Artificial Intelligence Project 4:

HMMs & Customer Journey

Our Problem: Give us state transition matrix, observe the probability distribution matrix, and user's action, we need to use HMM to calculate the customer's state transition matrix which has the maximum probability.

	A	B	C	D	E	F	G
1		Zero	Aware	Consi	Eeper	Ready	Lost
2	Zero	0.6	0.4	0	0	0	0
3	Aware	0	0.49	0.3	0	0.01	0.2
4	Consi	0	0	0.48	0.2	0.02	0.3
5	Eeper	0	0	0	0.4	0.3	0.3
6	Ready	0	0	0	0	0.8	0.2
7	Lost	0	0	0	0	0	1
8							

	Demo	Video	Testi	Price	Blog	Pay
Zero	0.1	0.01	0.05	0.3	0.5	0
Aware	0.1	0.01	0.15	0.3	0.4	0
Consi	0.2	0.3	0.05	0.4	0.4	0
Eeper	0.4	0.6	0.05	0.3	0.4	0
Ready	0.05	0.75	0.35	0.2	0.4	0
Lost	0.01	0.01	0.03	0.05	0.2	0
Satis	0.4	0.4	0.01	0.05	0.5	1

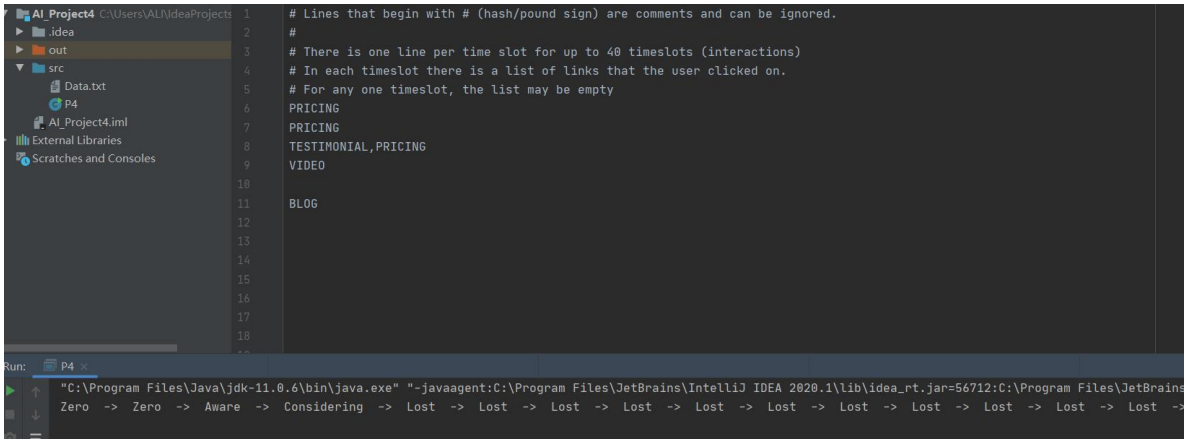
Algorithms: Using HMM algorithm. To be more precise, it should be used Viterbi algorithm. It is DP algorithm and every state only depend on the only one former state. Moreover, the transition expression is *Now = Max(every Former * (Former to Now) * Now)*, in our case, we have six situation need to be considered. So, each step we need to calculate 6 * 6 = 36 times. Other very important part is to calculate "Now". Professor said if user have no action(did not click anything), we need to calculate the possibility by (1 - p1) * (1 - p2) * .... * (1 - pn), so I also use this way to calculate the possibility if user had some action such as clicked the second and the forth with (1 - p1) * p2 * (1 - p3) * p4 * (1 - p5) * (1 - p6).

I have submitted the source code, I *wrote comment* in every place which if it is necessary.

Result comparison: I got almost exactly the same transition process as the standard result, but occasionally there were one or two different states, such as some transmission one step earlier or one step later than the standard answer, but the professor said this was acceptable! So, I got the right answer.

Time complexity : Based on former transition expression, we have three steps need time! Firstly, we need to spend N(*N is the number of customers' different states*) time to calculate one situation in one step, but every step we also have N situation, so it is N * N. Secondly, based on n square, if we want to calculate the "Now" possibility with professor's way, we need M(*M means the number of customers different actions*) time to get it. Last but not least, we need to multiply L(*L means the customer's action times*). So, the final result is N * N *M * L;

This is my running record.


AI_Project4 C:\Users\ALI\IdeaProjects
.idea
out
src
Data.txt
P4
AI_Project4.iml
External Libraries
Scratches and Consoles
Lines that begin with # (hash/pound sign) are comments and can be ignored.
#
There is one line per time slot for up to 40 timeslots (interactions)
In each timeslot there is a list of links that the user clicked on.
For any one timeslot, the list may be empty
PRICING
PRICING
TESTIMONIAL,PRICING
VIDEO
BLOG
Run:
P4
"C:\Program Files\Java\jdk-11.0.6\bin\java.exe" "-javaagent:C:\Program Files\JetBrains\IntelliJ IDEA 2020.1\lib\idea_rt.jar=56712:C:\Program Files\JetBrains
Zero -> Zero -> Aware -> Considering -> Lost -> Lost -> Lost -> Lost -> Lost -> Lost -> Lost -> Lost -> Lost -> Lost ->