

## Project 4

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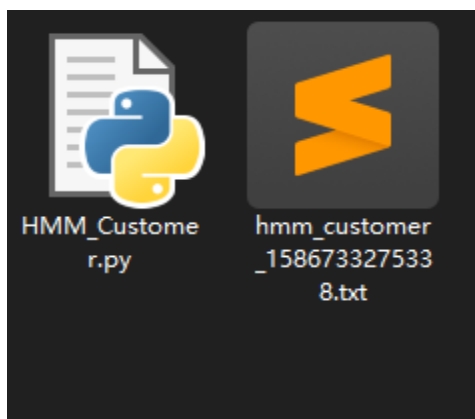
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**Language:** Python 3.7

**Environment:** WIN10-64bit

**Implementation method:** Creating transition probability matrix and emission probability matrix, using Viterbi algorithm.

**How to run my script:** Run HMM Customer.py, put the input file with the .py file at the same content. Like this:



If you want to change the input file, you can type the file name here:

```
122 observations_data, states_data = file_open('hmm_customer_1586733275338.txt')
```

## Sample outputs:

For file hmm\_customer\_1586733275338.txt:

```
Python 3.7.7 (tags/v3.7.7:d7c567b08f, Mar 10 2020, 10:41:24) [MSC v.1900 64 bit
(AMD64)] on win32
Type "help", "copyright", "credits" or "license()" for more information.
>>>
===== RESTART: D:\study\assignment\6511\Project4\HMM_Customer.py =====
States:
['zero', 'aware', 'considering', 'experiencing', 'ready', 'lost', 'satisfied']

Transition probability:
[[0.6  0.4  0.  0.  0.  0.  0. ]
 [0.   0.49 0.3  0.   0.01 0.2  0. ]
 [0.   0.   0.48 0.2  0.02 0.3  0. ]
 [0.   0.   0.   0.4  0.3  0.3  0. ]
 [0.   0.   0.   0.   0.8  0.2  0. ]
 [0.   0.   0.   0.   0.   1.   0. ]
 [0.   0.   0.   0.   0.   0.   1. ]]

Emission probability:
[[0.1  0.01 0.05 0.3  0.5  0. ]
 [0.1  0.01 0.15 0.3  0.4  0. ]
 [0.2  0.3  0.05 0.4  0.4  0. ]
 [0.4  0.6  0.05 0.3  0.4  0. ]
 [0.05 0.75 0.35 0.2  0.4  0. ]
 [0.01 0.01 0.03 0.05 0.2  0. ]
 [0.4  0.4  0.01 0.05 0.5  1.  ]]

The most likely explanation of the state:
['zero', 'zero', 'zero', 'zero', 'aware', 'considering', 'lost', 'lost', 'lost',
'lost', 'lost', 'lost', 'lost', 'lost', 'lost', 'lost', 'lost', 'lost', 'lost',
'lost', 'lost', 'lost', 'lost', 'lost', 'lost', 'lost', 'lost', 'lost', 'lost',
'lost', 'lost']

Accuracy:
0.9
>>>
```

For file hmm\_customer\_1586733275442.txt:

```
Python 3.7.7 (tags/v3.7.7:d7c567b08f, Mar 10 2020, 10:41:24) [MSC v.1900 64 bit
(AMD64)] on win32
Type "help", "copyright", "credits" or "license()" for more information.
>>>
===== RESTART: D:\study\assignment\6511\Project4\HMM_Customer.py =====
States:
['zero', 'aware', 'considering', 'experiencing', 'ready', 'lost', 'satisfied']

Transition probability:
[[0.6  0.4  0.  0.  0.  0.  0. ]
 [0.  0.49 0.3  0.  0.01 0.2  0. ]
 [0.  0.  0.48 0.2  0.02 0.3  0. ]
 [0.  0.  0.  0.4  0.3  0.3  0. ]
 [0.  0.  0.  0.  0.8  0.2  0. ]
 [0.  0.  0.  0.  0.  1.  0. ]
 [0.  0.  0.  0.  0.  0.  1. ]]

Emission probability:
[[0.1  0.01 0.05 0.3  0.5  0. ]
 [0.1  0.01 0.15 0.3  0.4  0. ]
 [0.2  0.3  0.05 0.4  0.4  0. ]
 [0.4  0.6  0.05 0.3  0.4  0. ]
 [0.05 0.75 0.35 0.2  0.4  0. ]
 [0.01 0.01 0.03 0.05 0.2  0. ]
 [0.4  0.4  0.01 0.05 0.5  1.  ]]

The most likely explanation of the state:
['zero', 'zero', 'zero', 'zero', 'aware', 'considering', 'lost', 'lost', 'lost',
 'lost', 'lost', 'lost', 'lost', 'lost', 'lost', 'lost', 'lost', 'lost', 'lost',
 'lost', 'lost', 'lost', 'lost', 'lost', 'lost', 'lost', 'lost', 'lost', 'lost',
 'lost', 'lost', 'lost', 'lost', 'lost', 'lost', 'lost', 'lost', 'lost', 'lost',
 'lost', 'lost']

Accuracy:
0.88
>>> |
```

For file hmm\_customer\_1586733275553.txt:

```
Python 3.7.7 (tags/v3.7.7:d7c567b08f, Mar 10 2020, 10:41:24) [MSC v.1900 64 bit
(AMD64)] on win32
Type "help", "copyright", "credits" or "license()" for more information.
>>>
===== RESTART: D:\study\assignment\6511\Project4\HMM_Customer.py =====
States:
['zero', 'aware', 'considering', 'experiencing', 'ready', 'lost', 'satisfied']

Transition probability:
[[0.6  0.4  0.  0.  0.  0.  0. ]
 [0.  0.49 0.3  0.  0.01 0.2  0. ]
 [0.  0.  0.48 0.2  0.02 0.3  0. ]
 [0.  0.  0.  0.4  0.3  0.3  0. ]
 [0.  0.  0.  0.  0.8  0.2  0. ]
 [0.  0.  0.  0.  0.  1.  0. ]
 [0.  0.  0.  0.  0.  0.  1. ]]

Emission probability:
[[0.1  0.01 0.05 0.3  0.5  0. ]
 [0.1  0.01 0.15 0.3  0.4  0. ]
 [0.2  0.3  0.05 0.4  0.4  0. ]
 [0.4  0.6  0.05 0.3  0.4  0. ]
 [0.05 0.75 0.35 0.2  0.4  0. ]
 [0.01 0.01 0.03 0.05 0.2  0. ]
 [0.4  0.4  0.01 0.05 0.5  1.  ]]

The most likely explanation of the state:
['zero', 'zero', 'zero', 'aware', 'lost', 'lost', 'lost', 'lost', 'lost', 'lost'
, 'lost', 'lost', 'lost', 'lost', 'lost', 'lost', 'lost', 'lost', 'lost', 'lost'
, 'lost', 'lost', 'lost', 'lost', 'lost', 'lost', 'lost', 'lost', 'lost', 'lost'
, 'lost', 'lost', 'lost', 'lost', 'lost', 'lost', 'lost', 'lost', 'lost', 'lost'
, 'lost']

Accuracy:
0.93
>>> |
```