9. Gaussian Generative models

Gaussian Generative models

And then here, we have exponent minus 1 divided by 2

sigma squared is x minus mu squared.

OK?

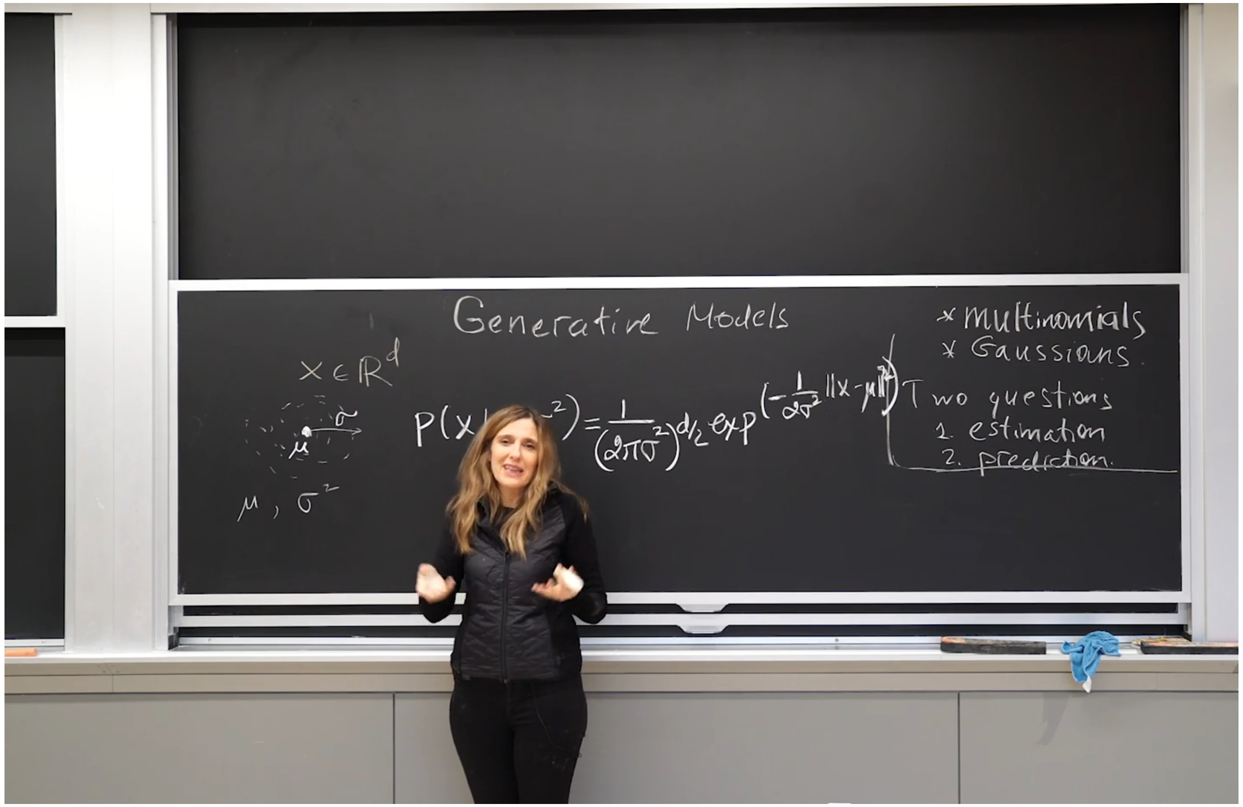
So this is the likelihood of a particular point being

generated by the Gaussian.

And you can see that if we select

different mus and different sigmas,

the same point may get different likelihoods.



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Gaussian distribution

1/1 point (graded)

Recall that the likelihood of x being generated from a gaussian with mean μ and std σ is:

$$P\left(x|\mu,\sigma^2\right) = \frac{1}{\left(2\pi\sigma^2\right)^{d/2}} exp\left(-\frac{1}{2\sigma^2}\|x-\mu\|^2\right)$$

Let $x = \begin{bmatrix} \frac{1}{\sqrt{\pi}} \\ 2 \end{bmatrix}$ be a vector in the two dimensional space.

Let G be a two-dimensional gaussian distribution with mean μ and standard deviation σ taking values as follows

$$\mu = \begin{bmatrix} 0 \\ 2 \end{bmatrix}, \sigma = \sqrt{\frac{1}{2\pi}}$$

Calculate the probability $p\left(x|\mu,\sigma^2\right)$ of x being sampled from the gaussian distribution G with mean μ and variance σ^2 taking values as given above.

Enter the value of $logp\left(x|\mu,\sigma^2\right)$ below (note that we use log for the natural logarithm, i.e. $log_e\left(\right)$

-1

✔ **Answer:** -1

Solution:

Note that the probability of vector x being sampled from a gaussian distribution G with mean μ and variance σ^2 is given as follows

$$P\left(x|\mu,\sigma^2\right) = \frac{1}{2\pi\sigma^2} exp\left(-\frac{1}{2\sigma^2}\|x-\mu\|^2\right)$$

Substituing the value of $\sigma = \sqrt{\frac{1}{2\pi}}$ from above, we have

$$P\left(x|\mu,\sigma^2\right) = \frac{1}{2\pi\frac{1}{2\pi}} exp\left(-\frac{1}{2\frac{1}{2\pi}}\|x-\mu\|^2\right)$$

$$P\left(x|\mu,\sigma^2\right) = exp\left(-\pi\|x-\mu\|^2\right)$$

Substituing the value of $x = \begin{bmatrix} \frac{1}{\sqrt{\pi}} \\ 2 \end{bmatrix}$ and $\mu = \begin{bmatrix} 0 \\ 2 \end{bmatrix}$, we have

$$P\left(x|\mu,\sigma^2\right) = exp\left(-\pi\left(\left(\frac{1}{\sqrt{\pi}}-0\right)^2 + (2-2)^2\right)\right)$$

$$P(x|\mu,\sigma^2) = exp(-\pi\frac{1}{\pi})$$

$$P(x|\mu,\sigma^2) = exp(-1)$$

$$ln(P(x|\mu,\sigma^2)) = ln(exp(-1)) = -1$$

Submit You have used 1 of 2 attempts

Answers are displayed within the problem

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? What is d in the formula of the Gaussian distribution?
Is it the dimension of the vector x? And how does it affect the formula? 2