

Table S1: Main characteristics of Automatic Spindles Detection Methods (ASDM). When several decision makings or features are tested, the best one is underlined>. Abbreviations:  $A_f$ : EEG signal filtered in the frequency band ‘f’,  $S_f$ : spectrum in the frequency band ‘f’, RMS: Root Mean Square, MA: Moving Average, AT: Adapted Threshold, FT: Fixed Threshold, CWT: Continuous Wavelet Transform, WT: Wavelet Transform, FFT: Fast Fourier Transform, SST:SynchroSqueezed Transform, CD: Complex demodulation, CUSUM: Cumulative sum, PCA: Principal Component Analysis, ACF: Autocorrelation Function, (A)AR(n): n-order (Adaptative) Autoregressive model, MLE: Maximum Likelihood Estimation, AHC: Ascending Hierarchical Classification

Decomposition	Features	Decision-making
<b>Schimicek, 1994 [90]</b>		
filtering	envelope( $A_\sigma$ )	FT
<b>Huupponen, 1999 [98]</b>		
segmentation	$R_\theta \propto \frac{S_\sigma}{S_\theta}$	fuzzy logic
FFT	$R_\alpha \propto \frac{S_\sigma}{S_\alpha}$	
	$R_\beta \propto \frac{S_\sigma}{S_\beta}$	
<b>Huupponen, 2000 [82]</b>		
<i><b>SS-like</b></i>		
filtering	peak( $A_\sigma$ )	fuzzy logic $\Rightarrow$ SS-like
segmentation	artifact index	
FFT	sleep index	
<i><b>SS detection</b></i>		
filtering	peak( $A_\sigma$ )	AT from SS-like
<b>Molle, 2002 [63]</b>		
filtering	RMS( $A_\sigma$ )	AT
segmentation		
<b>Görür, 2002 [102]</b>		
STFT(2-64Hz)	32 STFT values	MLP or <u>SVM</u>
<b>Görür, 2003 [118]</b>		
AR(16)	17 AR parameters	MLP or <u>SVM</u>
<b>Olbrich, 2004 [120]</b>		
AR(8)	oscillatory modes	FT
decomposition [136]	damping factors	
<b>Held, 2004 [91]</b>		

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<b>Decomposition</b>	<b>Features</b>	<b>Decision-making</b>
filtering	peak( $A_\sigma$ )	fuzzy logic $\Rightarrow$ Out1
filtering (<17Hz)	amplitude, frequency, symmetry	FT $\Rightarrow$ Out2
	Out 1-2	Out1 & Out2
<b>Acir, 2004 [119]</b>		
AAR(15)	16 AAR parameters	DP + (SVM or MLP)
<b>Clemens, 2005 [86]</b>		
filtering	envelope( $A_\sigma$ )	AT
<b>Ventouras, 2005 [92]</b>		
<b><i>SS-like</i></b>		
filtering	$A_\sigma$	MLP $\Rightarrow$ SS-Like
<b><i>SS detection</i></b>		
$sA_\sigma = \text{MA}$	peak( $sA_\sigma$ )	FT
<b>Bodizs, 2005 [94]</b>		
2 adapted filtering	envelope( $A_{\sigma_{slow}}$ ) envelope( $A_{\sigma_{fast}}$ )	AT from NREM
<b>Schonwald, 2006 [103]</b>		
MP	MP atoms	FT
<b>Devuyst, 2006 [83]</b>		
filtering	envelope( $A_\sigma$ )	AT
<b>Huupponen, 2007 [99]: comparison of 4 methods</b>		
<b><i>detector 1</i></b>		
segmentation FFT	$\Sigma I \propto \frac{(S_\sigma)}{S_\sigma + S_\beta}$	fuzzy logic $\Rightarrow$ SS-like
filtering	$\Sigma I, A_\sigma$	AT from SS-like
<b><i>detector 2</i></b>		
FFT	$\Sigma I$	FT
<b><i>detector 3</i> [82]</b>		
filtering	$A_\sigma$	AT
<b><i>detector 4</i></b>		
filtering	$A_\sigma$	FT

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<b>Èstevez, 2007 [100]</b>		
segmentation FFT	$S_{\delta-\theta}, S_{\alpha}, S_{\sigma}, S_{\sigma-\beta1}, S_{\beta2}$	NG or <u>MNG</u>
<b>Ferrarelli, 2007 [93]</b>		
filtering	envelope( $A_{\sigma}$ )	AT
<b>Schabus, 2007 [34]</b>		
filtering	RMS( $A_{\sigma_{slow}}$ ), RMS( $A_{\sigma_{fast}}$ )	AT
<b>Bodizs, 2009 [80]</b>		
adapted filtering	envelope ( $A_{slow}$ ) envelope ( $A_{fast}$ )	AT
<b>Ahmed, 2009 [95]</b>		
WT	$\frac{S_{\alpha}}{S_{\delta}}$	AT $\Rightarrow$ Out1
TEO + ACF	envelope	AT $\Rightarrow$ Out2
	Out 1-2	Out1 & Out2
<b>Duman, 2009 [74]</b>		
<i>localization</i>		
STFT	frequency	FT $\Rightarrow$ Out1
<i>sub-localization</i>		
$A_{\sigma}$ from WT		
MUSIC( $A_{\sigma}$ )	frequency	FT $\Rightarrow$ Out2
TEO( $A_{\sigma}$ )	amplitude	AT $\Rightarrow$ Out3
<i>detection</i>		
	Out 1-3	AND(Out1,Out2,Out3)
<b>Causa, 2010 [106]</b>		
<i>SS-Zones(30s)</i>		
FFT Average Power (AP)	$AP_{\delta}, AP_{\sigma}, AP_{\beta2}$	FT
<i>SS candidates (events)</i>		
HHT	amplitude, frequency	fuzzy logic

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<i>SS-like</i>		
peak detection	amplitude, frequency, symmetry	AT
<i>detection</i>		
	$AP_\delta, AP_\sigma$	decision tree
<b>Ray, 2010 [87]</b>		
filtering	peak ( $A_\sigma$ )	AT
<b>da Costa 2012 (WSMD) [137]</b>		
peak detection	frequency, shape	FT
<b>da Costa 2012 [89]</b>		
<i>detector 1</i>		
STFT	$S^2$	AT $\Rightarrow$ Out1
CWT	$\ S_\sigma\ $	AT $\Rightarrow$ Out2
peak detection	frequency, shape	FT $\Rightarrow$ Out3
	Out 1-3	Out1 & Out2 & Out3
<b>Wamsley, 2012 [78]</b>		
CWT	MA( $S_\sigma$ )	AT
<b>Wendt, 2012 [79]</b>		
filtering	envelope( $A_\sigma$ )	AT
<b>Babadi, 2012 [117]</b>		
<i>Instantaneous Probabilities (IP)</i>		
PCA	expansion coefficients	Bayesian inferences $\Rightarrow$ IP
<i>SS detection</i>		
MA(IP)	smoothed(IP)	FT
<b>Mporas, 2013: [101] fusion of 2 detectors</b>		
FFT	$11 S_\sigma + 11 \frac{\partial(S_\sigma)}{\partial(t)}$	SVM, HMM
<b>Martin, 2013 [17]</b>		
filtering	RMS( $A_\sigma$ )	AT
<b>Nonclercq, 2013 [84]</b>		
<i>pre-selection</i>		
FFT	amplitude, frequency	FT and AT

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Decomposition	Features	Decision-making
<i>detection</i>		
modelization (MLE)	amplitude, frequency	AT
<b>Warby, 2014 [26]: Comparison of [17, 63, 78–80, 93]</b>		
<b>O’Reilly, 2015 [138]: multichannel analysis</b>		
<i>sensitivity</i>		
average over channels CWT wavelet ridges peak detection	$S,$ $\Sigma I \propto \frac{S_\sigma}{S_\theta + S_{\beta 1}}$	AT
<i>specificity</i>		
PCA	localization $F = \frac{freq-10}{range_\sigma}$	AHC + AT
<b>Durka, 2015 [104]</b>		
adapted MP	$RMS(S_\sigma)$	AT
<b>Ray, 2015 [105]</b>		
CD	Z-score( $S_\sigma$ )	AT
<b>Kabir, 2015 [85]</b>		
<i>SS-Like</i>		
SST CUSUM zero-crossings	duration	FT $\Rightarrow$ SS-like
<i>detection</i>		
peak detection	regularity index	FT