Program #3: DBNs

CISC 3410

For this project, you will need to implement four inference tasks on an HMM: filtering, prediction, smoothing, and computation of the most likely sequence (the viterbi algorithm). These are described in Section 15.2 of the book.

A weather HMM with transition and probability tables is given in hmm.py. The hidden states are sunny, rainy, or foggy. Prior probabilities are P(sunny)=0.5, P(rainy)=0.25, P(foggy)=0.25. The remaining probabilities are specified in the provided code.

You will need to fill in the missing implementations of the following four functions in the included code:

Filtering: Given observation sequence $E(0), E(1), \ldots, E(T-1)$, compute $P(X(T-1)|E(0), \ldots, E(T-1))$.

Prediction: Given observation sequence $E(0), E(1), \ldots, E(T-1)$, compute $P(X(T)|E(0), \ldots, E(T-1))$.

Smoothing: Given observation sequence $E(0), E(1), \ldots, E(T-1)$, compute $P(X(k)|E(0), \ldots, E(T-1))$ for $0 \leq k \leq T-1$.

Viterbi algorithm: Given observation sequence $E(0), E(1), \ldots, E(T-1)$, compute the most likely sequence of states: $X(0), X(1), \ldots, X(T-1)$

Sample data is provided along with correct output. Your code will be tested on additional test cases in this format.

Python code is provided to start you off and it is strongly suggested that you use it. However, if you prefer, you may replicate the provided code in another language and use that instead.

Submit through Blackboard.