**Hidden Markov Model**

Introduction

In this project I am building a simple Hidden Markov Model classifier for a discrete dataset.

Dataset

The dataset (Project2Data.txt) contains 1000 rows of past weather observations. The states (ω) are “sunny”, “rainy” and “foggy”. The emission states are “yes”, “no” indicating if an umbrella was observed.

HMM program

HMM program will take an observation sequence (𝑉𝑇) as an input and will outputs

1. The state matrix and all needed probabilities such as 𝑎𝑖𝑗 𝑎𝑛𝑑 𝑏𝑗𝑘 need to be calculated from given data
2. The probability of the given observation using ***Viterbi*** algorithm.
3. The most probable path to generate the given observations using ***Decoding*** algorithm.
4. I am assuming the initialization state to be a “sunny” state.

The generated product

The program accepts a sequence of visible states (𝑉𝑇) and calculates the probability of this sequence occurs.

To achieve this goal I calculated transition probabilities and emission probabilities from dataset.

Outputs:

a- 𝑎𝑖𝑗 matrix

b- 𝑏𝑗𝑘 matrix

c- The probability of the HMM producing the given visible state (***Viterbi*** algorithm)

d- The sequence of hidden states that given visible states generates (***Decoding*** algorithm)