Neural Networks Lab Manual – Lab 2/4

From the Single Unit to MNIST — A Process-Over-Product Sequence

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Lab 2 — The XOR Network: Representability vs Learnability (15 pts)

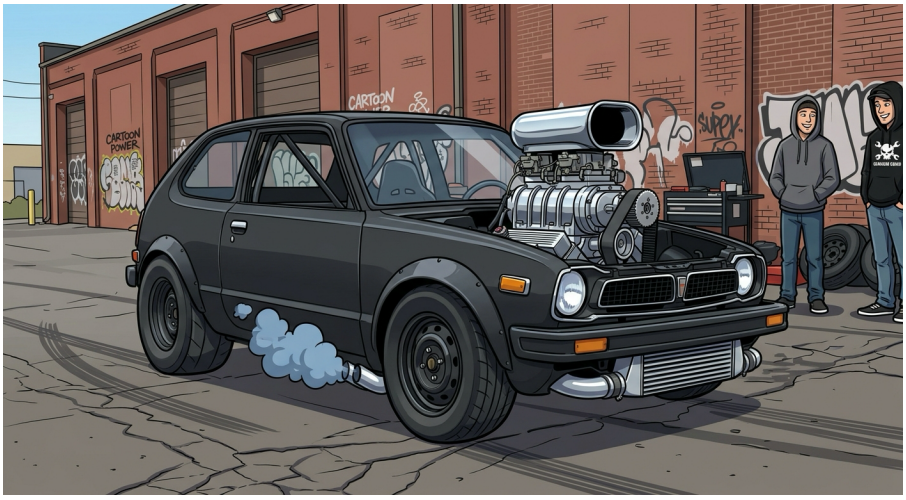
Idea

A single unit can't represent XOR. A two-layer network can. But whether a network can represent a function and whether it can learn that function by backprop are two different questions.

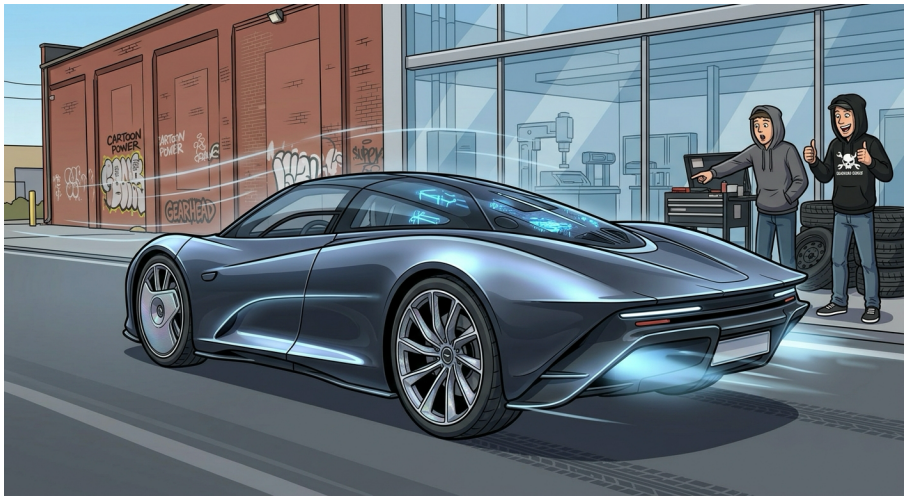
Tasks

A. Complete the XOR Learning worksheet and submit it with this assignment.

B. **Try to learn XOR with a sigmoid activation function, backprop, and multiple layers.** You may wish to start with an oversize network, akin to:



And then aim for something like:



Please use at least one hidden layer. Experiment with different hidden layer sizes. If/when you get the network to reliable learn XOR, then try to make it as lean as possible.

Deliverables and points

Item	Artifact	Pts
XOR Learning worksheet		3
Predictions: Do you think the network can learn XOR? Justify your prediction. If you are confident that you can train it, please give a sense of expected hyperparameter values.	Prediction ledger	3
Present the hyperparameters for three big runs and the success in training.	Results	3
Present the hyperparameters for the smallest network/least epochs with which you were able to train the network.	Results + interpretation	3
Reading the learned templates: what each hidden unit detects, and how the learned decomposition differs from the hand-derived OR/AND one	Mechanism explanation	3