Combining Soft
Biometrics to
Describe Person
Appearance

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CMSC 601 Spring
2011

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Introduction

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Overview

Data Collection

Relating Features

Conclusion

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9-11 2001

Japan 2011
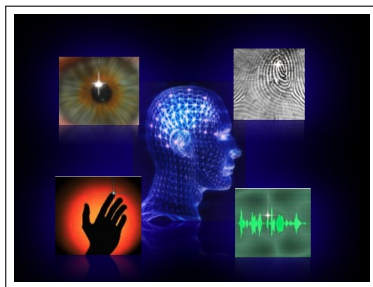
Soft Biometrics

Biometric features - Define human identity

Soft Biometrics

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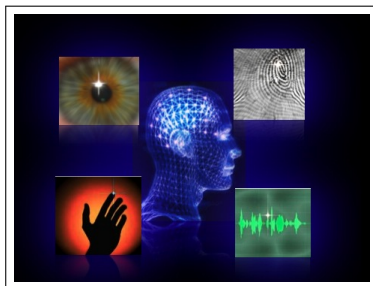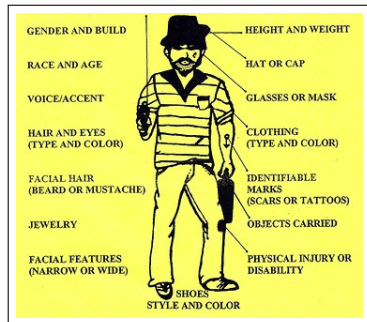Appearance

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Biometric features - Define human identity

Soft Biometrics: Features that describe person appearance but are not unique to that person. [Jain et al, 2004]

Aim 1

Extracting multiple soft biometrics to describe person appearance

Related Work

- Multibiometrics fusion [Nandakumar et al, 2005]
- Biometrics + soft biometrics [Jain et al, 2004]
- Bag of soft biometrics for person identification [Dantcheva et al, 2011]

Related Work

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- Multibiometrics fusion [Nandakumar et al, 2005]
- Biometrics + soft biometrics [Jain et al, 2004]
- Bag of soft biometrics for person identification [Dantcheva et al, 2011]
    - Combining face features with weight estimation and clothing information
    - Pairwise correlation to identify co–occurence of different values
    - Domain values of features are very coarsely defined (Skin color: Type 1, Type 2, Type 3)
    - Depends on the data for categories of authentication
   - Data distribution and size must be known

Related Work

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Feature detectors are perfect

Relating Features

Gender: Female
Facial Hair: Present

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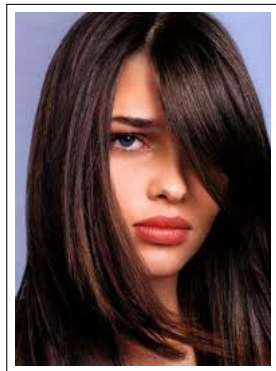
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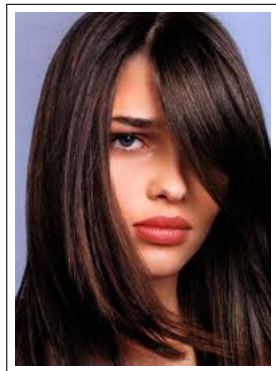CMSC 601 Spring
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Gender: Female
Facial Hair: Present

Need to identify and establish communication between different features using their mutual dependencies

Aim:2
Designing a way to relate different features using a probabilistic graphical model

Our Approach

- ▶ Data collection using Amazon Mechanical Turk: To understand relationships between human features
- ▶ Graphical structure: To represent the relationships derived from data and literature

Data Collection: Amazon Mechanical Turk

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Crowd sourcing for data annotation

- Gathering Survey Data
- Designing a HIT
  Beginning the Survey
  - IRB Approval
  - Deciding Worker Qualifications
  - Payment details
- Approving Responces
  - Accept / Reject
- Analyzing Data
  - Cleaning data
  - Representation
  - Identifying dependences

- ► Dataset: 300 images, LFW dataset [Huang et al, 2007], Gallagher person dataset [Gallagher and Chen, 2008]
- ► Annotations: 3 per image, 13 independent features
- ► Pay her HIT: $ 0.03
- ► Separate task for free description of person in the image

Example HIT

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Results

Data Collection

To be completed

- ▶ Clean data
- ▶ Visualize
- ▶ Extract mutual occurrences

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Data Collection

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To be completed

- Clean data
- Visualize
- Extract mutual occurrences

Evaluation

- How consistent is the data?
- Time and Effort for data gathering?
- What data is related? How strongly is it related?
- Amazon MTurk: Acceptance rate/ Rejection rate: Comparing these numbers w.r.t. the features

Relating Features: Graphical structure

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Factor graph showing relationships identified from literature

Potential Functions

- ▶ Node potential ψ: Validity of values from feature detector $\{0,1\}$
- ▶ Node confidence c_{node}: Weight of the node value
- ▶ Factor potential ϕ: Agreement or disagreement $\{0,1\}$

Relating Features

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To be completed

- ▶ Validate graphical structure
- ▶ Learn edges and weights from related data
- ▶ Identify convergence

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To be completed

- ▶ Validate graphical structure
- ▶ Learn edges and weights from related data
- ▶ Identify convergence

Evaluation

- ▶ Graph structure
- ▶ Efficiency of the potential functions

Summary

- ▶ Data collection using Amazon Mechanical Turk
- ▶ Probabilistic graphical structure to define relationships between different soft biometrics
- ▶ Potential functions to define communication between features

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Thank you !
Questions ?