Test Person 2021-07-05

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Class: E1a
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Question 1 (2 points)

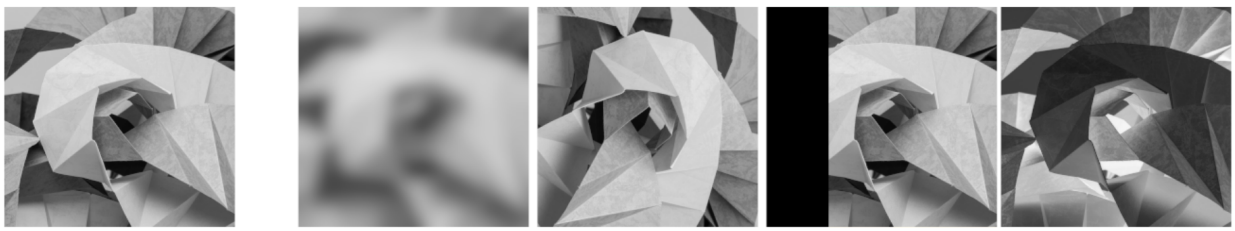
How many learnable parameters has a 3-layer MLP with bias (input → hidden1 → hidden2 → output) with 20-20-20-20 neurons, with batch normalization in the first hidden layer, and dropout (p=0.5) in the second hidden layer?

Question 2 (4 points)

What do we mean by privileged information in machine learning? Can you describe an use case for a real world problem? Originality is rewarded.

Question 3 (6 points)

Consider the following images:



Can you obtain each of the four images (a,b,c,d) as the result of a 2D convolution of the source with one single filter (a different filter for each image)? Consider two different settings: (i) the pixel values are in $[-1, 1]$, and (ii) the pixel values are in $[0, 1]$. Please motivate your answers.

Question 4 (6 points)

Consider the linear explanation of adversarial examples. Given two identical models trained to solve the same classification task, where one is trained with L_2 regularization and one without, which one is more vulnerable to adversarial attacks? Why?

Question 5 (8 points)

Assume you have a learning model X that, given some input, predicts the parameters a, b of a uniform distribution in $[a, b]$. Further, a second model Y samples from this distribution to compute the final output. Can you train the composed model $Y \circ X$ end-to-end? If yes, how?

Question 6 (8 points)

Consider a simple self-attention layer (i.e. with no trainable parameters). We observe the following phenomenon. Given an input sequence of length n, where each vector is drawn uniformly from the unit d-dimensional sphere with $d \gg n$, in the output we observe almost exactly the same sequence as the input. Why? Please explain your reasoning.

Question 7 (6 points)

Would you trust the predictions of an end-to-end neural network trained to predict if a nevus is malignant (melanoma) or not? Why yes? Why no? Why yes and no?
[A nevus is a birthmark, mole, or other colored spot on the skin]
You know that:
- The model is trained on a large dataset and reaches very high classification accuracy.
- 30% of the images in the dataset contain a ruler besides the nevus. Like this:

We do not grade opinions, we grade your understanding of what a prediction is and how an end-to-end neural network makes one.

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