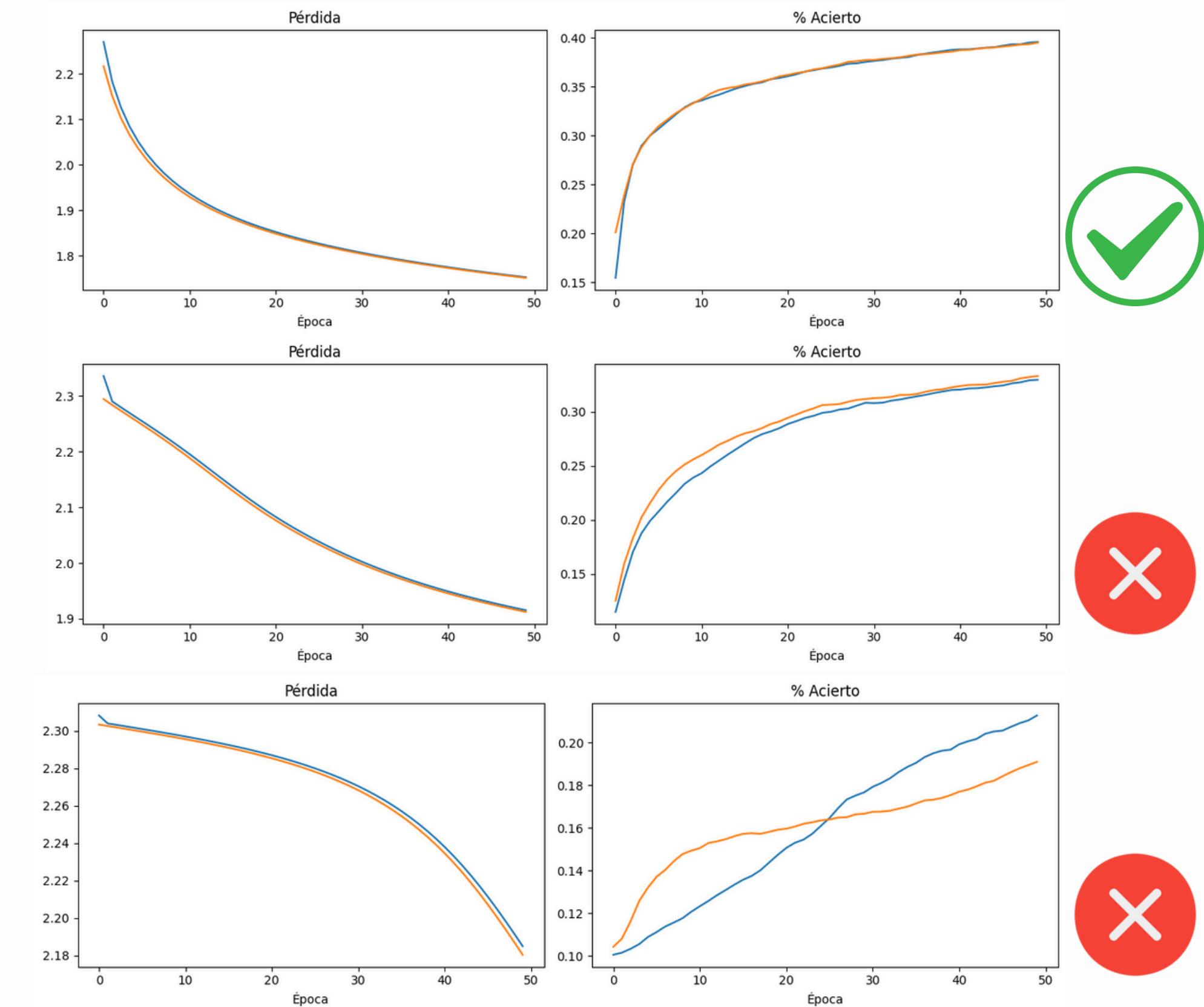
# SGD + Tanh

Tanh					
Capas	accuracy	loss	val_accur acy	val_loss	tiempo
1	0,5083	1,4454	0,4993	1,4415	62
2	0,5334	1,3618	0,5391	1,3339	65
3	<b>0,5454</b>	<b>1,3208</b>	<b>0,5503</b>	<b>1,2933</b>	<b>68</b>



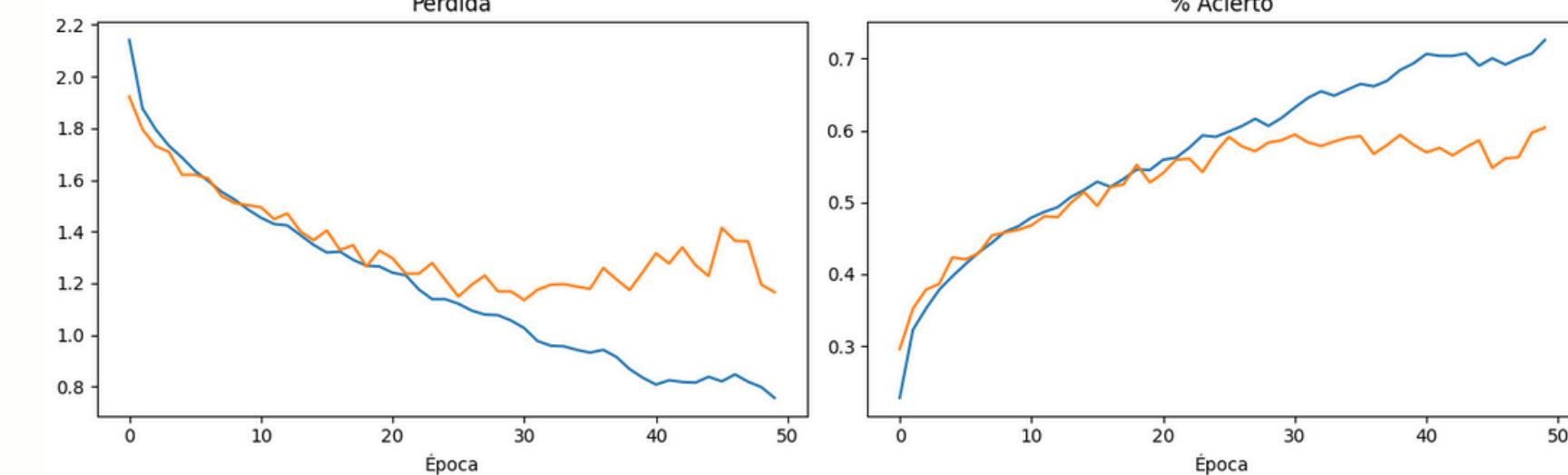
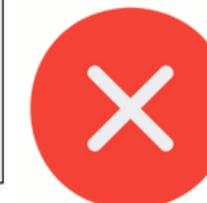
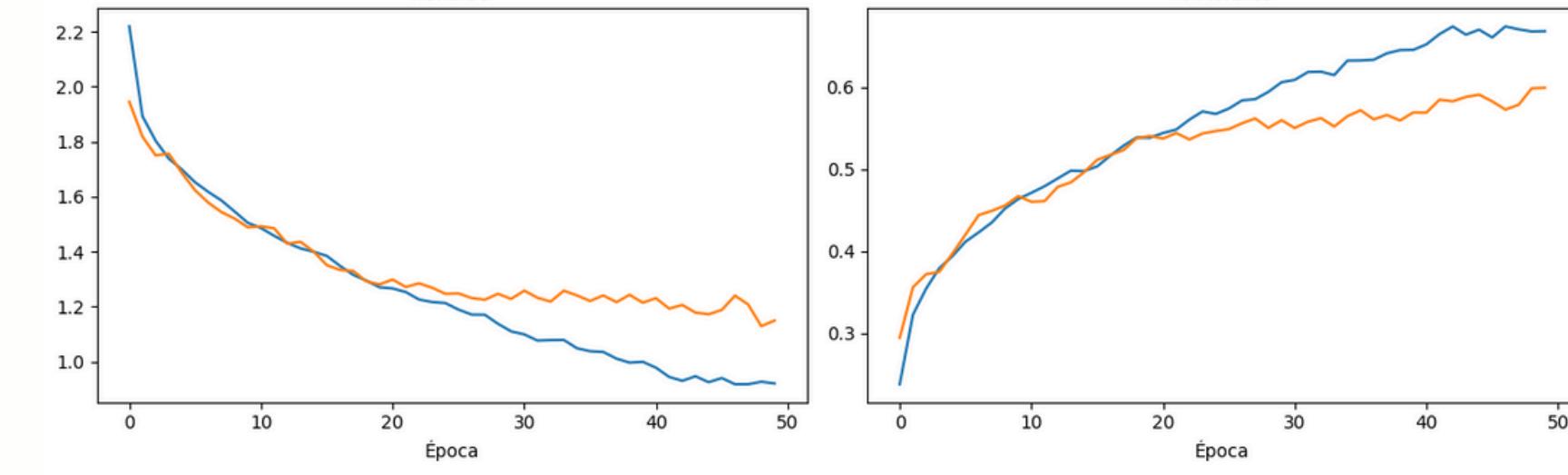
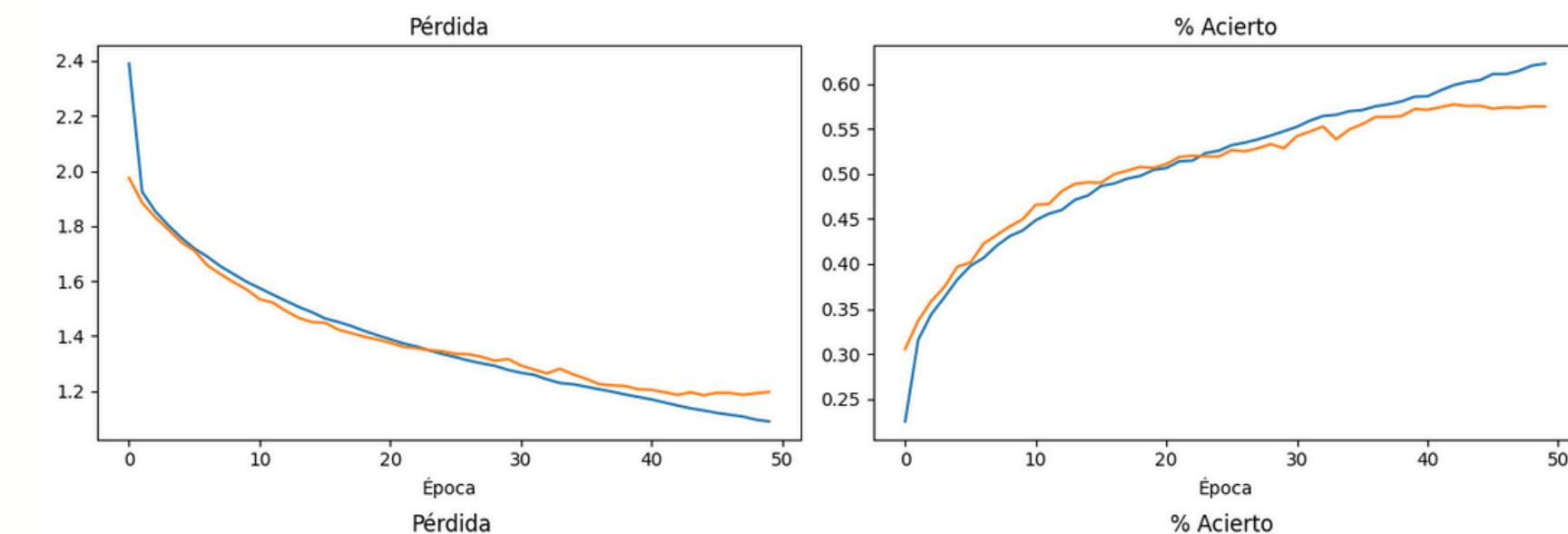
# SGD + Sigmoid

Capas	Sigmoid				
	accuracy	loss	val_accur acy	val_loss	tiempo
1	<b>0,4004</b>	<b>1,7536</b>	<b>0,3949</b>	<b>1,7515</b>	<b>59</b>
2	0,3269	1,9224	0,3330	1,9123	65
3	0,2126	2,1884	0,1909	2,1804	67



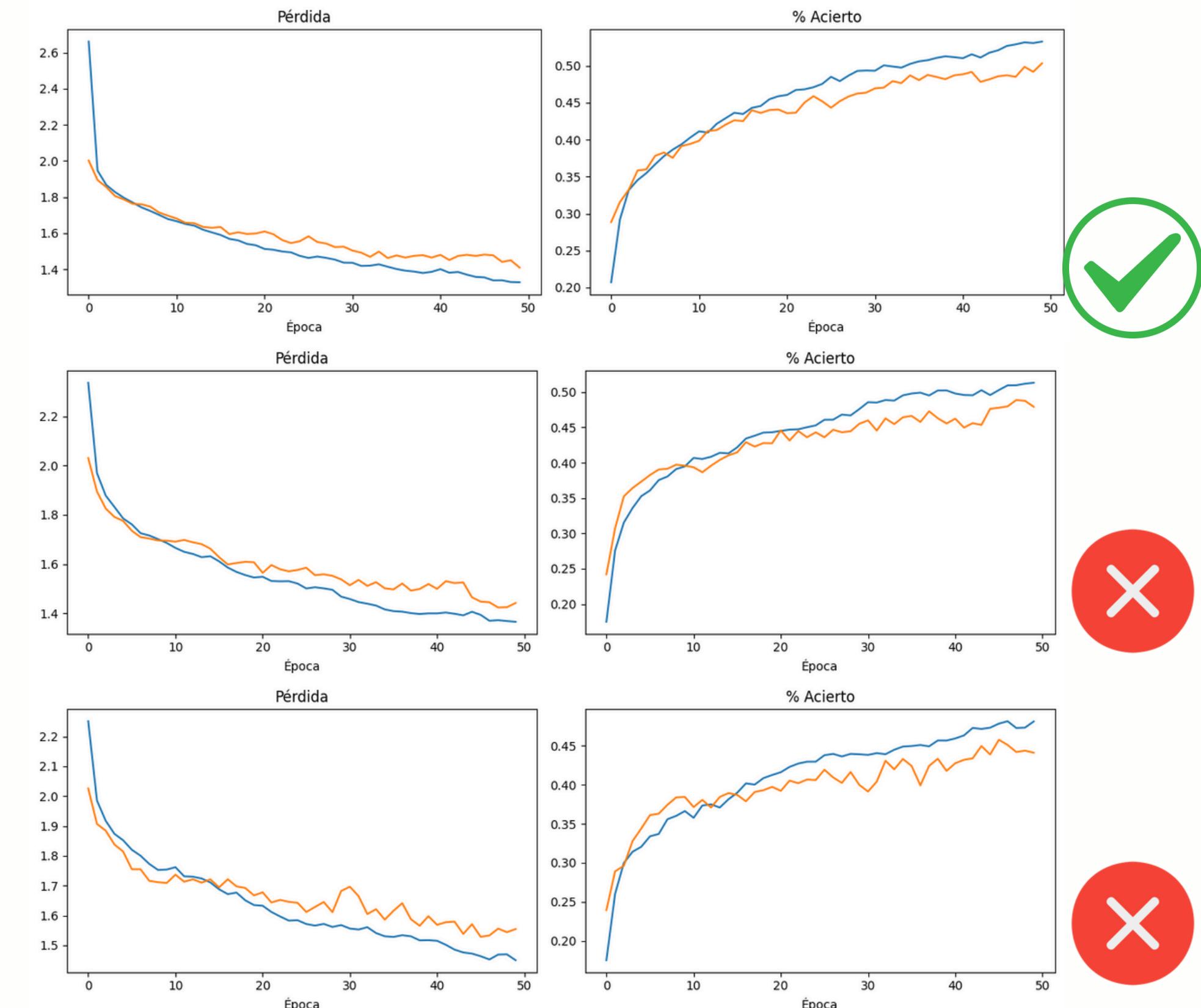
# ADAM + ReLu

Capas	Relu				
	accuracy	loss	val_accur acy	val_loss	tiempo
1	0,6154	1,1054	0,5748	1,1962	174
2	0,6713	0,9236	0,5989	1,1495	180
3	<b>0,7160</b>	<b>0,7959</b>	<b>0,6039</b>	<b>1,1658</b>	<b>299</b>



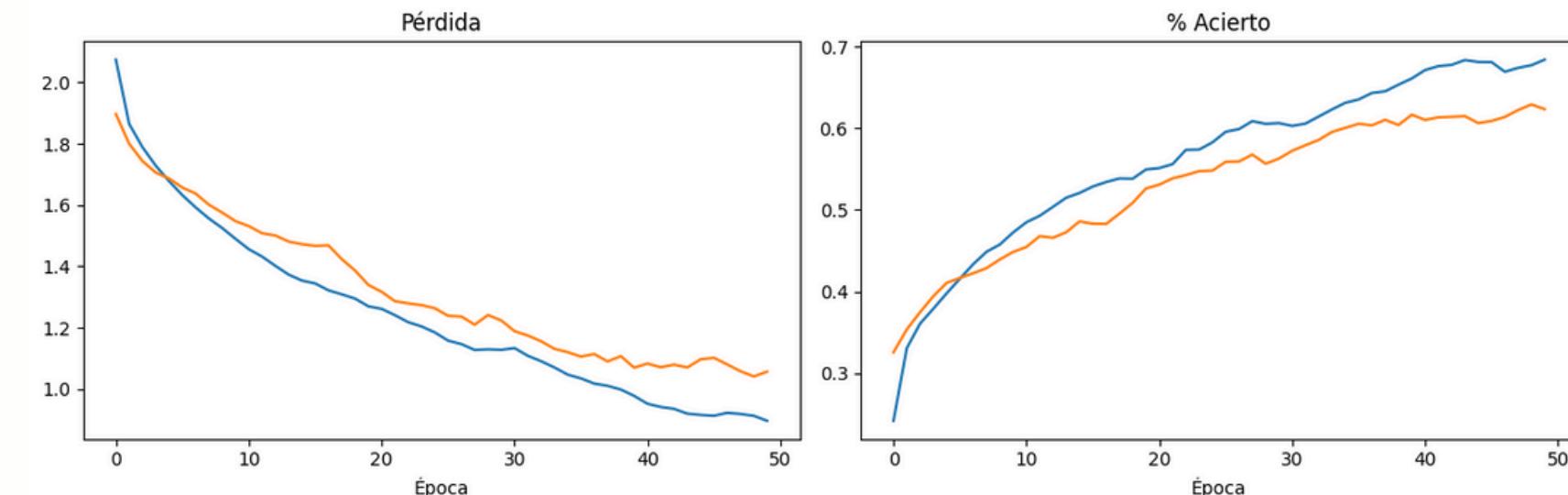
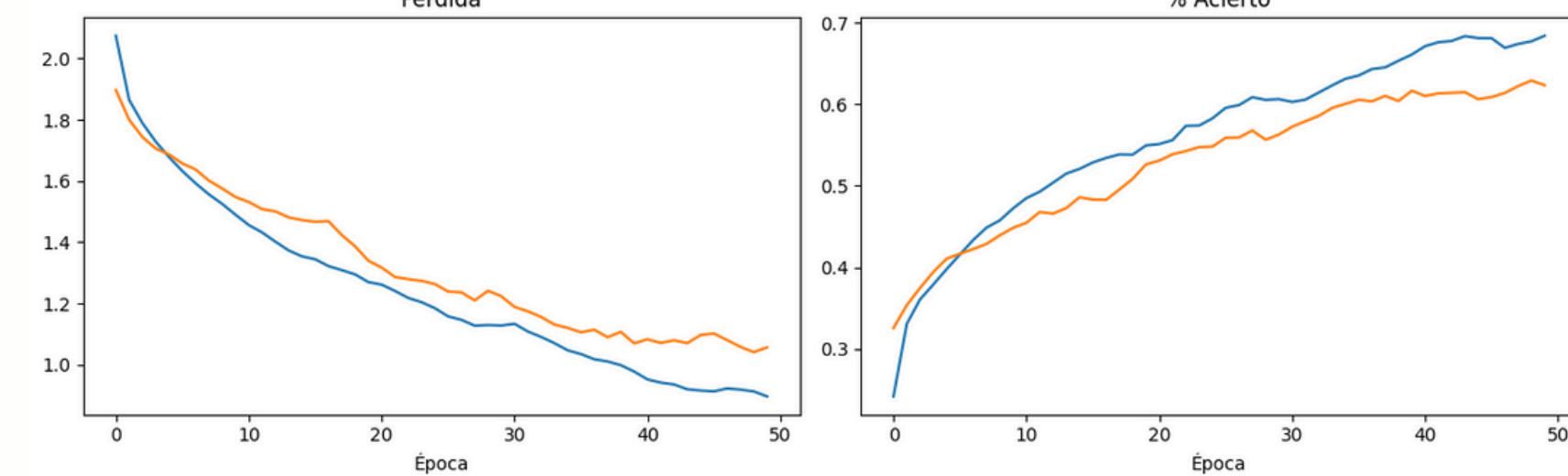
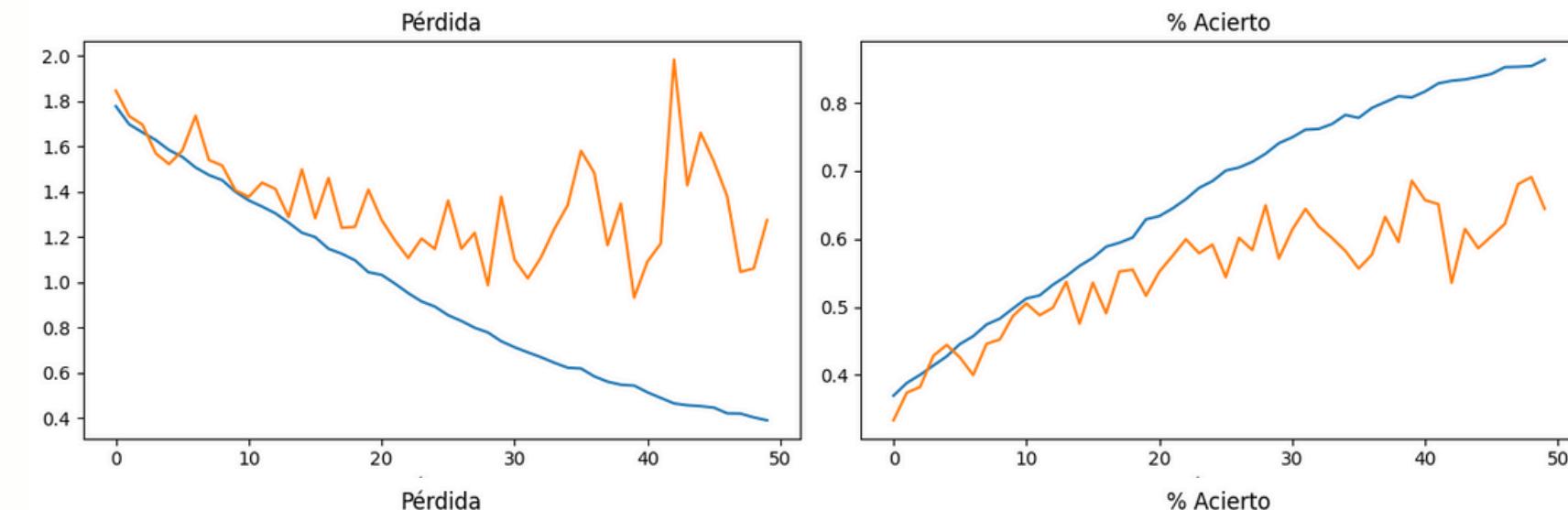
# ADAM + Tanh

Tanh					
Capas	accuracy	loss	val_accur acy	val_loss	tiempo
1	<b>0,5350</b>	<b>1,3251</b>	<b>0,5034</b>	<b>1,4098</b>	<b>158</b>
2	0,5191	1,3531	0,4791	1,4417	183
3	0,4814	1,4582	0,4411	1,5545	193



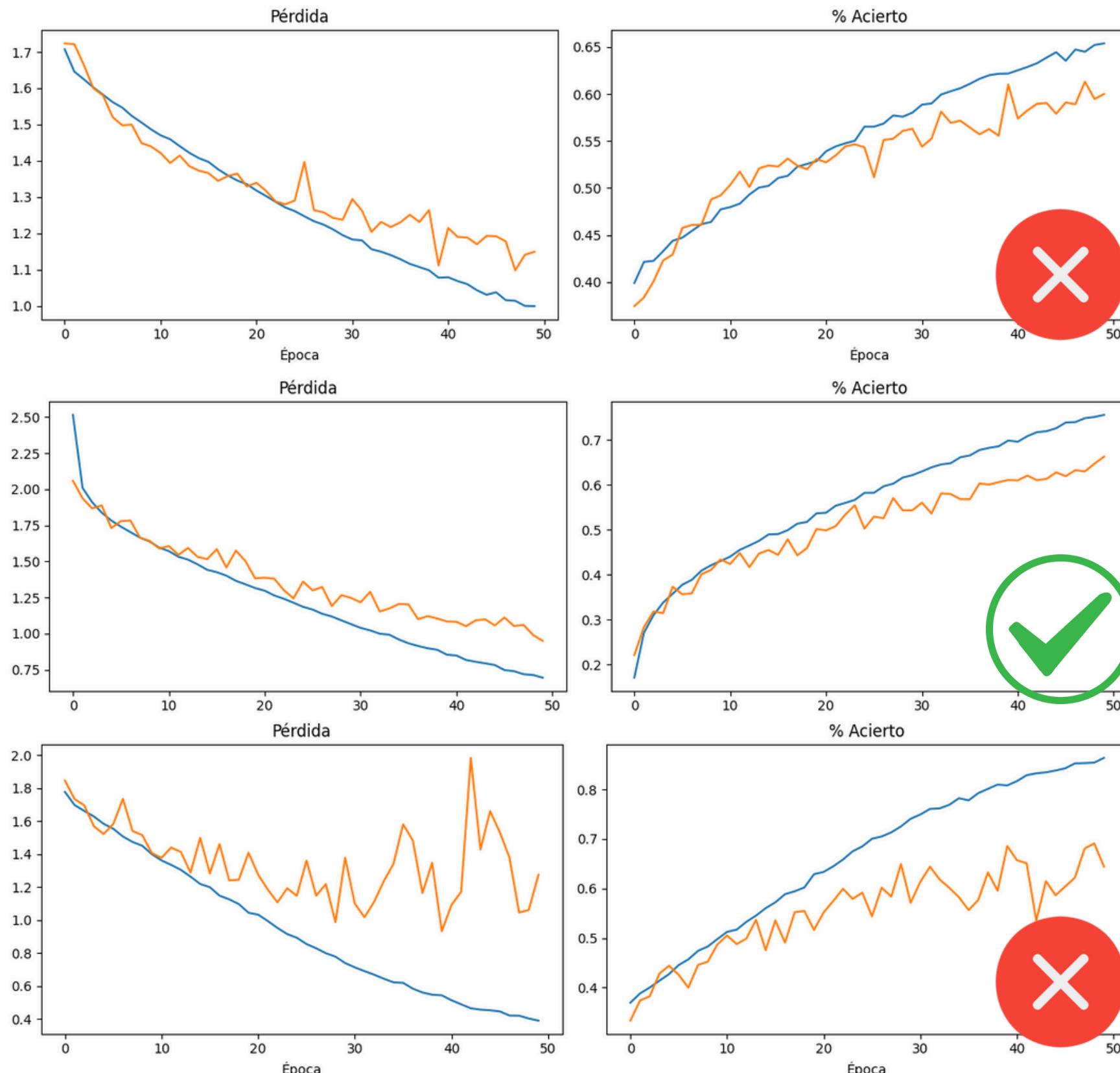
# ADAM + Sigmoid

	Sigmoid				
Capas	accuracy	loss	val_accur acy	val_loss	tiempo
1	0,7428	0,8059	0,6807	0,9001	117
2	<b>0,7397</b>	<b>0,7860</b>	<b>0,6400</b>	<b>1,0510</b>	<b>114</b>
3	0,6813	0,9301	0,6490	0,9837	125



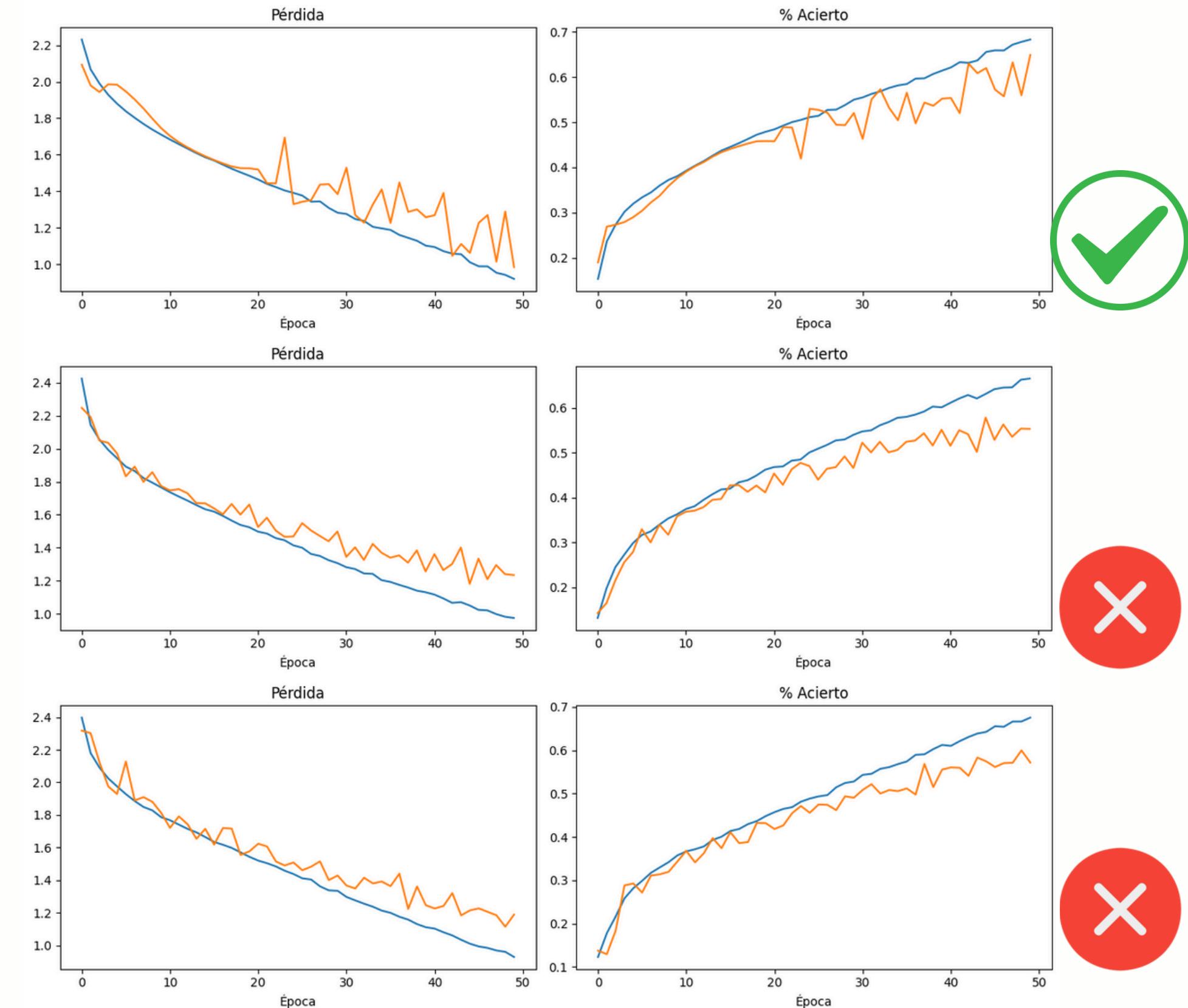
# RMSProp + ReLu

Relu					
Capas	accuracy	loss	val_accur acy	val_loss	tiempo
1	0,6474	1,0088	0,6000	1,1492	119
2	<b>0,7576</b>	<b>0,6916</b>	<b>0,6630</b>	<b>0,9490</b>	<b>123</b>
3	0,8641	0,3901	0,6443	1,2746	132



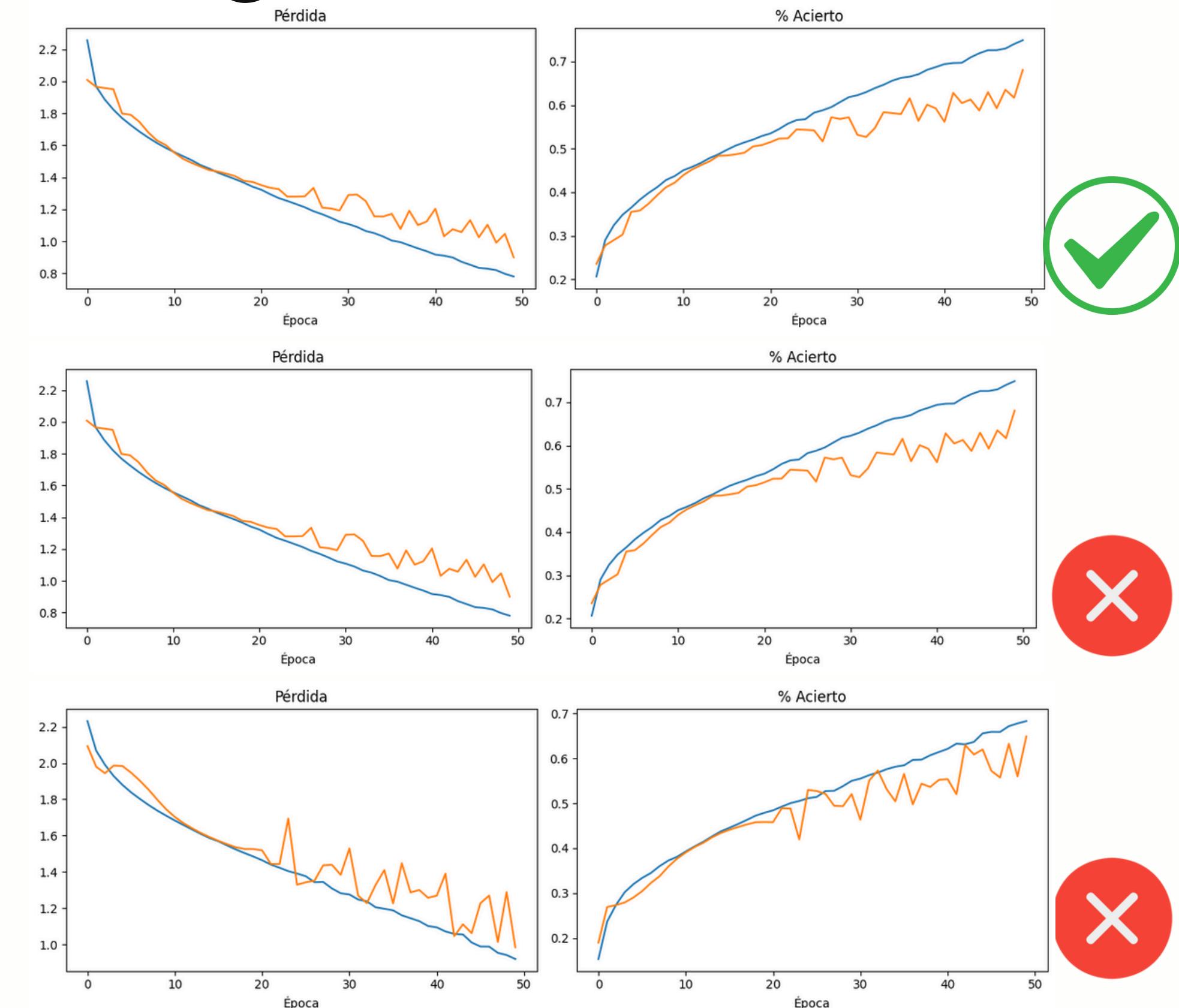
# RMSProp + Tanh

Tanh					
Capas	accuracy	loss	val_accur acy	val_loss	tiempo
1	<b>0,6218</b>	<b>1,108</b>	<b>0,4997</b>	<b>1,4631</b>	<b>117</b>
2	0,66	0,9886	0,5533	1,2350	126
3	0,6771	0,9359	0,5717	1,1889	129



# RMSProp + Sigmoid

Capas	Sigmoid				
	accuracy	loss	val_accur acy	val_loss	tiempo
1	<b>0,7428</b>	<b>0,8059</b>	<b>0,6807</b>	<b>0,9001</b>	<b>117</b>
2	0,7397	0,7860	0,6400	1,0510	114
3	0,6813	0,9301	0,6490	0,9837	125

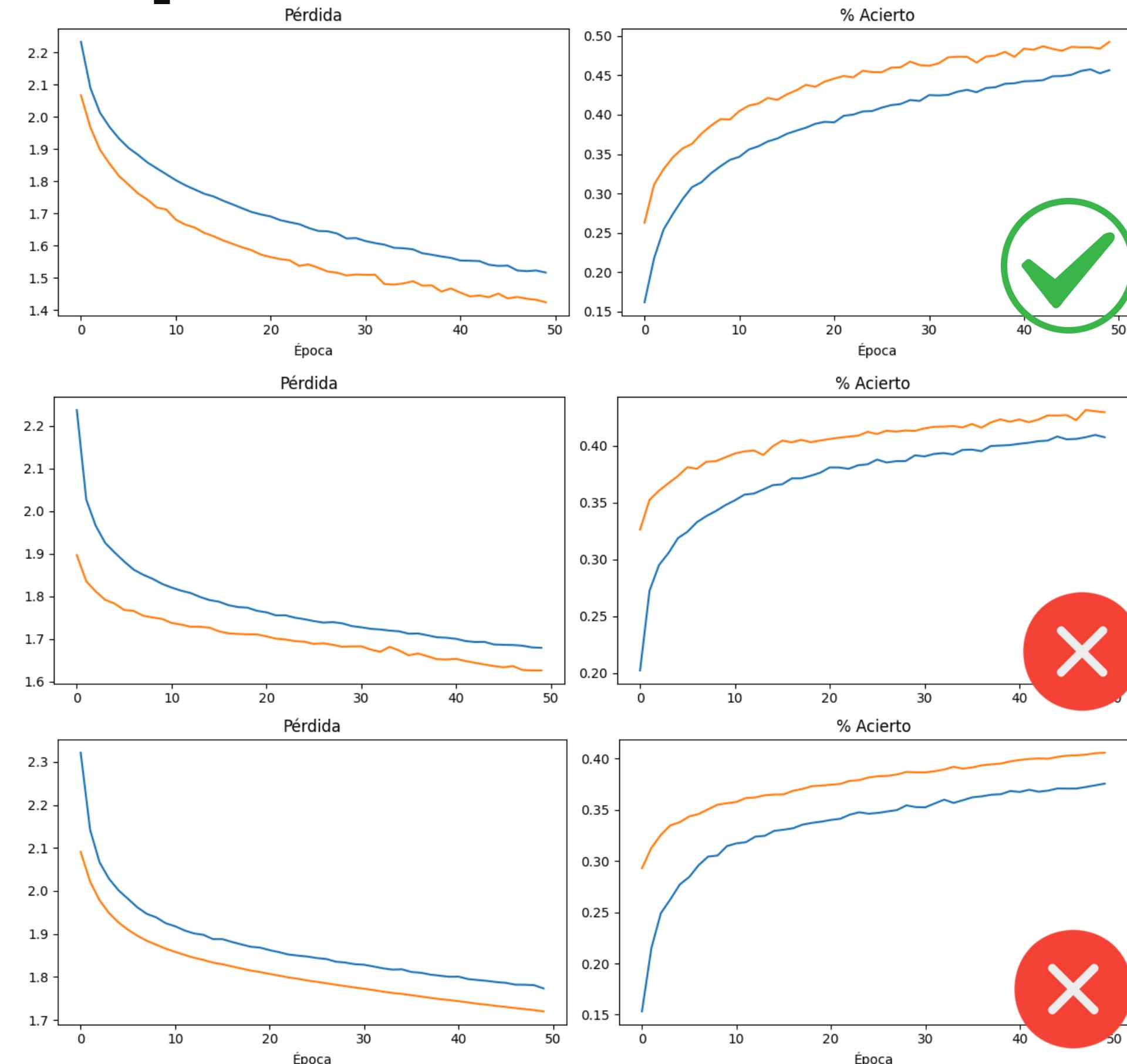


# Regularización

- Se escoge modelo con mejor rendimiento, tanto en SGD como en ADAM
  - Mejor combinación optimizador, función de activación y número de capas.
- Aplicamos Dropout y EarlyStopping

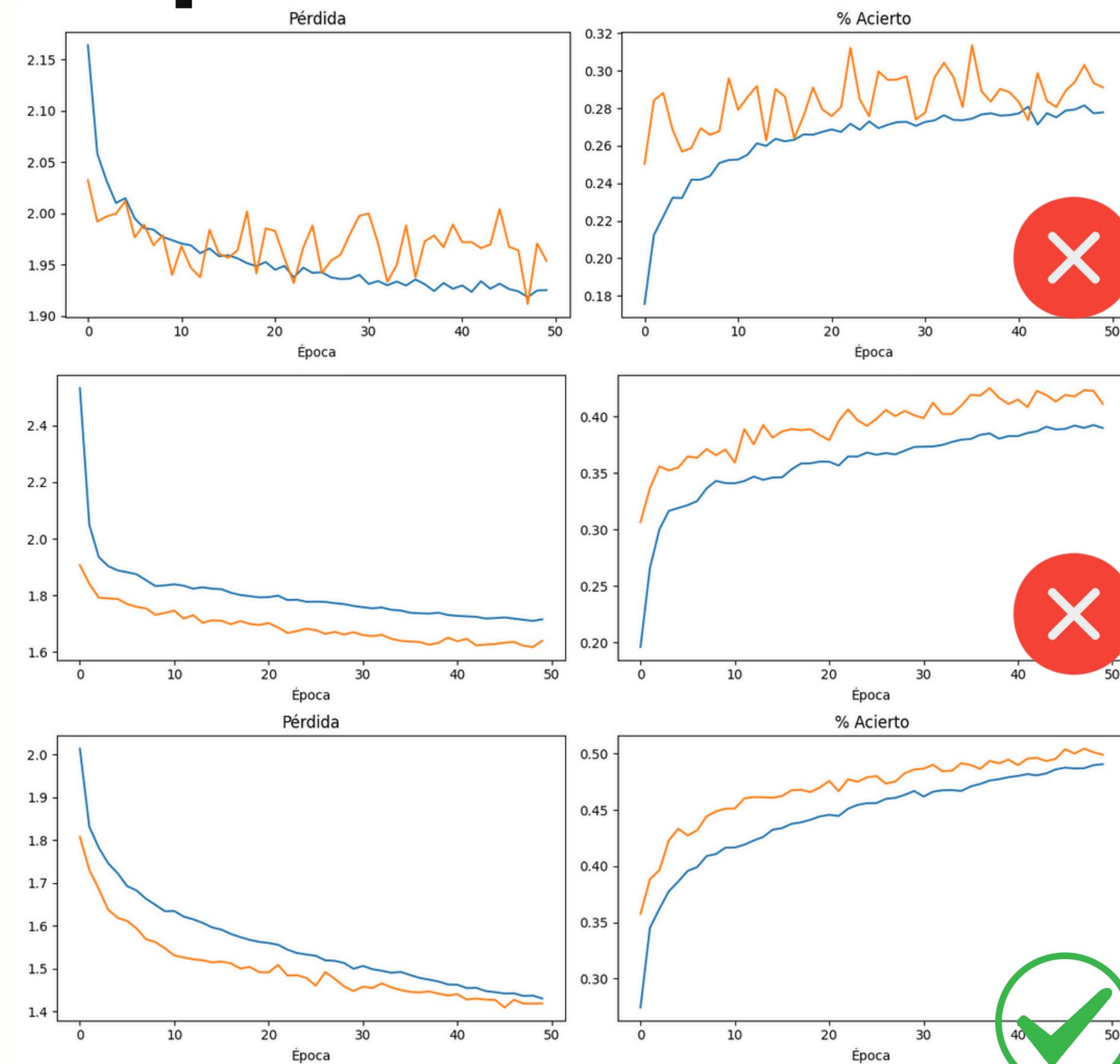
# SGD + Dropout

	Capas	accuracy	loss	val_accur acy	val_loss	tiempo
<b>Relu</b>	<b>3</b>	<b>0,4537</b>	<b>1,5168</b>	<b>0,4924</b>	<b>1,4245</b>	<b>247</b>
Tanh	3	0,4083	1,6801	0,4296	1,6265	244
Sigmoid	1	0,3705	1,7757	0,4058	1,7198	189



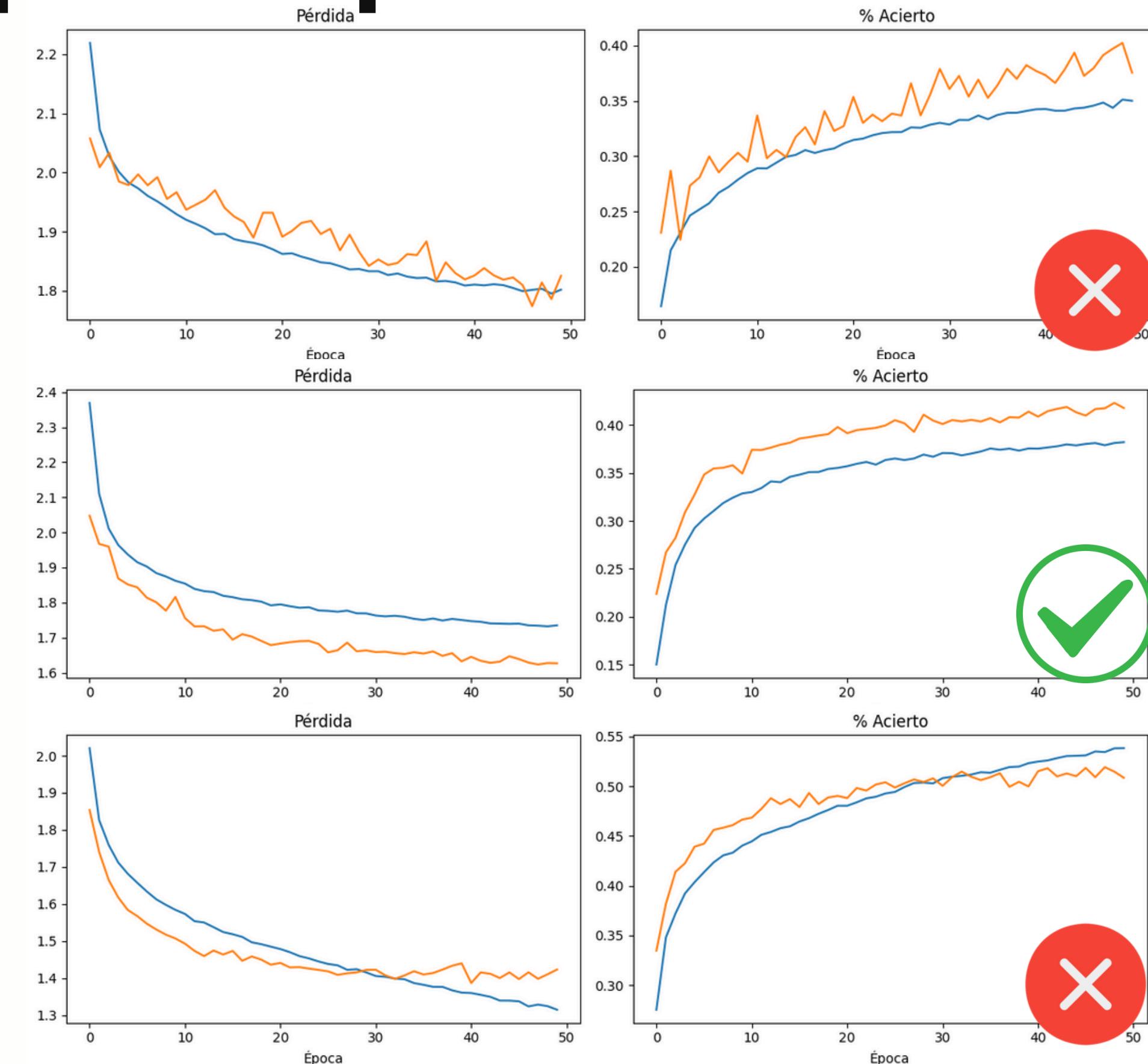
# ADAM + Dropout

	Capas	accuracy	loss	val_accuracy	val_loss	tiempo
Relu	3	0,2766	1,9304	0,2911	1,9537	501
Tanh	1	0,3905	1,7166	0,4114	1,6395	435
<b>Sigmoid</b>	<b>1</b>	<b>0,4919</b>	<b>1,4266</b>	<b>0,4991</b>	<b>1,4188</b>	<b>491</b>



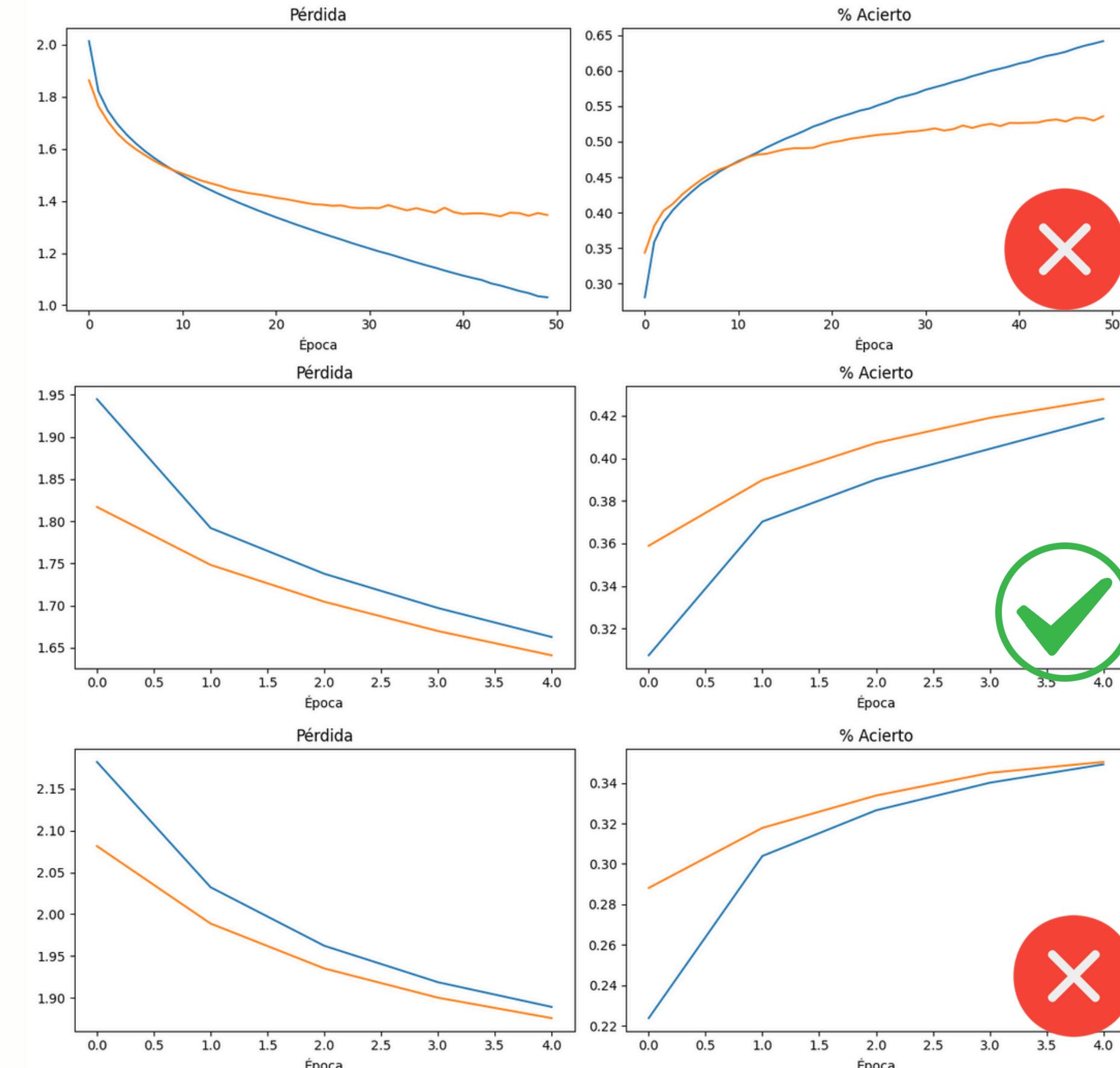
# RMSProp + Dropout

	<i>Capas</i>	<i>accuracy</i>	<i>loss</i>	<i>val_accuracy</i>	<i>val_loss</i>	<i>tiempo</i>
Relu	3	0,3462	1,8060	0,3756	1,8251	450
<b>Tanh</b>	<b>3</b>	<b>0,3835</b>	<b>1,7362</b>	<b>0,4178</b>	<b>1,6266</b>	<b>465</b>
Sigmoid	1	0,5405	1,3153	0,5084	1,4231	422



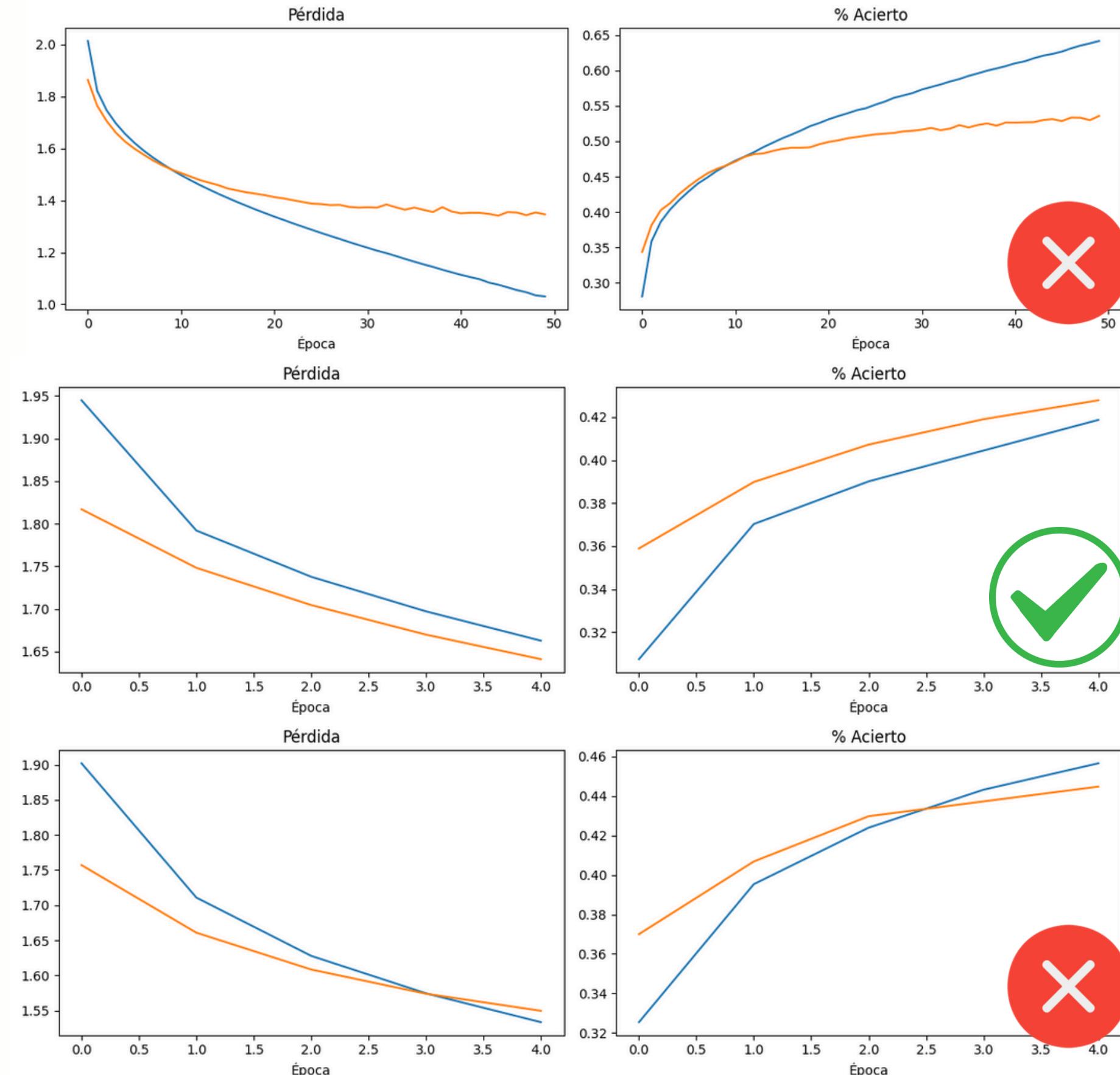
# SGD + Earlystopping

	Capas	acc	loss	val_acc	val_loss	tiempo	epoch
Relu	3	0,6413	1,0331	0,5357	1,3461	230	50
<b>Tanh</b>	<b>3</b>	<b>0,4171</b>	<b>1,6724</b>	<b>0,4278</b>	<b>1,6412</b>	<b>27</b>	<b>5</b>
Sigmoid	1	0,3473	1,8967	0,3504	1,8757	23	5



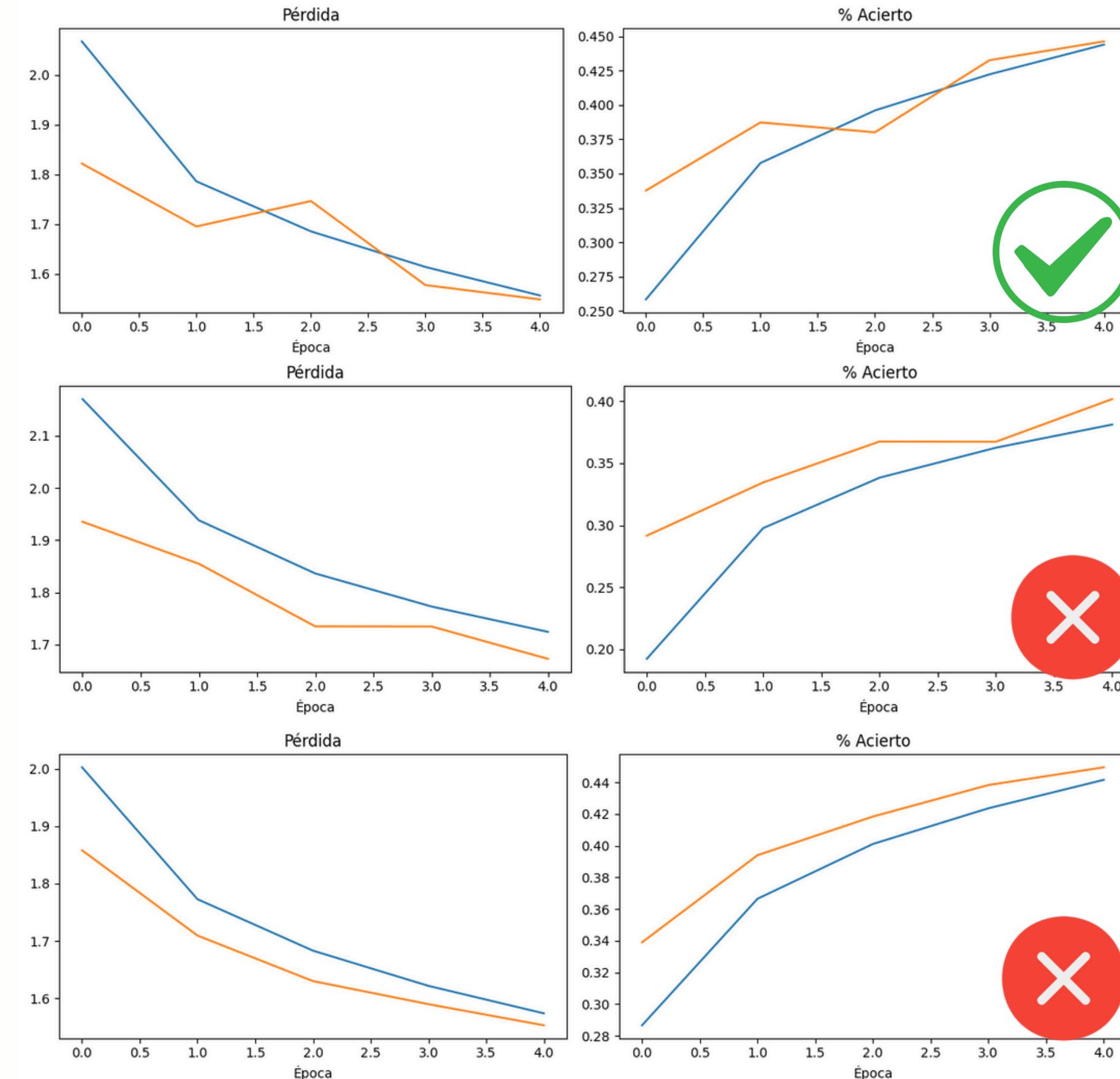
# ADAM + Earlystopping

	Capas	acc	loss	val_ac c	val_lo ss	tiempo	epoch
Relu	3	0,4620	1,4975	0,4621	1,5093	52	5
Tanh	1	<b>0,4096</b>	<b>1,6627</b>	<b>0,406 4</b>	<b>1,659 0</b>	<b>45</b>	<b>5</b>
Sigmoid	1	0,4522	1,5431	0,4447	1,5496	48	5



# RMSProp + Earlystopping

	Capas	acc	loss	val_acc	val_loss	tiempo	epoc
<b>Relu</b>	<b>3</b>	<b>0,436 4</b>	<b>1,5700</b>	<b>0,4463</b>	<b>1,5485</b>	<b>44</b>	<b>5</b>
Tanh	3	0,3706	1,7445	0,4017	1,6727	48	5
Sigmoid	1	0,4354	1,5872	0,4495	1,5596	44	5



# Evaluation:

- Más no siempre es mejor: Dependiendo la combinación, rendimiento mejora con menos capas.
- Regularizadores no mejora necesariamente accuracy pero sí el rendimiento de datos de prueba, especialmente con Sigmoid.
- La combinación SGD + ReLu mostró el mejor rendimiento, es decir, la mejor relación de accuracy entre los datos de entrenamiento y datos de prueba.



# Premios:

- Mejor optimizador: **SGD**
- Mejor función de activación: **ReLU**
- Mejor regularizador: **Dropout**
- Mejores combinaciones:
  - SGD: ReLu + 3 capas (60% vs 58%)
  - ADAM: ReLu + 3 capas (71% vs 60%)
  - RMSProp: Tanh + 3 capas (35% vs 41%)
  - Dropout: SGD + ReLu + 3 capas (45% vs 49%)
  - EarlyStopping: Adam + Tanh + 1 capa (40% vs 40%)



# Conclusión

# ¡Gracias!

