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In [1]: import numpy as np
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In [2]: class HMM:
    def __init__(self, ann, bnm, pi, O):
        self.A = np.array(ann, np.float)
        self.B = np.array(bnm, np.float)
        self.Pi = np.array(pi, np.float)
        self.O = np.array(O, np.float)
        self.N = self.A.shape[0]
        self.M = self.B.shape[1]

    def viterbi(self):
        T = len(self.O)
        I = np.zeros(T, np.float)

        delta = np.zeros((T, self.N), np.float)
        psi = np.zeros((T, self.N), np.float)

        for i in range(self.N):
            delta[0, i] = self.Pi[i] * self.B[i, int(self.O[0])]
            psi[0, i] = 0

        for t in range(1, T):
            for i in range(self.N):
                delta[t, i] = self.B[i, int(self.O[t])] * np.array([delta[t-1, j] * self.A[j, i]
                                                                    for j in range(self.N)]).max()
                psi[t, i] = np.array([delta[t-1, j] * self.A[j, i]
                                     for j in range(self.N)]).argmax()

        P_T = delta[T-1, :].max()
        I[T-1] = delta[T-1, :].argmax()
        for t in range(T-2, -1, -1):
            I[t] = psi[t+1, int(I[t+1])]

        return I, P_T
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In [3]: O = [8, 6, 4, 6, 5, 4, 5, 5, 7, 9]
A = [[ 0, 1, 0, 0, 0, 0, 0, 0, 0, 0],
      [1/2, 0, 1/2, 0, 0, 0, 0, 0, 0, 0],
      [0, 1/2, 0, 1/2, 0, 0, 0, 0, 0, 0],
      [0, 0, 1/2, 0, 1/2, 0, 0, 0, 0, 0],
      [0, 0, 0, 1/2, 0, 1/2, 0, 0, 0, 0],
      [0, 0, 0, 0, 1/2, 0, 1/2, 0, 0, 0],
      [0, 0, 0, 0, 0, 1/2, 0, 1/2, 0, 0],
      [0, 0, 0, 0, 0, 0, 1/2, 0, 1/2, 0],
      [0, 0, 0, 0, 0, 0, 0, 1/2, 0, 1/2],
      [0, 0, 0, 0, 0, 0, 0, 0, 1, 0]]
B = [[1/2, 1/2, 0, 0, 0, 0, 0, 0, 0, 0],
      [1/3, 1/3, 1/3, 0, 0, 0, 0, 0, 0, 0],
      [0, 1/3, 1/3, 1/3, 0, 0, 0, 0, 0, 0],
      [0, 0, 1/3, 1/3, 1/3, 0, 0, 0, 0, 0],
      [0, 0, 0, 1/3, 1/3, 1/3, 0, 0, 0, 0],
      [0, 0, 0, 0, 1/3, 1/3, 1/3, 0, 0, 0],
      [0, 0, 0, 0, 0, 1/3, 1/3, 1/3, 0, 0],
      [0, 0, 0, 0, 0, 0, 1/3, 1/3, 1/3, 0],
      [0, 0, 0, 0, 0, 0, 0, 1/3, 1/3, 1/3],
      [0, 0, 0, 0, 0, 0, 0, 0, 1/2, 1/2]]
pi = [1/10, 1/10, 1/10, 1/10, 1/10, 1/10, 1/10, 1/10, 1/10, 1/10]
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In [4]: hmm_res = HMM(A,B,pi,O)
hmm_res.viterbi()
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Out[4]: (array([7., 6., 5., 6., 5., 4., 5., 6., 7., 8.]), 3.3076343375840383e-09)
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