

Human Analytics: From Biometrics to Biomedicine

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Changing the way ~~people~~ look at ~~computers~~ ~~people~~

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2D Face Analysis Challenges

Poses

Hair

Accessories

Twins

illumination Conditions

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Challenge 1

What's in a Face?

ECCV 2012 Workshop
12th October 2012

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Key Areas

- Image Analysis
- Computer Vision / Pattern Recognition
- Data Analytics / Machine Learning

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3D

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3D-3D Face Recognition

Problem Statement:
Given a 3D facial scan, determine or verify the identity of the subject.

Extract Signature

I.A. Kakadiaris, G. Passalis, G. Toderici, N. Murty, Y. Lu, N. Karampatzakis, and T. Theoharis, "Three-dimensional face recognition in the presence of facial expressions: An annotated deformable model approach," *IEEE Trans. on Pattern Analysis and Machine Intelligence*, vol. 29, no. 4, pp. 640–649, 2007.

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YOUR FACE IS YOUR PASSWORD

TEXTURE SWAPPING AND MORPHING

SPECULAR HIGHLIGHT REMOVAL

3D Face Recognition

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3D-3D Face Recognition

- Face Recognition Grand Challenge (FRGCv2)

| 3D-3D system | Recognition % (Rank-1) | Verification % (@ 10 ⁻⁴ FAR) |
|-------------------------|------------------------|---|
| Kakadiaris et al., 2007 | 97.5 | 97.10 |
| Wang et al., 2010 | 98.3 | 98.13 |
| Ocegueda et al., 2012 | 99.0 | 98.00 |

O. Ocegueda, T. Fang, S.K. Shah, and I.A. Kakadiaris, "3D Face discriminant analysis using Gauss-Markov posterior marginals," *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 2012.

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3D-2D Face Recognition

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2D-2D Face Recognition

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Challenges & Opportunities: 2D

- Low Resolution
- Artifacts
- Landmark Detection
- Pose
- Illumination
- Score Normalization

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21 Camera System

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21 Pod Acquisition: 3D

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21 Pod Acquisition: 2D

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Facial Analytics

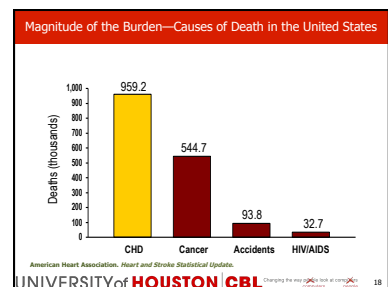
- Biometrics
- Forensics
- Cognitive Psychology
 - Infer Emotional State
 - How do human's recognize faces?
- Medicine
 - Infer health status
- HCI

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Challenge 2

Can we predict your risk for a disease?

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Cardiovascular Informatics

To develop the theoretical framework and computational tools to aid physicians in scoring the patients' vulnerability and the likelihood of a future coronary event.

<http://www.cbl.uh.edu/CARDIA>

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Computational Methods for the Extraction of CVD Biomarkers from Non-contrast CT Data

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In Vivo Imaging of Coronary Neovascularization

Goal: Early detection of atherosclerotic plaques with a high probability of causing future cardiovascular events (heart attack or stroke)

Objective: Imaging and identification of new neovascular biomarkers associated with plaque inflammation and instability through intravascular perfusion imaging

Impact: A quantitative method for cumulative risk assessment of vulnerable patients

Methods: Multidimensional Contrast-Enhanced Frame Coring, Image fusion from arbitrary view, Rigid elastic Contour Tracking, Plaque Comparison to Capture Changes due to New Neovascularization

Results: Plaque Segmentation, Registration, Histology, ASSTTM Analysis

Challenges: Low Contrast, Motion Artifacts

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Application Domains

- Biometrics
- Health Computing
 - Cardiovascular Informatics
 - Cancer Informatics
- Computational Life Sciences
 - Neuro-Information
- Earth Sciences
 - Emergency Management – Aerial 3D Images
 - Detection of Natural Resources – Seismic Data Analysis

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- Research Areas
 - Image Analysis
 - Computer Vision / Pattern Recognition
 - Data Analytics / Machine Learning

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- Research Interests
 - Shape Representation / Modeling
 - Object Recognition
 - Segmentation
 - Learning & Inference
 - Predictive Analytics

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Publications – 2013: www.cbl.uh.edu

Recent Papers

1. G. Wang, M. S. Brown, S. A. Srinivasan, D. R. Bricker, J. G. Han, et al. Atherosclerotic Neovascularization in Atherosclerotic Plaques. *Journal of Vascular Medicine and Biology*, 2013.
2. G. Wang, M. S. Brown, S. A. Srinivasan, D. R. Bricker, J. G. Han, et al. Atherosclerotic Neovascularization in Atherosclerotic Plaques. *Journal of Vascular Medicine and Biology*, 2013.
3. G. Wang, M. S. Brown, S. A. Srinivasan, D. R. Bricker, J. G. Han, et al. Atherosclerotic Neovascularization in Atherosclerotic Plaques. *Journal of Vascular Medicine and Biology*, 2013.
4. G. Wang, M. S. Brown, S. A. Srinivasan, D. R. Bricker, J. G. Han, et al. Atherosclerotic Neovascularization in Atherosclerotic Plaques. *Journal of Vascular Medicine and Biology*, 2013.
5. G. Wang, M. S. Brown, S. A. Srinivasan, D. R. Bricker, J. G. Han, et al. Atherosclerotic Neovascularization in Atherosclerotic Plaques. *Journal of Vascular Medicine and Biology*, 2013.
6. G. Wang, M. S. Brown, S. A. Srinivasan, D. R. Bricker, J. G. Han, et al. Atherosclerotic Neovascularization in Atherosclerotic Plaques. *Journal of Vascular Medicine and Biology*, 2013.
7. G. Wang, M. S. Brown, S. A. Srinivasan, D. R. Bricker, J. G. Han, et al. Atherosclerotic Neovascularization in Atherosclerotic Plaques. *Journal of Vascular Medicine and Biology*, 2013.
8. G. Wang, M. S. Brown, S. A. Srinivasan, D. R. Bricker, J. G. Han, et al. Atherosclerotic Neovascularization in Atherosclerotic Plaques. *Journal of Vascular Medicine and Biology*, 2013.
9. G. Wang, M. S. Brown, S. A. Srinivasan, D. R. Bricker, J. G. Han, et al. Atherosclerotic Neovascularization in Atherosclerotic Plaques. *Journal of Vascular Medicine and Biology*, 2013.
10. G. Wang, M. S. Brown, S. A. Srinivasan, D. R. Bricker, J. G. Han, et al. Atherosclerotic Neovascularization in Atherosclerotic Plaques. *Journal of Vascular Medicine and Biology*, 2013.

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CBL Roadmap

New Computational Tools For Scientific Discovery

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Research Teams of The Future: Collaborators

- Computer Scientists
- Engineers
- Mathematicians
- Biologists
- Biochemists
- Neuroscientists
- Pathologists
- Cardiologists
- Cardiothoracic Surgeons

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Press Coverage




- ABC 13 News
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EDUCATION Colleges

Discover 11 Hot College Majors That Lead to Jobs

By CATHE GARDEL
Updated on 10/18/13 @ 10:08 PM

2. **Biometrics:** This field teaches students how to build automated identification devices, such as facial recognition systems. As biometric readers replace photo IDs and passwords in both the public and private sectors, the industry is expected to grow to \$363 million by 2016, according to New York-based Transparency Market Research.

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6. **Data science:** The International Data Corp., a Massachusetts-based technology market research firm, says the global volume of computerized data is doubling every two years. This will help create some 4.4 million jobs worldwide by 2015, estimates Connecticut-based technology research firm Gartner Inc. Interested students should consider a major in data science or business analytics (Dn-7 below).

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Alumni: Academia



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Alumni: Research Labs & Industry (2)



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Research Experience

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