Sequence tagging with probabilistic models

Quiz, 5 questions

Congratulations! You passed!

Next Item

1 / 1 point

1.
Which of these models are discriminative, i. e., which of them model the distribution $p(\mathbf{y}|\mathbf{x})$?

- [ ] Hidden Markov Models

Un-selected is correct

- [x] Conditional Random Fields

Correct

- [x] Maximum Entropy Markov Models

Correct

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1 / 1 point

2.
Let $\mathbf{x} = x_1, \ldots, x_n$ be visible words and $\mathbf{y} = y_1, \ldots, y_n$ be corresponding hidden tags. Find the correct formula for Maximum Entropy Markov Model:

- $p(\mathbf{x}, \mathbf{y}) = \prod_{t=1}^{T} p(x_t|x_{t-1})p(y_t|y_{t-1})$
- $p(\mathbf{x}, \mathbf{y}) = p(\mathbf{y}|\mathbf{x})p(\mathbf{x}) = \prod_{t=1}^{T} p(x_t|x_{t-1})p(y_t|x_t)$
- $p(\mathbf{x}, \mathbf{y}) = p(\mathbf{x}|\mathbf{y})p(\mathbf{y}) = \prod_{t=1}^{T} p(x_t|y_t)p(y_t|y_{t-1})$
- [x] $p(\mathbf{y}|\mathbf{x}) = \prod_{t=1}^{T} p(y_t|y_{t-1}, x_t)$

Correct

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2 / 2 points

3.

Find the correct statements about Viterbi algorithm.

- [x] At each time step of the 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

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

Un-selected is correct

- [ ] Viterbi algorithm has exponential time complexity.

Un-selected is correct

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

Correct

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2 / 2 points

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.
- [x] There are two possible best tag sequences: ONVON and ONVOV. They are equiprobable.

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.

- [ ] The best tag sequence is OOVOV.
- [ ] The best tag sequence is ONVON.

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 $\frac{1}{3}$ ~~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 Response

You got it!