

In order to reflect these differences in attribute values, we introduce a modified version of the Damerau-Levenshtein distance, that not only reflects the difference between two process instances, but also the attribute values. We achieve this by introducing a cost function $cost_{a_i, b_j}$, which applies to a normed vector-space¹. Concretely, we formulate the modified Damerau-Levenshtein distance as shown in Equation 1. For the remainder, we will denote this edit-distance as Semi-structured Damerau-Levenshtein distance (SSDLD).

$$d_{a,b}(i, j) = \min \begin{cases} d_{a,b}(i-1, j) + cost(\mathbf{0}, b_j) & \text{if } i > 0 \\ d_{a,b}(i, j-1) + cost(a_i, \mathbf{0}) & \text{if } j > 0 \\ d_{a,b}(i-1, j-1) + cost(a_i, b_j) & \text{if } i, j > 0 \\ & \& \bar{a}_i = \bar{b}_j \\ d_{a,b}(i-1, j-1) + cost(a_i, \mathbf{0}) + cost(\mathbf{0}, b_j) & \text{if } i, j > 0 \\ & \& \bar{a}_i \neq \bar{b}_j \\ d_{a,b}(i-2, j-2) + cost(a_i, b_{j-1}) + cost(a_{i-1}, b_j) & \text{if } i, j > 1 \\ & \& \bar{a}_i = \bar{b}_{j-1} \\ & \& \bar{a}_{i-1} = \bar{b}_j \\ 0 & \& i = j = 0 \end{cases} \quad (1)$$

Here, $d_{a,b}(i, j)$ is the recursive form of the Damerau-Levenshtein-Distance. a and b are sequences and i and j specific elements of the sequence. $cost(a, b)$ is a cost function which takes the attribute values of a and b into account. The first two terms correspond to a deletion and an insertion from a to b . The idea is to compute the maximal cost for that the wrongfully deleted or inserted event. The third term adds the difference between two events with identical activities \bar{a}_i and \bar{b}_j . As mentioned earlier, two events that refer to the same activity can still be different due to event attributes. The distance between the event attributes determines *how* different these events are. The fourth term handles the substitution of two events. Here, we compute the substitution cost as the sum of an insertion and a deletion. The fifth term computes the cost after transposing both events. This cost is similar to term 3 only that we now consider the differences between both events after they were aligned. The last term relates to the stopping criterion of the recursive formulation of the Damerau-Levenshtein distance.

¹A normed vector-space is a vector space, in which all vectors have the same dimensionality. For instance, if all vectors have three dimensions, we can call the vector-space *normed*.