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4. Likelihood Function
Likelihood function

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Likelihood of the First Model

1/1 point (graded)

For simplicity, assume that our vocabulary W consists of just two symbols 0 and 1, i.e. $W = \{0, 1\}$. s 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:

$$P\left(D|\theta\right) = \prod_{w \in W} \theta_w^{\text{count}(w)}$$

$$P\left(D|\theta^{(1)}\right) = \left(0.5^2\right)\left(0.5^2\right) = 0.0625.$$

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 $P\left(D|\theta^{(2)}\right)$ 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

$$P\left(D|\theta\right) = \prod_{w \in W} \theta_w^{\text{count}(w)}$$

$$P\left(D|\theta^{(2)}\right) = \left(0.2^2\right)\left(0.8^2\right) = .0256$$

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

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Answers are displayed within the problem

The Better 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,

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

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

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Answers are displayed within the problem

Independent Word Generation

1/1 point (graded)

Is the language model of each word being generated independently of all other words technically correct in the context of real-world languages like English?

- ( ) Yes
- (•) No

✔

Solution:

Absolutely not. There is definitely a memory to the word generation process in, for example, the English language. For instance, the word "the" does not follow the word "the" in any meaningful sentence.

Submit You have used 1 of 1 attempt

Answers are displayed within the problem

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