LISTS OF SYMBOLS

The section, in which each symbol is introduced, is given in brackets. Note that this list does not include the symbols introduced in appendices A and B.

Patterns and Pattern Classes

0	Transpose
T	Length of observation sequence
d	Feature vector dimension
x	Feature
$x = [x_1 , x_2 , \ldots , x_d]^0$	Continuous observation (feature vector)
Ω	Number of pattern classes
ω	Pattern class
Nj	Number of training samples for pattern class ω_j
xTest	Test vector
$X1 = \{x_1 , x_2 , \ldots , x_T \}$	Continuous observation sequence
xRef	Reference vector
XTest	Test sequence
XRef	Reference sequence
Nω	Number of training samples for pattern class ω

Probability Density Functions

$f(\cdot)$	Probability density function
μj	Mean vector for pattern class ω_j
Σj	Covariance matrix for pattern class ω_j
σ^j	Variance of the jth feature
σij	Correlation between the ith and jth features
$DEucl(\cdot)$	Euclidean distance
$^{D}Mah(\cdot)$	Mahalanobis distance

Discrete Radon transform

Ψ	Total number of pixels in an image
i	Intensity of the ith pixel
$N\Theta$	Number of angles (projections)
$N\phi$	Number of beams per angle
Rj	The jth beam-sum
w_{ij}	Contribution of the ith pixel to the jth beam-sum
	Dynamic time warping
θr	Angle (in a clockwise or counter-clockwise direction) through which a sample sequence is allowed to rotate with respect to a templat sequence
K	Number of transitions in optimal path
HVec	Bandwidth to which the search is restricted when two feature vectors are aligned
$\leftarrow$	Optimal preceding node
HSeq	Bandwidth to which the search is restricted when two observation sequences are aligned
H^{Seq}	Bandwidth to which the search has to be restricted in order to only provide for rotations through an angle of θ_r (in a clockwise or counter-clockwise direction), with respect to a template sequence

Hidden Markov models

λ	Hidden Markov Model
N	Number of states
$S = \{s_1, s_2,..., s_N\}$	Individual states

$\pi = \{\pi_1 , \pi_2 , . . , \pi_N \}$	Initial state distribution
$A = \{a_{i,j} \}$	State transition probability distribution State at time t Number of allotted forward links
Node (x_i , x_j)	Dynamic time warping-based distance between feature vectors x_i and x_j (section 5.3.2)
DNODE (x_i , x_j)	Node-based cost when comparing feature vectors
$D(X_i , X_j)$	Dynamic time warping-based distance between ob-alvation sequences X_i and X_j
$f (x\|s_j , \lambda)$	The probability density function, which quantifies the similarity between a feature vector x and the state s_j (f (X|λ) The probability density function, which quantifies the similarity between observation sequence X and hidden Markov model λ
$D(X, \lambda)$	Distance between observation sequence X and hidden Markov model λ

Verification

μ_ω	Mean of the distances between a set of Training patterns and the signature model for writer ω
σω	Standard deviation of the distances between a set of training patterns and the signature model for writer ω

Other symbols

X	Random variable that counts the number of successes in a number of independent trials, where the experiment follows a binomial distribution
Nf	Number of floating point operations required to obtain the dynamic time arping-based distance between two feature vectors
F{·}	Fourier transform

$F^{-1}\{\cdot\}$	Inverse Fourier transform
α	Sharpness (Gabor function major axis)
β	Sharpness (Gabor function minor axis)
γ	Sharpness of Gabor filter (major axis)
η	Sharpness of Gabor filter (minor axis)
θ	Orientation angle of Gabor filter
$\xi(t)$	1-d signal
$\xi(x, y)$	2-d signal
φ	Gabor filter phase shift
$\psi(t)$	1-d Gabor filter in time domain
$\psi(t; f)$	1-d Gabor filter in time domain
$\psi(n)$	Discrete 1-d Gabor filter in time domain
$\psi(x, y)$	2-d Gabor filter in spatial domain
$\psi(x, y; f, \theta)$	2-d Gabor filter in spatial domain
$\psi^*(t)$	Complex conjugate of $\psi(t)$
$\psi(t) * \xi(t)$	Convolution of $\psi(t)$ and $\xi(t)$
$\psi kl'(t)$	Gabor function in Gabor expansion
Δ	Uncertainty
$\Psi(f)$	1-d Gabor filter in frequency domain
$\Psi(u, v)$	2-d Gabor filter in frequency domain
kl	Expansion coefficient in Gabor expansion
f	Frequency (Gabor filter frequency)

f_0	Frequency of Gabor function
j	Imaginary unit
$r\xi(t; f)$	Response of 1-d Gabor filter
$r\xi(x, y; f, \theta)$	Response of 2-d Gabor filter
t	Time
t_0	Location of Gabor function
x	Spatial coordinate
y	Spatial coordinate