Dynamic Time Warping

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Tags: Reconocimiento de Patrones

$$x = \{1, 3 - 1\}$$
$$y = \{2, 1, 2, 4\}$$

$$\mathbf{M} = (i, j) \rightarrow \text{Matriz de proximidad}$$

$$\mathbf{M}_{1,1} = \delta(1, 2) = |1 - 2| = 1$$
$$\mathbf{M}_{1,2} = \delta(1, 1) = |1 - 1| = 0 + \mathbf{M}_{1,1} = 1$$
$$\mathbf{M}_{1,3} = \delta(1, -2) = |1 - (-2)| = 3 + \mathbf{M}_{1,2} = 4$$
$$\mathbf{M}_{1,4} = \delta(1 - 4) = |1 - 4| = 3 + \mathbf{M}_{1,3} = 7$$

$$\mathbf{M} = \begin{pmatrix} ? & ? & ? & ? \\ ? & ? & ? & ? \\ 1 & 1 & 4 & 7 \end{pmatrix}$$

$$\mathbf{M}_{2,1} = \delta(2 - 3) = |2 - 3| = 1 + \mathbf{M}_{1,1} = 2$$
$$\mathbf{M}_{1,3} = \delta(2, -1) = |2 - (-1)| = 3 + \mathbf{M}_{2,1} = 5$$

$$\mathbf{M} = \begin{pmatrix} 5 & ? & ? & ? \\ 2 & ? & ? & ? \\ 1 & 1 & 4 & 7 \end{pmatrix}$$

Utilizando la reestriccion de Sakoe

$$\delta_{\text{Sakoe}}(i, j) = min \begin{cases} \delta(i - 1, j) + d(x_i, y_i) \\ \\ \delta(i, j) + 2d(x_i, y_i) \\ \\ \delta(i, j - 1) + d(x_i, y_i) \end{cases}$$

$$\mathbf{M}_{2,2} = \delta_{\text{Sakoe}}(3, 1)$$
$$\mathbf{M}_{2,2} = \delta(3, 1) = |3 - 1| = 2$$

$$min \begin{cases} 2 + 2 = 4 \\ 2 + 2(1) = 4 \\ 2 + 1 = 3 \end{cases}$$

$$\mathbf{M}_{2,2} = 3$$

$$\mathbf{M}_{2,3} = \delta_{\text{Sakoe}}(-1, 1)$$
$$\mathbf{M}_{2,3} = \delta(-1, 1) = |-1 - 1| = 2$$

$$min \begin{cases} 2 + 5 = 7 \\ 2 + 2(2) = 6 \\ 2 + 3 = 5 \end{cases}$$

$$\mathbf{M}_{2,3} = 5$$

$$\mathbf{M} = \begin{pmatrix} 5 & 5 & ? & ? \\ 2 & 3 & ? & ? \\ 1 & 1 & 4 & 7 \end{pmatrix}$$

$$\mathbf{M}_{2,3} = \delta_{\text{Sakoe}}(3, -2)$$
$$\mathbf{M}_{2,3} = \delta(3, -2) = |3 - (-2)| = 5$$

$$min \begin{cases} 5 + 3 = 8 \\ 5 + 2(1) = 7 \\ 5 + 4 = 9 \end{cases}$$

$$\mathbf{M}_{2,3} = 7$$

$$\mathbf{M}_{3,3} = \delta_{\text{Sakoe}}(-1, -2)$$
$$\mathbf{M}_{3,3} = \delta(3, -2) = |(-1) - (-2)| = 1$$

$$min \begin{cases} 1 + 5 = 6 \\ 1 + 2(3) = 7 \\ 1 + 7 = 8 \end{cases}$$

$$\mathbf{M}_{3,3} = 6$$

$$\mathbf{M}_{2,4} = \delta_{\text{Sakoe}}(3, 4)$$
$$\mathbf{M}_{2,4} = \delta(3, 4) = |3 - 4| = 1$$

$$min \begin{cases} 1 + 7 = 8 \\ 1 + 2(4) = 9 \\ 1 + 7 = 8 \end{cases}$$

$$\mathbf{M}_{3,3} = 8$$

$$\mathbf{M}_{3,4} = \delta_{\text{Sakoe}}((-1), 4)$$
$$\mathbf{M}_{3,4} = \delta(-1, 4) = |(-1) - 4| = 3$$

$$min \begin{cases} 3 + 6 = 9 \\ 3 + 2(7) = 17 \\ 3 + 8 = 11 \end{cases}$$

$$\mathbf{M}_{3,3} = 9$$

$$\mathbf{M} = \begin{pmatrix} 5 & 5 & 6 & 9 \\ 2 & 3 & 7 & 8 \\ 1 & 1 & 4 & 7 \end{pmatrix}$$

Una vez obtenida la matriz de proximidades:

- Encontrar el valor minimo de los vecino en la matriz

$$Path = \{1, 1, 3, 5, 6, 9\}$$

- Casar el valor de la matriz, con el valor de los vectores, relativo a su movimiento

$$\text{Reconstruccion} = \{1, 1, 3, -1, -2, 4\}$$

References

Medidas de similitud y distancias métricas