Appendix
openSMILE Standardised Feature Sets

All's well that ends well.
—William Shakespeare.

In Table A.1 the LLDs and functionals and their frequency across the four openSMILE standard feature sets as were mentioned in this book are given.

LLDs are processed by simple moving average (SMA) low-pass filtering.

Delta regression coefficients are added per LLD. The total number of features is—in principle—obtained by multiplying the number of LLD times two times the number of functionals. However, for the two larger feature sets exceptions hold from this strict brute-forcing rule as are indicated. This prevents creation of non-sense features.

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Table A.1 openSMILE standard features sets by LLDs and functionals

Feature	EC	PC	SSC	AVEC
Frequencies				
# LLDs	16	38	59	31
# Functionals	12	22	41	42
# Features	384	1 582	4 368	1 941
LLDs				
RMS energy	✓		✓	
Sum of auditory spectrum (loudness)		✓[a]	✓	✓
Sum of RASTA-sytle filtered auditory spectrum			✓	
ZCR	✓		✓	✓
Energy in bands from 250–650 Hz, 1–4 kHz			✓	✓
Spectral roll-off points 25 %, 50 %, 75 %, 90 %			✓	✓
Spectral flux			✓	✓
Spectral entropy			✓	✓
Spectral variance			✓	✓
Spectral skewness			✓	✓
Spectral kurtosis			✓	✓
Spectral slope			✓	
Psychoacousitc sharpness				✓
Harmonicity				✓
MFCC 0		✓		
MFCC 1–10	✓	✓	✓	✓
MFCC 11–12	✓	✓	✓	
MFCC 13–14		✓		
Log Mel frequency band 0–7		✓[a]		
LSP frequency 0–7		✓		
RASTA-style auditory spectrum bands 1–26 (0 – 8 kHz)			✓	
F_0 (ACF based)	✓			
F_0 (SHS based)		✓		
F_0 (SHS based followed by Viterbi smoothing)			✓	✓
F_0 envelope		✓		
Probability of voicing	✓	✓	✓	✓
Jitter		✓	✓	✓
Jitter (delta: 'jitter of jitter')		✓	✓	✓
Shimmer		✓	✓	✓
Logarithmic HNR				✓
Functionals				
Positive arithmetic mean				✓[d]
Arithmetic mean	✓	✓	✓	✓[d]
Root quadratic mean				✓
Contour centroid			✓	
Standard deviation	✓	✓	✓	✓
Flatness				✓

(continued)

Table A.1 (continued)

Feature	EC	PC	SSC	AVEC
Skewness	✓	✓	✓	✓
Kurtosis	✓	✓	✓	✓
Quartiles 1, 2, 3		✓[a]	✓	✓
Inter-quartile ranges 2-1, 3-2, 3-1		✓[a]	✓	✓
Percentile 1 %, 99 %		✓[a]	✓	✓
Percentile range 1–99 %		✓	✓	✓
% frames above minimum + 25%, 50% of range				✓
% frames above minimum + 75 % of range		✓[a]		
% frames above minimum + 90 % of range		✓[a]	✓	✓
% frames below minimum + 25 % of range			✓	
% frames rising			✓	✓
% frames falling			✓	
% frames left, right curvature			✓[f]	
% frames that are non-zero			✓[b]	
Linear regression offset	✓	✓[a]		
Linear regression slope	✓	✓[a]	✓	✓[c]
Linear regression approximation error (MAE)		✓[a]		✓[c]
Linear regression approximation error (MSE)	✓	✓[a]	✓	
Quadratic regression coefficient *a*			✓	✓[c]
Quadratic regression coefficient *b*			✓	
Quadratic regression approximation error (MAE)				✓[c]
Quadratic regression approximation error (MSE)			✓	
Maximum, minimum	✓			
Maximum–minimum (range)	✓			
Rising, falling slopes (min to max) mean, standard deviation				✓[c]
Inter maxima distances mean, standard deviation			✓	✓[c]
Amplitude mean of maxima relative to mean				✓[c]
Amplitude range of minima relative to mean				✓[c]
Amplitude range of maxima relative to mean				✓[c]
Relative position of maximum, minimum	✓	✓[a]		
LP gain			✓	✓[c,e]
LP coefficients 1–5			✓	✓[c,e]
Peak value arithmetic mean			✓	
Peak value arithmetic mean–arithmetic mean			✓	
Segment length mean, max, min, standard deviation			✓[b]	✓[e]
Input duration in seconds		✓[b]	✓[b]	

EC:INTERSPEECH 2009 Emotion Challenge, PC:INTERSPEECH 2010 Paralinguistic Challenge, SSC:INTERSPEECH 2011 Speaker Trait Challenge, AVEC:Audio/Visual Emotion Challenge 2011

[a] Only used for the TUM AVIC baseline (PC)

[b] Only applied to F_0

[c] Not applied to delta coefficient contours

[d] For delta coefficients the mean of only positive values is applied, otherwise the arithmetic mean is applied

[e] Not applied to voicing related LLDs

[f] Only applied to voicing related LLDs. For the PC feature set, the two additional features turn duration and number of voiced segments (F_0 onsets) were added

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