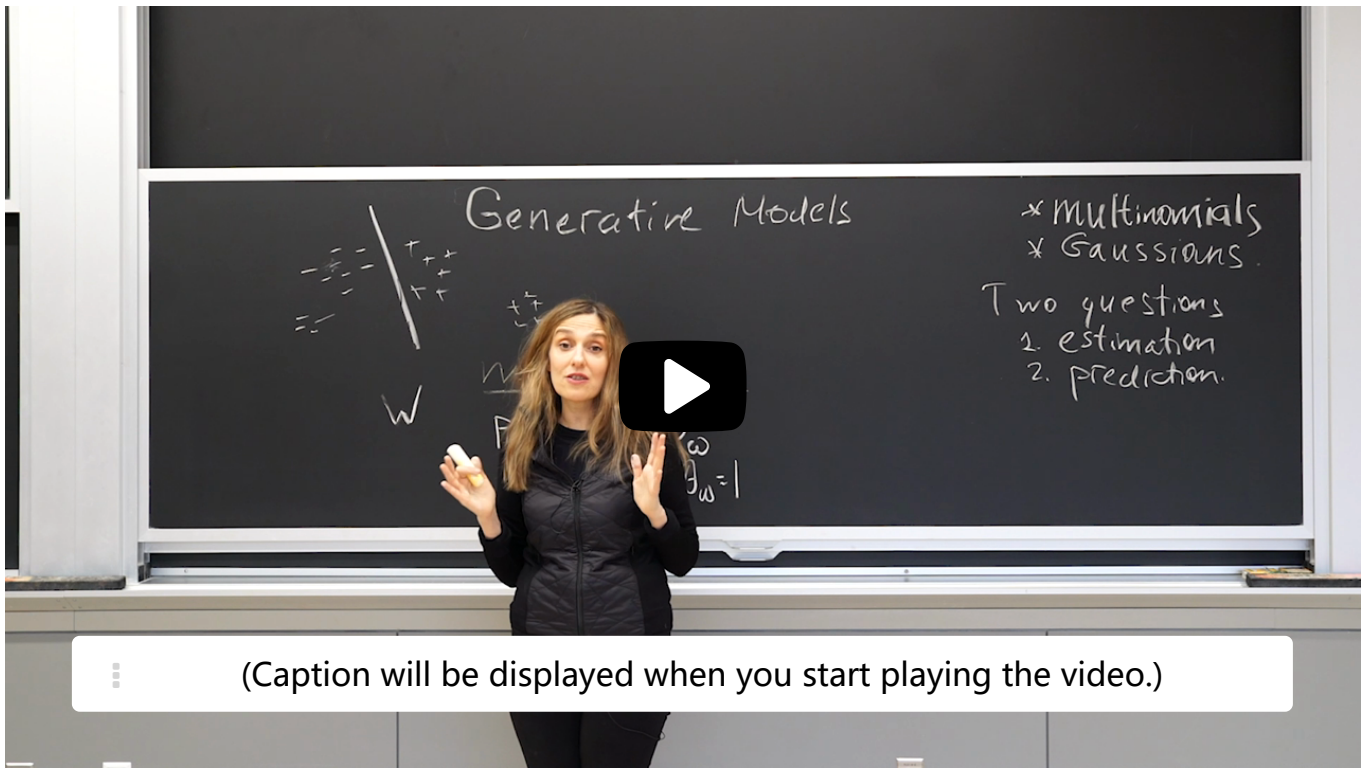
4. Likelihood function
Likelihood function



Start of transcript. Skip to the end.

So now, given that, how can I compute

the likelihood of generating a second set of documents?

So let's say somebody gave me all this theta W's.

I have them.

How do I compute the likelihood of generating a document?

So we would assume that we have our document--

and this is the capital D, and I will use it

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Likelihood of the first model

1/1 point (graded)
Note that a multinomial distribution is a generalization of a binomial distribution (vocabulary consists of just two classes). As a simple exercise for the following set of problems, we consider generating documents using a multinomial distributions with only two parameters

As an example for such a multinomial generative model, let us assume that our vocabulary W consists of just two symbols 0 and 1. So, $W = \{0, 1\}$.

We want to estimate a multinomial model to generate a document $D =$"0101".

For this task, we consider two multinomial models M_1 and M_2 with parameters, $\theta^{(1)}$ and $\theta^{(2)}$ respectively. First consider a multinomial model M_1 with parameters $\theta^{(1)}$ given as follows:

$$\theta_0^{(1)} = \frac{1}{2}, \theta_1^{(1)} = \frac{1}{2}$$

Let the probability of model M_1 generating the document D be denoted by $P\left(D|\theta^{(1)}\right)$.

Enter the value of $P\left(D|\theta^{(1)}\right)$ given that $\theta^{(1)}$ takes the values as described above. Enter your answer below as a numerical expression or round it off to four decimal places.

1/16 ✔ **Answer:** 0.0625

Solution:

Recall from the lecture that,

$$P(D|\theta) = \Pi_{w \in W} \theta_w^{count(w)}$$

$$P(D|\theta^{(1)}) = .5^2 * .5^2 = .0625$$

Hence, the probability of model M_1 generating the document D is 0.0625.

Submit You have used 1 of 3 attempts

Answers are displayed within the problem

Likelihood of the second model

1/1 point (graded)
Now consider another multinomial model M_2 with different parameters θ_2 given as follows:

$$\theta_0^{(2)} = \frac{1}{5}, \theta_1^{(2)} = \frac{4}{5}$$

The document $D =$"0101" remains the same as that from the previous problem.

Enter the value of $P(D|\theta^{(2)})$ given that $\theta^{(2)}$ takes the values above. Enter below your answer as a numerical expression or round it off to four decimal places.

16/625 ✔ **Answer:** 0.0256

Solution:

Recall from the lecture that,

$$P(D|\theta) = \Pi_{w \in W} \theta_w^{count(w)}$$

$$P(D|\theta^{(2)}) = .2^2 * .8^2 = .0256$$

Hence, the probability of model M_2 generating the document D is 0.0256

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Answers are displayed within the problem

Better fitting model

1/1 point (graded)
Based on your answers for the above two questions, which model between M_1 and M_2 is more likely to generate the document D?

- ◉ M_1 ✔
- ○ M_2

Solution:

From the above two questions it is clear that,

$$P(D|\theta^{(1)}) > P(D|\theta^{(2)})$$

Therefore, model M_1 is more likely to generate the document D than M_2.

Submit You have used 1 of 1 attempt

Answers are displayed within the problem

Discussion

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