Practice/Real-Life Applications of Computational Algorithms, Spring 2021

Homework 3: Viterbi Algorithm
Due: 2021/06/07

1. Goal

Suppose your friend Andrew lives in London and he likes posting what he wears on Instagram every day. And you are asked to implement Viterbi algorithm to find the most likely weather sequence in London (the hidden state sequence in hidden Markov model).

The following two tables show the transition matrix of the weather in London and the emission matrix of Andrew's wearing, respectively.

today \ tomorrow	sunny	foggy	rainy
sunny	0.8	0.15	0.05
foggy	0.2	0.5	0.3
rainy	0.2	0.2	0.6

	sunny	foggy	rainy
P(coat=no|weather)	0.9	0.7	0.2
P(coat=yes|weather)	0.1	0.3	0.8

And assume that the probability of each weather on the first day is

Start_prob.	sunny	foggy	rainy
	0.5	0.25	0.25

2. Input / Output

The first line in the input file is an integer n $(1 \leq n \leq 1000)$, which is the number of observed days. The next n lines each describes the actual weather in London (hidden) and whether or not Andrew wears a coat the day (observable). In this homework, you should print out an output file, which displays the accuracy of your Viterbi classifier on the given data set in the first line and in the following n lines, shows the classified weather sequence in London (found by using Viterbi algorithm).

Sample Input	Sample Output	Comment
10	0.4	Because of the states of the following 4 lines (marked with 'V') are the same, the accuracy is 4/10 = 0.4
foggy,no	sunny	
foggy,no	sunny	
foggy,no	sunny	
rainy,yes	sunny	
sunny,no	sunny	V
foggy,no	sunny	
rainy,yes	rainy	V
rainy,yes	rainy	V
foggy,no	rainy	
rainy,yes	rainy	V

3. **Command line**

   To run your program:

   > ./viterbi [input file] [output file]

4. **Programming Language**

   C/C++

5. **Hand in your assignment**

   Please upload the following files in a zip, specifying your ID (e.g., Student_ID.zip) to E3 by the deadline.

   (1) Source code and Makefile

   (2) A PDF report that introduces your implementation

6. **Platform**

   Linux workstation of CSCC server (linux{1,2,3,4}.cs.nctu.edu.tw)

7. **Q&A**

   For any questions regarding homework 3, please contact Ning-Chi Huang (blackitty321@gmail.com)