Need help

discussion posted 5 days ago by love-yourself

Hi. In this unit I'm struggling when moving from the lecture exercises to the HW assignments. I think I understood linear regression when I'm dealing with calculus f(), but the matrix notation seems still confusing to me. I'm familiar with matrix operations, as long as I can visually see the matrix I'm dealing with. When performing linear regression, I have some doubts about the specific role each term play. Is anybody facing the same challenge?

What may we do to better seize this concept?

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3 responses

younhun (Staff)
4 days ago

I used to struggle with the same thing, so I can sympathize. The single best way is to actually understand what the derivative is doing in smaller-dimensional cases, say in 2 dimensions.

HOWEVER, there's kind of a "cheat" way of doing matrix calculus. When multi-dimensional things seem foreign, you should always appeal to the single-variable case for guidance.

For example, when you have a function like $f(x) = x^T A x$, you should notice that this is a quadratic function in x. Think of something like $h(x) = cx^2$, and take the derivative. You should get $h'(x) = 2cx$. So ∇f, which is the multi-dimensional analogue of the derivative, should resemble $2Ax$. But there are a few different candidates, like $2A^T x$, $2x^T A$, $2x^T A^T$, etc. Only one of them makes sense (depending on whether you think of gradients as column or row vectors. In this class, we've often thought of them as column vectors) so we get $2Ax$.

In fact, if you write it out the long way, then you'll see that this "cheat" actually gave the right answer, since

$f(x) = \sum_{i,j} A_{i,j} x_i x_j$ which gives $\frac{\partial}{\partial x_i} f(x) = 2A_{i,i} x_i + 2\sum_{j \neq i} A_{i,j} x_j = 2(Ax)_i$.