UWB system description*

EVALITA 2009

Lukáš Machlica
Jan Vaněk

University of West Bohemia, Czech Republic

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System Description

- **Parametrization – 20 cepstral coefs.-0th**
  - MFCC or LFCC + Δ, $\Delta\Delta$, DCT2
  - Mean & Var normalizations

$$W(i) = \cos\left(\frac{i}{wlength} \cdot P \cdot \pi\right), \ i = 1, \ldots, wlength \Rightarrow \text{DCT2}_{(P, wlength)}$$

- **Modelling**
  - UBM $\rightarrow$ MLLR and/or MAP
- **Verification $-$ *majority voting rule*** $\quad D_s = \dfrac{1}{T}\sum_{i=1}^{T} D_i$

$$D_i = \begin{cases} 1 & \text{if } L(\boldsymbol{o}_i \mid s) > L(\boldsymbol{o}_i \mid UBM) \\ 0 & \text{otherwise} \end{cases}, \quad D_i = \frac{1}{1 + \exp\left\{\dfrac{-1.8}{\lambda}\left(L(\boldsymbol{o}_i \mid s) - L(\boldsymbol{o}_i \mid UBM)\right)\right\}}$$

Individual SubSystems

	parametrization	UBM	modelling	verify
SYS1	$P_{LFCC}(\Delta, M, V)$	512	$MAP(\mu)$	MVR
SYS2	$P_{LFCC}(\Delta, \Delta\Delta, M)$	512	$MLLR(\mu)+MAP(\mu,\sigma)$	SMVR
SYS3	$P_{LFCC}(DCT2_{(3,9)}, M)$	512	$MLLR(\mu)+MAP(\mu,\sigma)$	MVR
SYS4	$P_{LFCC}(DCT2_{(3,9)}, M)$	256	$MLLR(\mu)+MAP(\mu,\sigma)$	SMVR
SYS5	$P_{LFCC}(DCT2_{(3,9)}, M)$	512	$MLLR(\mu)+MAP(\mu,\sigma)$	SMVR
SYS6	$P_{LFCC}(DCT2_{(3,9)}, M)$	1024	$MLLR(\mu)+MAP(\mu,\sigma)$	SMVR
SYS7	$P_{MFCC}(DCT2_{(4,13)}, M,V)$	512	$MLLR(\mu)+MAP(\mu)$	MVR
SYS8	$P_{MFCC}(\Delta, \Delta\Delta, M)$	512	$MLLR(\mu)+MAP(\mu,\sigma)$	MVR

Description of employed systems used in the
EVALITA 2009 evaluation campaign.

Experiments & Results

- **Complementarity Examination**
  - ? Optimal weights w_i ? (minimal overall EER)
  - Utilization of gradient methods

$$result_C = \sum_{i=1}^{S_{NUM}} w_i \cdot result_{SYS_i}$$

- **System count reduction**
  - STEP 1: w_i estim.
  - STEP 2: remove system $j_{out} = \operatorname{argmin}_j \{w_j\}$
  - STEP 3: repeat until increase in overall EER

Results

- Genders handled separately (UBM), channels not detected
- Results obtained on the development set [%]:

SYS3 EERs	Female		Male	
	GSM	PSTN	GSM	PSTN
TC1	**17.20**	3.73	**19.57**	3.13
TC2	8.90	**19.76**	6.49	**13.41**
TC3	**14.00**	2.64	**16.86**	2.35
TC4	5.07	**13.30**	3.13	**12.12**
TC5	7.83	5.59	6.65	4.08
TC6	7.40	3.73	4.69	2.50

Overall EER: 8.50%

SYSC EERs	Female		Male	
	GSM	PSTN	GSM	PSTN
TC1	**14.93**	2.48	**15.76**	3.18
TC2	6.83	**14.64**	5.00	**8.75**
TC3	**11.18**	1.45	**12.44**	1.51
TC4	3.37	**13.04**	3.13	**8.21**
TC5	6.21	4.18	5.78	2.58
TC6	4.90	3.64	3.75	1.62

Overall EER: 6.61%

Results

- Results obtained in the EVALITA 2009 evaluation campaign [%]:

EERs	TC1	TC2	TC3	TC4	TC5	TC6
TS1	15.96	16.51	13.34	15.69	**7.50**	**5.89**
TS2	10.82	12.02	9.83	11.25	**3.62**	**2.11**

PRIMARY: Overall EER: 10.38%

EERs	TC1	TC2	TC3	TC4	TC5	TC6
TS1	20.48	21.48	17.98	19.71	**10.32**	**7.54**
TS2	15.37	17.43	13.12	15.4	**4.81**	**3.32**

SECONDARY: Overall EER: 13.91%

- Decision cost functions:

mDCFs	TC1	TC2	TC3	TC4	TC5	TC6
TS1	0.40	0.40	0.33	0.38	**0.18**	**0.14**
TS2	0.27	0.28	0.22	0.28	**0.09**	**0.06**

Overall minDCF: 0.25

mDCFs	TC1	TC2	TC3	TC4	TC5	TC6
TS1	0.47	0.46	0.43	0.41	**0.27**	**0.20**
TS2	0.39	0.39	0.30	0.35	**0.14**	**0.08**

Overall minDCF: 0.32

$$C_{Det} = C_{FR} \cdot P_{FR/Client} \cdot P_{Client} + C_{FA} \cdot P_{FA/NonClient} \cdot (1 - P_{Client})$$
$$C_{FR} = 10, \ C_{FA} = 1, \ P_{Client} = 0.5$$

Thank You For Your Attention