



INSTITUTE OF INFORMATION AND
COMMUNICATION TECHNOLOGIES
BULGARIAN ACADEMY OF SCIENCES



The 3DEarDB and applications

a presentation by D. Dimov (IICT-BAS)

at Computer Vision and Multimedia Lab
University of Pavia
Nov. 15, 2016



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This presentation is build up on 3 papers in collaboration presented at 2 international scientific events organized in the frames of AComIn, namely:

- The International Conference Advanced Computing for Innovation (AComIn'2015) Sofia, Bulgaria, November 10-11, 2015, (SCI, 648, Springer, 2016) <http://www.springer.com/gp/book/9783319322063>, and
- First International Workshop on Biometrics, BIOMET'2014, Sofia, Bulgaria, June 23-24, 2014, (LNCS, 8897, Springer, 2015)

Studies in Computational Intelligence



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Innovative Approaches and Solutions in Advanced Intelligent Systems

Editors: Margenov, Svetozar, Angelova, Galia, Agre, Gennady (Eds.)

Recent research in Intelligent Systems



The International Conference
Advanced Computing for Innovation (AComIn'2015)
Sofia, Bulgaria, 10-11 November, 2015

Multi-Modal Ear Database for Biometrics Applications

AComIn



Atanas Nikolov, IICT-BAS, Bulgaria
Virginio Cantoni, Pavia University, Italy
Dimo Dimov, IICT-BAS, Bulgaria
Andrea Abate, Salerno University, Italy
Stefano Ricciardi, Salerno University, Italy

Nikolov, A., Cantoni, V., Dimov, D., Abate, A., Ricciardi, S.. Multimodel Ear Database for Biometric Applications. In: S. Margenov, G. Agnelova, G. Agre (Eds.) *Innovative Approaches and Solutions in Advanced Intelligent Systems. Studies in Computational Intelligence*, **648**, Springer, 2016, pp.169-188, ISBN: 978-3-319-32206-3, ISSN:1860-949X. SJR:0.209.

Image Processing, Computer Vision,
Pattern Recognition, and Graphics



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Biometric Authentication

First International Workshop, BIOMET 2014, Sofia, Bulgaria, June 23-24, 2014. Revised Selected Papers

Editors: Cantoni, Virginio, Dimov, Dimo, Tistarelli, Massimo (Eds.)



BIOMET

23-24 June
Sofia BULGARIA **2014**



3D Ear Analysis by an EGI Representation



Virginio Cantoni, Full Prof., University of PAVIA - Italy
Dimo Dimov, Assos. Prof., IICT-BAS, Bulgaria
Atanas Nikolov, Ph.D. student, IICT-BAS, Bulgaria

Cantoni, V., D. T. Dimov, and A. Nikolov: 3D Ear Analysis by an EGI Representation. In: Cantoni, V., D. T. Dimov, and M. Tistarelli (Eds.) Proceedings of First International Workshop on Biometrics, BIOMET'2014, June 23-24, 2014, Sofia, Bulgaria, Springer, Biometric Authentication, LNCS, Vol. 8897, pp. 136-150, DOI: 10.1007/978-3-319-13386-7_1.



<http://vision.unipv.it/SOFIA-2014/>



<http://iict.bas.bg/acomin/>



<http://iict.bas.bg/>



Computer Vision Lab

<http://vision.unipv.it/>

Appearance-Based 3D Object Approach to Human Ears Recognition

by Dimo T. Dimov, and Virginio Cantoni
(dtdim@iinf.bas.bg , virginio.cantoni@unipv.it)

a paper presentation

at the International Workshop on Biometrics, **BIOMET'2014**,
in the frames of **AComin** project (Advanced Computing for Innovation) of **IICT-BAS**
June, 23-24, 2014, Sofia, Bulgaria

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Dimov, D.T., V. Cantoni: Appearance-Based 3D Object Approach to Human Ears Recognition. In: Cantoni, V., D. T. Dimov, and M. Tistarelli (Eds.) Proceedings of First International Workshop on Biometrics, BIOMET'2014, June 23-24, 2014, Sofia, Bulgaria, Springer, Biometric Authentication, LNCS, Vol. 8897, pp. 121-135, Print ISBN: 978-3-319-13385-0, DOI: 10.1007/978-3-319-13386-7_10

The objective: to describe in brief the 3DEarDB of IICT, as well as a few applications of 3DEarDB, and to provoke a discussion about its future.

Why 3 dimensional DB (P3, 8-12), and **Why** in Ear Biometrics (P3, 4-5 - 7).

The **3DEarDB structure** (P1, 2-4),

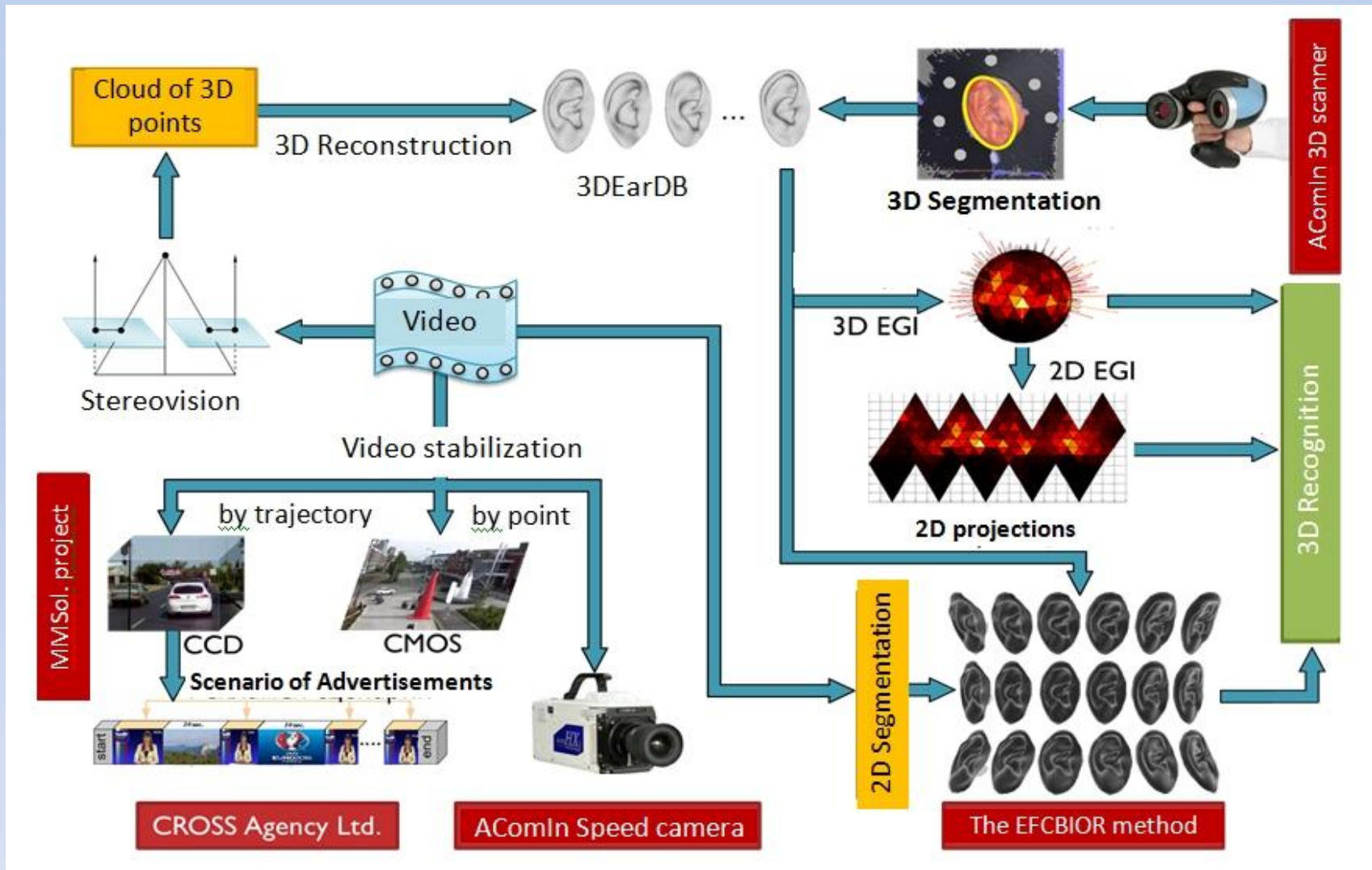
Extended Gaussian Image (EGI): an approach to 3D object representation (see P2, 3-11)

Data gathering for 3DEarDB: 3D scanner,... (P1, 5-13),

Tests for recognition ability of 3DEarDB:

- Primary 3D test ($3D \leftrightarrow 3D$) (not any sense for now)
- EGI based test ($3D \rightarrow 2D \leftrightarrow 2D \leftarrow 3D$) (see P2, 13-16) (see P1, 14-17)
- 2D appearance and multi-view based test ($2D \leftrightarrow 2D \leftarrow 3D$) (see P3, 8-18)
- a 'shape-from-shadow' approach for 2D appearance and EGI based test ($2D \leftrightarrow 3D$) ☺ still under construction

Discussion



A more detailed schema of using 3DEarDB in our research recently

07.10.2016:m_test_origi_3Dsolving(sv13e)(newAppr).m

the heaviest case: 01_VC_ear_refined_1st(saved).obj <=> 04_DD_ear_refined_1st(saved).obj

gaussian, gSize=19; sigma=gSize/5; some distortions at smoothing small images ?

preliminary smooth: gaussian, gSize=11; sigma=gSize/5; some distortions at smoothing small images ?

gaussian, gSize= 3; sigma=gSize/5;

	nlco, facets, Niso, N100	2, 170, 20, 170		3, 700, 72, 700		4, 5120, 272, 2690		5, 20480, 1056, 10790		6, 81920, 4160, 43780	
	Visible OBJ facets (3-angles):	5815	5617	5918	5726	5899	5704	5829	5630	5818	5621
No	EGI Obj file => Input BMP file	SSD err [%] (VC_obj)	SSD err [%] (DD_obj)	SSD err [%] (VC_obj)	SSD err [%] (DD_obj)	SSD err [%] (VC_obj)	SSD err [%] (DD_obj)	SSD err [%] (VC_obj)	SSD err [%] (DD_obj)	SSD err [%] (VC_obj)	SSD err [%] (DD_obj)
1	01_VC_ear_noSpecular_(Inty 100)_size3.bm imgSize= 22800 =(190x120) sizRol = 17627	6.549	7.235	4.157	4.547	2.506	2.732	1.730	1.808	1.381	1.415
		7.214	7.816	4.334	4.643	2.626	2.808	1.736	1.818	1.371	1.411
		7.135	7.699	4.431	4.827	2.647	2.777	1.783	1.834	1.411	1.439
2	01_VC_ear_noSpecular_(Inty 100)_size2.bm imgSize= 97500 =(390x250) sizRol = 65831	7.544	8.157	4.371	4.729	2.613	2.810	1.669	1.768	1.260	1.302
		7.987	8.510	4.383	4.705	2.598	2.770	1.660	1.746	1.257	1.290
		6.743	7.263	4.224	4.591	2.642	2.690	1.813	1.825	1.428	1.426
3	01_VC_ear_noSpecular_(Inty 100)_size1.bm imgSize= 402900 =(790x510) sizRol = 253700	7.983	8.516	4.360	4.673	2.594	2.757	1.649	1.742	1.234	1.276
		7.731	8.269	4.250	4.542	2.529	2.661	1.617	1.690	1.213	1.248
		6.322	6.783	4.126	4.453	2.777	2.769	1.946	1.947	1.564	1.569

Thank you
(for your questions 😊)