
Exercise 3

Due: Thursday, May 4, 2023

Task 1: Log-sum-exp trick

This is a continuation of Task 2 from Exercise 2.

In our implementation of the forward-backward algorithm in our solution to Task 2 of Exercise 2 we made use of the so called *log-sum-exp trick*.

For the sake of this Exercise, you are to pretend that you just came up with this *trick* and want to convince the scientific community that it is a really good idea (plus: publish a paper ;)). Please write an abstract on your “discovery” (here an abstract refers to a *really* short paper). Please include the sections *Problem*, *Idea*, *Experiments* and *Conclusion*. The shorter, the better, as the plan is to read some of your abstracts in class (please be prepared to answer questions about your write-up). Despite the goal of being short (= concise), try to properly motivate the *log-sum-exp trick*, elaborate why it is a good idea (as detailed as necessary) and show its usefulness empirically (on some appropriate toy-data; implement the *trick* yourself for the experiments).

Bonus: include a *Related Work* section and discuss downsides to the *log-sum-exp trick*, if any.

Task 2: Hidden Markov perceptron learning

You have been reading [Altun et al., 2003] and are currently discussing it in the lectures. In Section 4 (Hidden Markov Perceptron Learning) of the paper it is stated how

$$F(\mathbf{x}, \mathbf{y}) = F_1(\mathbf{x}, \mathbf{y}) + F_2(\mathbf{x}, \mathbf{y}),$$

where we refer to the paper for notation. Please proof the equality explicitly.

References

- [Altun et al., 2003] Altun, Y., Tsochantaridis, I., and Hofmann, T. (2003). Hidden markov support vector machines. In *Proceedings of the 20th international conference on machine learning (ICML-03)*, pages 3–10.