Human Analytics: From Biometrics to Biomedicine

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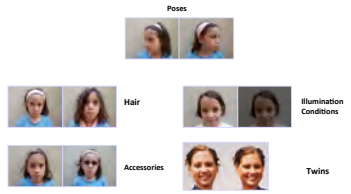
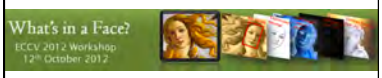
2D Face Analysis Challenges



Challenge 1



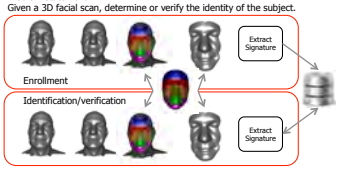
Key Areas

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

3D

3D-3D Face Recognition

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



I.A. Kakadiaris, G. Passalis, G. Toderici, N. Murtuza, Y. Lu, N. Karampatziakis, 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.

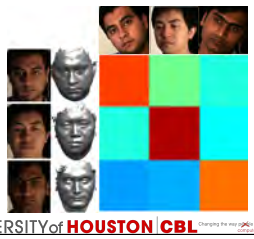
3D-3D Face Recognition

- Face Recognition Grand Challenge (FRGCv2)

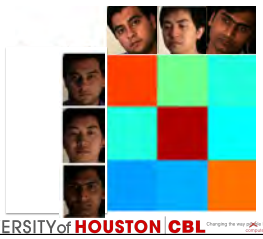
3D-3D system	Recognition % (Rank-1)	Verification % (@ 10^{-3} FAR)
Kakadiaris *et al.*, 2007	97.5	97.10
Wang *et al.*, 2010	98.3	98.13
Ocequeda *et al.*, 2012	99.0	98.00

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.

3D-2D Face Recognition



2D-2D Face Recognition

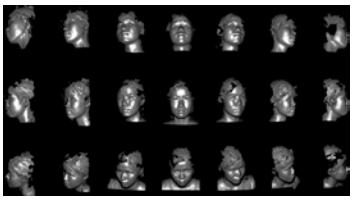


Challenges & Opportunities: 2D

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

21 Camera System

21 Pod Acquisition: 3D



21 Pod Acquisition: 2D

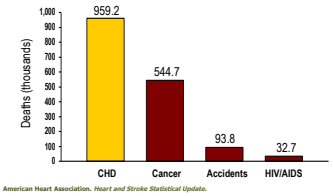
Facial Analytics

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

Challenge 2

Can we predict your risk for a disease?

Magnitude of the Burden—Causes of Death in the United States



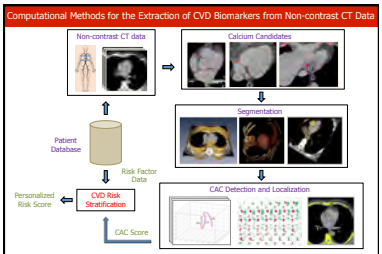
American Heart Association. *Heart and Stroke Statistical Update.*

Cardiovascular Informatics

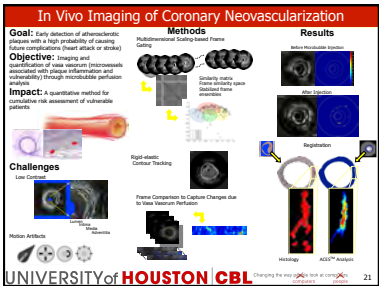
To develop the theoretical framework and computational tools to aid physicians in scoring the patients' vulnerability and the likelihood of a future coronary event.

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

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



In Vivo Imaging of Coronary Neovascularization



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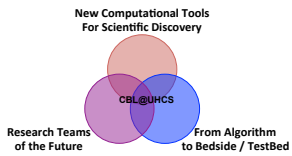
- Research Interests
  - Shape Representation / Modeling
  - Object Recognition
  - Segmentation
  - Learning & Inference
  - Predictive Analytics

Publications – 2013: www.cbl.uh.edu

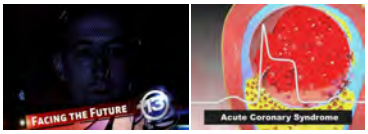
CBL Roadmap



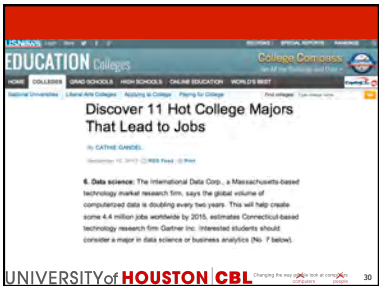
Research Teams of The Future: Collaborators

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

Press Coverage



- ABC 13 News
- Fox News
- Local2 News
- Discovery Channel



Alumni: Academia

Alumni: Research Labs & Industry (2)

Research Experience

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