TDT4171 Assignment 2

**Task 1**

1. The information given in task 1 formulated as a hidden markow model:

* The unobservable variable for any value of t is *fish nearby*
* The observable variable for any value of t is *birds nearby*
* The transition model for P(Fish nearbyt | Fish nearbyt-1) can be formulated in the transition matrix:

|  |  |
| --- | --- |
| 0.8 | 0.2 |
| 0.3 | 0.7 |

From this matrix we can see the probabilities for fish nearby given both if there were fish nearby yesterday (then the probability would be 0.8 of there being fish nearby, and 0.2 of there not being any), and if there were no fish nearby yesterday (then the probability would be 0.3 of there being fish nearby, and 0.7 of there not being any).

* The sensor model P(Birds nearbyt | Fish nearbyt) can also be formulated in a matrix. This matrix will be different depending on the evidence (birds nearby or not):

O1:

|  |  |
| --- | --- |
| 0.75 | 0 |
| 0 | 0.2 |

O2:

|  |  |
| --- | --- |
| 0.25 | 0 |
| 0 | 0.8 |

* Complete probability tables for the Hidden markow model:

|  |  |
| --- | --- |
| Fish nearbyt-1 | P(Fish nearbyt) |
| true | 0.8 |
| false | 0.3 |

|  |  |
| --- | --- |
| Fish nearbyt | P(Birds nearbyt) |
| true | 0.75 |
| false | 0.2 |

*For the tasks 1 b-e, see the python-file for calculations*

1. Given that we are trying to estimate up to a current value of t based on previous states to date, this is an example of filtering. The filtering-operations provides the distribution for the current state, taking all previous evidence into account.
2. Given that we are trying to estimate a future state of t based on previous states, this is an example of prediction. The prediction-operation provides probabilities for a state in the future, based on evidence up to the current state.
3. This is an example of smoothing, because we are trying to calculate the probabilities for a past state, when we have evidence up to a current state. This operation can give calculations for some probability in the past, based both on the states before and after the state being calculated.
4. As task is to find the maximum of the probabilities, this is an example of most likely sequence. This operation provides information about what sequence of states beforehand is most likely provide a certain result.

Python-output for task 1 b-e:

Task 1 B:

P(X1 | e1:1) = [0.82089552 0.17910448]

P(X2 | e1:2) = [0.90197069 0.09802931]

P(X3 | e1:3) = [0.48518523 0.51481477]

P(X4 | e1:4) = [0.81645924 0.18354076]

P(X5 | e1:5) = [0.43134895 0.56865105]

P(X6 | e1:6) = [0.79970863 0.20029137]

Task 1 C:

P(X1 | e1:1) = [0.82089552 0.17910448]

P(X2 | e1:2) = [0.90197069 0.09802931]

P(X3 | e1:3) = [0.48518523 0.51481477]

P(X4 | e1:4) = [0.81645924 0.18354076]

P(X5 | e1:5) = [0.43134895 0.56865105]

P(X6 | e1:6) = [0.79970863 0.20029137]

P(X7 | e1:6) = [0.69985432 0.30014568]

P(X8 | e1:6) = [0.64992716 0.35007284]

P(X9 | e1:6) = [0.62496358 0.37503642]

P(X10 | e1:6) = [0.61248179 0.38751821]

P(X11 | e1:6) = [0.60624089 0.39375911]

P(X12 | e1:6) = [0.60312045 0.39687955]

P(X13 | e1:6) = [0.60156022 0.39843978]

P(X14 | e1:6) = [0.60078011 0.39921989]

P(X15 | e1:6) = [0.60039006 0.39960994]

P(X16 | e1:6) = [0.60019503 0.39980497]

P(X17 | e1:6) = [0.60009751 0.39990249]

P(X18 | e1:6) = [0.60004876 0.39995124]

P(X19 | e1:6) = [0.60002438 0.39997562]

P(X20 | e1:6) = [0.60001219 0.39998781]

P(X21 | e1:6) = [0.60000609 0.39999391]

P(X22 | e1:6) = [0.60000305 0.39999695]

P(X23 | e1:6) = [0.60000152 0.39999848]

P(X24 | e1:6) = [0.60000076 0.39999924]

P(X25 | e1:6) = [0.60000038 0.39999962]

P(X26 | e1:6) = [0.60000019 0.39999981]

P(X27 | e1:6) = [0.6000001 0.3999999]

P(X28 | e1:6) = [0.60000005 0.39999995]

P(X29 | e1:6) = [0.60000002 0.39999998]

P(X30 | e1:6) = [0.60000001 0.39999999]

Task 1 D:

t = 0

probability: [0.66485218 0.33514782]

t = 1

probability: [0.87640731 0.12359269]

t = 2

probability: [0.86578657 0.13421343]

t = 3

probability: [0.59792735 0.40207265]

t = 4

probability: [0.76663731 0.23336269]

t = 5

probability: [0.57082582 0.42917418]

Task 1 E

at t = 1 it is most likely fish nearby!

at t = 2 it is most likely fish nearby!

at t = 3 it is most likely not fish nearby!

at t = 4 it is most likely fish nearby!

at t = 5 it is most likely not fish nearby!

at t = 6 it is most likely fish nearby!

None

Process finished with exit code 0



















