Testing the IDEM System
Technical Report for Evalita-2009 Forensic SIV

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Technical report

The IDEM software has been used to accomplish the Forensic SIV task. IDEM uses a semiautomatic formant based method distributed by Fondazione Ugo Bordoni. IDEM is a modular system containing a tool for speech analysis and a tool for statistic evaluation.

The test has been carried out only on the CST data set without following the linguistic analysis demanded by the internal protocol in use at the "Laboratorio di Fonica - Reparto Carabinieri Investigazioni Scientifiche".

The method is carried out by extracting the values of fundamental frequencies and the first three formant frequencies. At least five samples of the four most frequent vowels *a, e, i* and *o* were considered. These features are extracted using the Fast Fourier Transform (FFT), Cepstrum and LPC algorithms, implemented in the ARES tool of IDEM software.

The decisional test, a chi-square test ($\chi2$) using 16 parameters, is implemented in the SPREAD tool of IDEM. Its threshold is set to 32, with lower scores giving *yes* answer, and higher scores giving *no* answers. A Bayesian approach is used to calculate the probability of false identification (P.F.I) through a *Montecarlo integration*, using a reference community containing F0 and formant measures of approximately 30.000 measurements for male Italian speakers.

Before any measurement all files have been resampled to a 11kHz format.

Since the files of TR data set were too short to allow a sufficient number of features to extract, some of them have been merged in a single file as follows:

Suspected 1 = TR_S1_C_N_LR1[1] + TR_S1_C_N_LR2[1]
Suspected 2 = TR_S2_C_N_LR3[1] + TR_S2_C_N_LS[1]

The OST data set has not been considered because of its low and insufficient quality level.

Table 1. Results and scores for the comparisons involving Suspected 1 with the CST files

Anonymous	Suspected 1		
	$\chi 2$	Yes/No[1]	P.F.I.
CST_008_S_N_LR3[1]	271,7	No	
CST_011_I_N_LS[1]	29.6	Si	200
CST_013_S_N_LR3[1]	98,7	No	
CST_018_A_N_LR2[1]	65,7	No	
CST_018_A_N_LR2[2][2]	--------------	--------------	--------------
CST_022_I_N_PS[1]	101,3	No	
CST_027_I_N_PS[1]	104,8	No	
CST_028_I_N_PS[1]	27,8	Si	400
CST_030_I_N_LS[2][3]	--------------	------------	--------------
CST_044_S_N_LR3[1]	76,5	No	
CST_049_S_N_LR3[1]	25,1	Si	300
CST_054_A_N_LR2[2]	162,8	No	
CST_055_I_N_LS[1]	133,8	No	
CST_068_I_N_PS[1]	60,2	No	
CST_072_I_N_LS[1]	74,5	No	
CST_081_A_N_LR2[1]	109,0	No	

Table 2. Results and scores for the comparisons involving Suspected 2 with the CST files

Anonymous	Suspected 2[4]		
	$\chi 2$	Si/NO	P.F.I.
CST_008_S_N_LR3[1]	120,7	No	
CST_011_I_N_LS[1]	49,6	No	
CST_013_S_N_LR3[1]	44,7	No	
CST_018_A_N_LR2[1]	7,8	Si	15,2
CST_018_A_N_LR2[2]	--------------	--------------	--------------
CST_022_I_N_PS[1]	44,8	No	
CST_027_I_N_PS[1]	26,1	Si	17,9
CST_028_I_N_PS[1]	43,4	No	
CST_030_I_N_LS[2]	--------------	--------------	--------------
CST_044_S_N_LR3[1]	13,8	Si	23
CST_049_S_N_LR3[1]	59,1	No	
CST_054_A_N_LR2[2]	66,9	No	
CST_055_I_N_LS[1]	30,6	No	
CST_068_I_N_PS[1]	51,3	No	
CST_072_I_N_LS[1]	10,9	Si	17,7
CST_081_A_N_LR2[1]	32,3	No	

[1] Positive for $\chi 2$ values below 32.
[2] The signal is analogous to the previous and gives the same result.
[3] The signal to noise ratio is too low and it was not possible to extract the needed parameters.
[4] Fundamental frequency was not considered because of its high variability.