Pattern and Speech Recognition WS2015-16
Exercise 9

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Hidden Markov Model

Exercise-2

- Done.

Exercise-3

- The results are:

  Accuracy = 91.9%
  Precision = 75.87%
  Recall = 48.46%
  F-Score = 59.14%

Exercise-4

- x = 2, 1, 5, 6, 2, 1, 3, 1, 6, 2
  π = F, F, L, F, F, F, L, F, L, F

  The maximum likelihood probability of transitioning from state **i** to state **j** is just the number of times we transition from **i** to **j** divided by the total number of times we are in state **i**. In other words, the maximum likelihood parameter corresponds to the fraction of the time when we were in state **i** that we transitioned to **j**

  Formula to caculate transition matrix:

  $\hat{A}_{ij} = \frac{\sum_{t=1}^{T} 1\{z_{t-1}=s_i \wedge z_t=s_j\}}{\sum_{t=1}^{T} 1\{z_{t-1}=s_i\}}$
  where **T** is the sequence length and we transition from state **i** to **j**.

$$\begin{array}{c} \\ F \\ L \end{array} \begin{array}{c} \begin{array}{cc} F & L \end{array} \\ \begin{pmatrix} 3/6 & 3/6 \\ 3/3 & 0 \end{pmatrix} \end{array}$$

The emission probabilities for state **j** are calculated as
(# times state **j** emitted symbol **s**) / (# times state **j** occurred).

$$\begin{array}{c} \\ F \\ L \end{array} \begin{array}{c} \begin{array}{cccccc} 1 & 2 & 3 & 4 & 5 & 6 \end{array} \\ \begin{pmatrix} 3/7 & 3/7 & 0 & 0 & 0 & 1/7 \\ 0 & 0 & 1/3 & 0 & 1/3 & 1/3 \end{pmatrix} \end{array}$$