Chapter 1

Handwriting Recognition Engine

1.1 Character Recognition Process

The character recognition process relies on the Radical recognition process. Each character is comprised of a set of Radicals the position of their bounding boxes. In order to determine if a stroke sequence represents a certain character, firstly the individual Radicals are recognised. For character matching, the recognised Radicals are compared with the Radicals of the character. If they match with a confidence values above the threshold and their position within the character is correct and the character is recognised correctly. Generally, the confidence value of a character depends on the confidence values of the individual radicals and the distance and position of the bounding boxes to the database entry. A feature vector F here is defined as:

$$F := \begin{pmatrix} \text{Number of Radicals} & & n_r \\ \text{Position of Radical bounding boxes} & P_i & i = 1, \ldots, n_r \\ \text{Radical confidence values} & c_i & i = 1, \ldots, n_r \end{pmatrix}$$

The $n_{r,db}$ and $n_{r,exp}$ are compared numerically, as they are real numbers. The positions of the Radical bounding boxes $P_{i,db}$ and $P_{i,exp}$ are compared by their euclidian distance. The Radical confidence values c_i are averaged. The confidence value C for a character is calculated in several steps. The confidence value C_n for the number of Radicals is computed as follows:

$$C_n := \begin{cases} \frac{n_{r,db}}{n_{r,exp}} & \text{if } n_{r,db} \leq n_{r,exp} \\ \frac{n_{r,exp}}{n_{r,db}} & \text{if } n_{r,db} > n_{r,exp} \end{cases}$$

The confidence value C_p for the Radical positions is extracted from a matrix of euclidian distances between the Radical handles $P_{i,db} =< x_{i,db}, y_{i,db} >$ and $P_{i,exp} =< x_{i,exp}, y_{i,exp} >$. All the distance values $\mu_{i,j}$ are computed first to generate a Matrix of Radical position distances $M_{m,n}$, where $n = n_{r,db}$ and $m = n_{r,exp}$.

$$\mu_{i,j} := \sqrt{(x_{i,db} - x_{j,exp})^2 + (y_{i,db} - y_{j,exp})^2}$$

$$M_{m,n} = \begin{pmatrix} \mu_{1,1} & \mu_{1,2} & \cdots & \mu_{1,n} \\ \mu_{2,1} & \mu_{2,2} & \cdots & \mu_{2,n} \\ \vdots & \vdots & \ddots & \vdots \\ \mu_{m,1} & \mu_{m,2} & \cdots & \mu_{m,n} \end{pmatrix}$$

The minimal value ξ_m of each line or column is chosen. f_p is a constant factor for scaling the confidence value.

$$C_p := \begin{cases} f_p * \sum_{i=1}^{n_{r,db}} \xi_i & \text{if } n \geq m \\ f_p * \sum_{i=1}^{n_{r,exp}} \xi_i & \text{if } n < m \end{cases}$$

The confidence value C is the averaged sum of the other confidence values. The sum consits of the confidence values for the number of characters C_n, for the position of the Radical bounding boxes C_p and the averaged sum of the Radical confidence values. All partial confidence values are weighted with the w_i constants.

$$C := \tfrac{1}{3}(w_n * C_n + w_p * C_p + \tfrac{w_c}{n_{r,exp}} \sum_{i=1}^{n_{r,exp}} c_i)$$

1.2 Error Handling

see section **??** in chapter **??** for possible sources of error

1.2.1 Error Recognition

why this section? to demonstrate own achievements of error recognition. the reader should know how it is done technically.

what goes into this section? the aspects of finding errors. finding errors is not a straightforward trivial task - whenever something does not match it is an error - doesn't work like that. instead, firstly, it needs to be made sure that it actually is an error. meaning - not a recognition error, but a user error. secondly, the type of error needs be identified. see section **??** (or handwritten page 58) for sources of error.

how will this section be written? technical - first describe how the error recognition integrates into the recognition process, then how errors are identified.

1.2.2 Error Processing

why this section? actually the 'handling' or 'processing' aspect could be described in the recognition section 1.2.1 as well. so this section is only for a better overview, for document structure, thematically they are the same section. thus they are put together under Error Handling 1.2.

what goes into this section?