Nanoquiz Week 11

The questions below are due on Thursday April 26, 2018; 09:50:00 AM.

Nanoquiz Instructions

Nanoquizzes are just like any other tutor exercise, except that they are timed, and that some questions allow a limited number of submissions. When the timer hits zero, you will be prevented from making any further submissions to the nanoquiz, and the answers will be displayed, so **please make sure you have submitted something before that occurs**.

Note that you are free to use any materials you want (electronic or otherwise, including notes, calculators, Python, and Wikipedia) during the nanoquiz, but you are **not** allowed to converse with other humans (including through text message, email, etc).

Nanoquiz

We will use an RNN to predict y_t, which we know is a decaying sum of the inputs x_t (which are numbers) with decay rate γ between 0 and 1:

$$y_t = \sum_{i=0}^{t} \gamma^{t-i} x_i$$

We will use an RNN of the following form:

$$s_t = f_1(W^{sx} x_t + W^{ss} s_{t-1})$$
$$y_t = f_2(W^{o} s_t)$$

where f_1 and f_2 are two activation functions, and the x_t can be treated as 1x1 arrays. The output are numbers y_t.

Throughout this question, assume $x_t = 0$ for all $t < 0$.

1) Assuming $\gamma = 0.9$, what are the values of $[y_0, y_1, y_2]$ given $[x_0, x_1, x_2] = [1, 0, 2]$.

Enter a list of three numbers:

Save Submit Clear Answer

As staff, you are always allowed to submit. If you were a student, you would see the following:

You have infinitely many submissions remaining.

Solution: `[1, 0.9, 2.81]`

2) Conveniently, the definition of y_t can be rewritten in a recursive form, if we assume $y_t = 0$ for $t < 0$. Which of the following is correct?

Pick one:

- $y_t = \gamma y_{t-1} x_t$
- $y_t = \gamma y_{t-1} + x_t$
- $y_t = y_{t-1} + \gamma x_t$
- $y_t = y_{t-1} + \sum_{i=1}^{t} x_i \gamma^{t-i}$

Save Submit Clear Answer

As staff, you are always allowed to submit. If you were a student, you would see the following:

You have infinitely many submissions remaining.

Solution:

✗ $y_t = \gamma y_{t-1} x_t$

✓ $y_t = \gamma y_{t-1} + x_t$

✗ $y_t = y_{t-1} + \gamma x_t$

✗ $y_t = y_{t-1} + \sum_{i=1}^{t} x_i \gamma^{t-i}$

3) What is the best choice for f_1?

Pick one: --

Save Submit Clear Answer

As staff, you are always allowed to submit. If you were a student, you would see the following:

You have infinitely many submissions remaining.

Solution: linear

4) What is the best choice for f_2?

Pick one: --

Save Submit Clear Answer

As staff, you are always allowed to submit. If you were a student, you would see the following:

You have infinitely many submissions remaining.

Solution: linear

5) What is the smallest dimensionality for the state s that will allow this function to be implemented exactly?

Enter a single number:

Save Submit Clear Answer

As staff, you are always allowed to submit. If you were a student, you would see the following:

You have infinitely many submissions remaining.

Solution: 1

6) Provide matrices $W^{s,x}$, $W^{s,s}$, W^{o} (in that order) that implement this model (assuming $\gamma = 0.9$). Assume that the initial state is a column vector of 0's.

You will need to enter a list of three matrices, each matrix as a list of **rows**, each row is also a list. **If the answer were** three 2x2 matrices, you would enter something like this.

```
[ [ [ a, b], [c, d] ], [ [e, f], [g, h] ], [ [i, j], [k, l] ] ]
```

Enter a list of matrices:

Save Submit Clear Answer **100.00%**

As staff, you are always allowed to submit. If you were a student, you would see the following:

You have infinitely many submissions remaining.

Solution: `[[[1]], [[0.9]], [[1]]]`