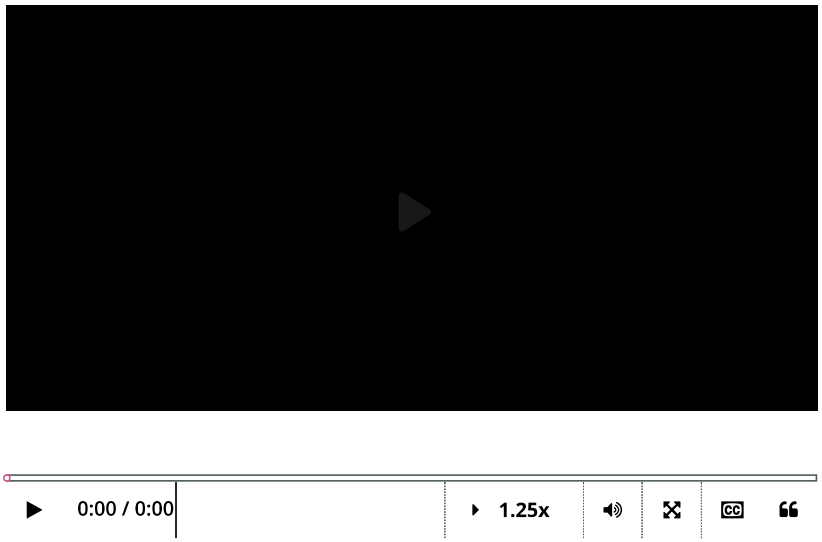
3. Markov Models to Feedforward Neural Nets

Exercises due Oct 28, 2020 05:29 IST *Completed*

Feature Based Markov Models and Temporal/Sequence Problems



Video
Download video file

Transcripts
Download SubRip (.srt) file
Download Text (.txt) file

Markov Transitions

2/2 points (graded)
Suppose we represent a Markov model as a feedforward neural network, as described in the lecture. Given a word, let the probability that word j occurs next be p_j. Which of the condition(s) below must hold true? Let K be the set of words. (Choose all that apply.)

- [x] $\sum_{k \in K} p_k = 1$
- [x] p_k is greater than or equal to zero for all $k \in K$
- [ ] p_k is less than 0.5 for all $k \in K$

✔

How do we satisfy the conditions you marked above? (Choose all that apply.)

- [x] take the softmax activation of the outputs
- [ ] add a bias to the outputs
- [ ] apply any nonlinear transformation to the inputs

✔

Solution:

Since it is a probability, it cannot be negative. In addition, as the p_k represent a probability distribution over the choice of the next word, they must add to 1. As described in the lecture video, a softmax activation forces the probabilities to be non-negative and sum to 1. Adding a bias and applying a nonlinear transformation don't have

anything to do with those two conditions.

Submit You have used 1 of 2 attempts

Answers are displayed within the problem

Markov As Feedforward

1/1 point (graded)
When representing a first-order Markov model as a feedforward network, what is the number of non-zero values in a single input vector?

- ○ 0
- ◉ 1
- ○ 2
- ○ 3

✔

Solution:

The words are one-hot encoded, so each input word would activate one unique node on the input layer.

Submit You have used 1 of 2 attempts

Answers are displayed within the problem

Markov vs Feedforward

3/3 points (graded)
What are some advantages of the feedforward NN as described in the lecture versus Markov models? (Choose all that apply.)

- ☑ They contain a fewer number of parameters
- ☑ We can easily control the complexity of feedforward NN by introducing hidden layers
- ☐ They are able to encode more complex transition probabilities than Markov Models.

✔

Suppose you have a word vocabulary of size 10 (including <beg> and <end>), and you were using a trigram language model to predict the next word.

How many parameters would you need for a Markov Model?

- ○ 1100
- ○ 1001
- ○ 1110

- [x] 1000

✔

How many parameters would you need for a feedforward neural network that contained biases and no hidden units?

- [ ] 190
- [ ] 195
- [ ] 200
- [x] 210

✔

Solution:

A Markov model would have 100 choices for the previous two words, and 10 choices for the next word, leading to a size of 1000. A feedforward neural network would have an input layer of size 20 and an output layer of size 10, leading to a weight matrix of size 200. We add 10 parameters for the bias vector.

As demonstrated in the second exercise, NNs contain fewer parameters. In addition, we can add hidden layers to NNs, showing that they have a more flexible architecture. However,any information encoded in a neural network could also be encoded in a very large transition probability matrix, i.e. a Markov Model. Therefore, the essential information is the same.

Submit You have used 1 of 2 attempts

Answers are displayed within the problem

Discussion

Hide Discussion

Topic: Unit 3 Neural networks (2.5 weeks):Lecture 11. Recurrent Neural Networks 2 / 3. Markov Models to Feedforward Neural Nets

Add a Post

Show all posts by recent activity

?	No. of words For a trigram model the lecturer says "if we have here the possible words roughly speaking, then each combination of preceding wo...	3
?	How exactly do we calculate the complexity O()	3
☑	Markov vs Feedforward	4
☑	Examples of one hot encoders in the lecture Hi! When we see examples of one hot vectors in the lecture, such as tremendous = [0, ..., 1, 0], this just means the position of this w...	2
💬	Why not as general (FFNN)? Two times the professor mentions that the FFNN mode is not as general, but what exactly does that mean?	1
?	Trigram Markov Model Parameters I was expecting different number of parameters for Trigram Markov Model. Assuming $< unk >$ is in the vocabulary, and noting tha...	6
💬	[Transcript] "one hat" to "one hot" This error occurs frequently throughout the video (whenever the professor mentions that a vector is "one hot"). If you're reading alo...	1
💬	Not clear question and not enough information or time...	2

I really would appreciate if you are going to be asking question or providing not clear answers. That at least you could provide some ...

Parameters Feedforward
Hello guys, maybe I am missing something about the last question. What does it mean that the Feedforward NN contained biases? I... 3

Simple Markov Chain Python Implementation
I was watching the lecture and though about how I would implement such thing in python. Well, there you go: import numpy as np i... 2

[staff] Nonlinear transformation
Community TA 11

Markov Property?
Community TA 3

About: What are some advantages of the feedforward NN as described in the lecture versus Markov models? (Choose all that apply.)
Though as mentioned in the lecture a two layer Neural Network, would not be able to model probabilities as complex as Markov Mo... 2

< Previous Next >