Matrix derivatives

Quiz, 3 questions

1.

Choose the correct statements about MLP implementation:

- [ ] You shouldn't prefer matrix operations when working with GPU

- [ ] A backward pass of a dense layer needs a 4-d tensor derivative

- [x] A forward pass of a dense layer can be done with matrix product

- [x] You can write both passes of a dense layer with NumPy and make it quick even in Python

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2.

How many dimensions will a derivative of a 3-d tensor by a 4-d tensor have?

7

3.

Let's play around with matrix derivatives!

A trace $Tr(X)$ of a matrix X is a sum of its diagonal elements.

For example: $Tr \begin{pmatrix} 1 & 3 \\ 3 & 1 \end{pmatrix} = 1 + 1 = 2$. Note that trace is a scalar!

Let's find a matrix notation for $\frac{\partial Tr(X^2)}{\partial X}$ for matrix $X = \begin{pmatrix} x_{1,1} & x_{1,2} \\ x_{2,1} & x_{2,2} \end{pmatrix}$, where X^2 is a matrix product $X \cdot X$.

Please do this element-wise and figure out a matrix notation for it:

○ $Tr(2X)$

○ $X^T X$

○ $2X$

◉ $2X^T$

○ $2Tr(X^T)$

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