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MDL QUIZ 1

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1) An AI/ML application that I found very interesting is the generation of Artificial faces by studying real ones.
The generated faces look very real and its almost impossible to tell the difference.
The technique used to achieve this is called GAN which stands for: Generative Adversarial Network. This works by having two convolutional neural nets. One called the generator and other the discriminator. The generator creates an image based on random numbers and generates an image. The discriminator is fed that image alongside real images and it tries to distinguish real from fake ones. The generator thus tries to fool the discriminator by getting better every time.
Following is an example of a double feedback loop.

2)

a) $y = 7x^2 + 31x + 27$ $a = 7, b = 31, c = 27$

b) $y' = 28x + 31$, $y'' = 14$

$y - y' = 7x^2 + 3x - 4$

$y - y'(0) = -4$
$y - y'(1) = 6$
$(2) = 18$
$(3) = 68$
$(4) = 120$
$(5) = 186$

$y - y'' = 7x^2 + 31x + 13 =$

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From observing above formulas we can clearly say distance between f(x) & f'(x) will be smaller.

Ans: f'(x)

c)

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3) The number of features corresponds to the dimensionality of the data.
Now some features might be redundant or some may add unnecessary noise & randomness to the data. Therefore if we find and choose to ignore such features. we can better fit our model and also reduce over complicating our model.

When we talk about alphabets in a language there is no correspondence between the seperate alphabets of two languages. The language with 100 alphabets ~~doesn't~~ wouldn't be able to convey same information in only 26 alphabets.
There is no redundancy present in the language. When you are thinking in your mothertongue you think in terms of meaning & not Alphabets.
Hence you don't perform dimensionality reduction.

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4)

a) x_1 y_1 627 , 627
x_2 y_2 27 , 27
x_3 y_3 7 , 7
x_4 y_4 15 , 15
x_5 y_5 9 , 9
x_6 y_6 135 , 135

b) $Bias^2 = \left(E[\hat{f}(x)] - f(x)\right)^2$

Bias is the difference between the average prediction of our model & the correct value which we are trying to predict.

c)

	MR1	MR2
x_1 y_6	627 , 135	
x_2 y_5	27 , 9	
x_3 y_4	7 , 15	
x_4 y_3	15 , 7	
x_5 y_2	9 , 27	
x_6 y_1	135 , 627	

Value of x.	MR1	MR2	MR3.	Mean
x_1	135	7	627	256.3
x_2	9	27	27	21
x_3	15	627	7	216.3
x_4	7	135	15	52.3
x_5	27	9	9	15
x_6	627	15	135	259

c) $|(627 - 256.3) + (27 - 21) + |(7 - 216.3)|$
$+ |(15 - 52.3)| + |(9 - 15)| + |(135 - 259)|$

Bias is mean of abs of above terms.

$$\frac{370.7 + 6 + 209.3 + 37.3 + 6 + 344}{6} = \boxed{170.55}$$

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d) $Var = E\left[(\hat{f}(x) - E[\hat{f}(x)])^2\right]$

Variance is variability of a model prediction given for a datapoint.

~ It is how much the predictions for a given point vary between different realisation.

e) ~~13 (135-256.3)+(9-256.3)+(15-256.3)+(27-256.3)+(627-256.3)~~

$MR1^2 = ((135 - 256.3)^2 + (9-21)^2 + (15-216.3)^2 + (7-52.5)^2 + (27-315)^2 + (627-253)^2)$

$MR2^2$

$MR3^2$

& take average of all to get answer.

f) $MSE = E\left[(f(x) - \hat{f}(x))^2\right]$