Sequence tagging with probabilistic models

LATEST SUBMISSION GRADE

90%

1.Question 1

Which of these models are discriminative, i. e., which of them model the distribution p(\mathbf{y} | \mathbf{x})$p(\mathbf{y|x})$?

☑ Maximum Entropy Markov Models

Correct

☑ Conditional Random Fields

Correct

☑ Hidden Markov Models

1 / 1 point

3.Question 3

Find the correct statements about Viterbi algorithm.

☐ Viterbi algorithm has exponential time complexity.

☑ Viterbi algorithm can find dynamically the most probable sequence of hidden tags in $O($N^2 T$)O(N_2T)$operations. The brute force search of this solution would take an exponential time on TT.

Correct

☐ At the tt-th time step of Viterbi algorithm we just choose the state y_ty_t such that the value p(y_t | y_{t-1}) p(x_t | y_t)$p(y_t|y_{t-1})p(x_t|y_t)$ is maximal. We do not take into account best paths computed at the previous steps.

☑ At each time step of the Viterbi algorithm, for each state the probability of the best tag sequence ending in this state is computed. This probability is estimated using the similar probabilities from the previous step and the current word.

Correct

2 / 2 points

4.Question 4

Consider a Hidden Markov Model with three hidden states: N (noun), V (verb) and O (other). Let all transitions between states be equiprobable. Consider the following possible outputs:

N: *mimsy | borogoves*

V: *were | borogoves*

O: *All | mimsy | the*

Let all these outputs be also equiprobable.

Consider the sentence "*All mimsy were the borogoves*" and choose the correct statement.

○ There are four possible best tag sequences: ONVON, ONVOV, OOVON, OOVOV. All of them are equiprobable.

○ The best tag sequence is OOVON.

○ The best tag sequence is ONVOV.

◉ There are two possible best tag sequences: ONVON and ONVOV. They are equiprobable.

○ The best tag sequence is OOVOV.

○ The best tag sequence is ONVON.

Correct

Exactly! It's easier to generate "mimsy" from a noun than from a verb, so these two sequences are more probable than OOVON or OOVOV.

2 / 2 points

5.Question 5

As before, consider a Hidden Markov Model with three hidden states: N (noun), V (verb) and O (other). Let all transitions between states be equiprobable. Consider the following possible outputs:

N: *mimsy | borogoves*

V: *were | borogoves*

O: *All | mimsy | the*

Let all these outputs be also equiprobable.

The probability p (V | O) of a transition from O to V is $\frac{1}{3}$31 in this model. Let's reestimate it on the sentence "*All mimsy were the borogoves*" using one iteration of Baum-Welch algorithm.

Find the new value of this probability and write it with **precision of 3 digits** after the decimal point.

Hint: there are four possible tag sequences: ONVON, ONVOV, OOVON, OOVOV. The first and the second sequences have the same probability, and so do the third and the fourth ones. You need to estimate these probabilities and find the ratio of the expectations for (O -> V) and (O->?) transition counts.

0.375

Correct

You got it!