Artificial Intelligence (CS571)

Assignment – 1 : Implementation of Expectation Maximization Algorithm

(Read all the instructions carefully and adhere to them.)

Date : 6th Aug 2018

Assume there are two coins C_1 and C_2.

1. P = probability of choosing coin C_1
2. P_1 = probability of head from C_1
3. P_2 = probability of head from C_2

Choose P (say 0.7), P_1 (say 0.6), P_2 (say 0.3). Read these as input variables.

1. Generate data i.e. data based on the values given. Understanding the properties of random number generator such that probability of choosing C_1 is 0.7
2. Generate another random number so that head is produced with probability 0.6 (for C_1) and 0.3 (for C_2)
3. Estimate P, P_1 and P_2 by Expectation Maximization (EM) Algorithm
    a. Initialize P, P_1 and P_2
    b. E steps

$$E(z_i) = (P.P_1^{x_i}.(1 - P_1)^{1-x_i}) / (P.P_1^{x_i}.(1 - P_1)^{1-x_i} + P.P_2^{x_i}.(1 - P_2)^{1-x_i})$$

    c. M steps
        i. $P = (\sum_{i=1}^{N} E(z_i)) / N$
        ii. $P_1 = (\sum_{i=1}^{N} x_i . E(z_i)) / (\sum_{i=1}^{N} E(z_i))$
        iii. $P_2 = M - (\sum_{i=1}^{N} x_i . E(z_i)) / N - (\sum_{i=1}^{N} E(z_i))$
    d. Repeat steps b and c until convergence or termination criteria.

Indicator variable z_i = 1, if C_1 is chosen else 0.
Hidden variable x_i = 1, if head else 0

Note:

1. You may choose any programming language for the implementation, however, ***Python*** is recommended.
2. Assignment has to be done in group of maximum three members.