

AI Research: From the University Lab to Commercial Products

- **Dr. Karl Ricanek Jr**
- **Faculty Researcher & VC Backed Entrepreneur**

- Session 5: Universities as drivers of AI research and innovation
- **2nd ITU-Academia Partnership Meeting**
- **"Developing Skills for the Digital Era"**
- Atlanta, Georgia, USA, 2-3 December 2019

University to Industry Pipeline



University Research

Industry/Government Funding

Workforce Development



Ideation Labs

Univ Partnerships (Co-operative Agreements)

Formalize Research Statement



Incubators

Intellectual Property (Patents/Trade Secrets/etc)

Research Articles & Presentations (Data/Perf/Competitions)



Spinout

Industry-backed startup



Commercial Adoption

Followers – Copycats - Mimicry

CASE STUDY

Improve Identity Matching in Face Recognition

University Research: The Problem



▪ WHO AM I?

Face Recognition Identity Matching

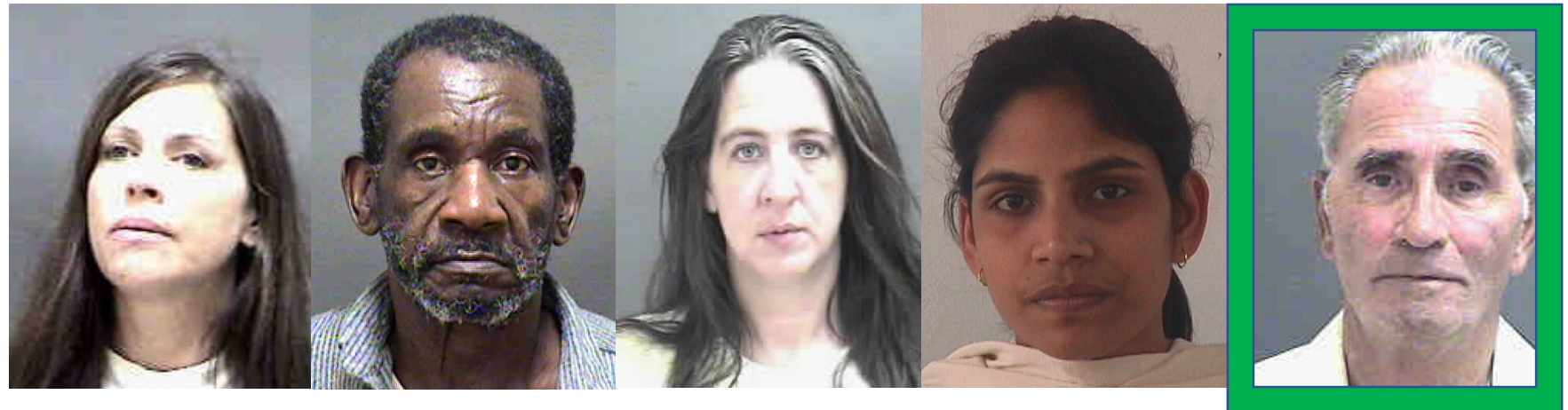
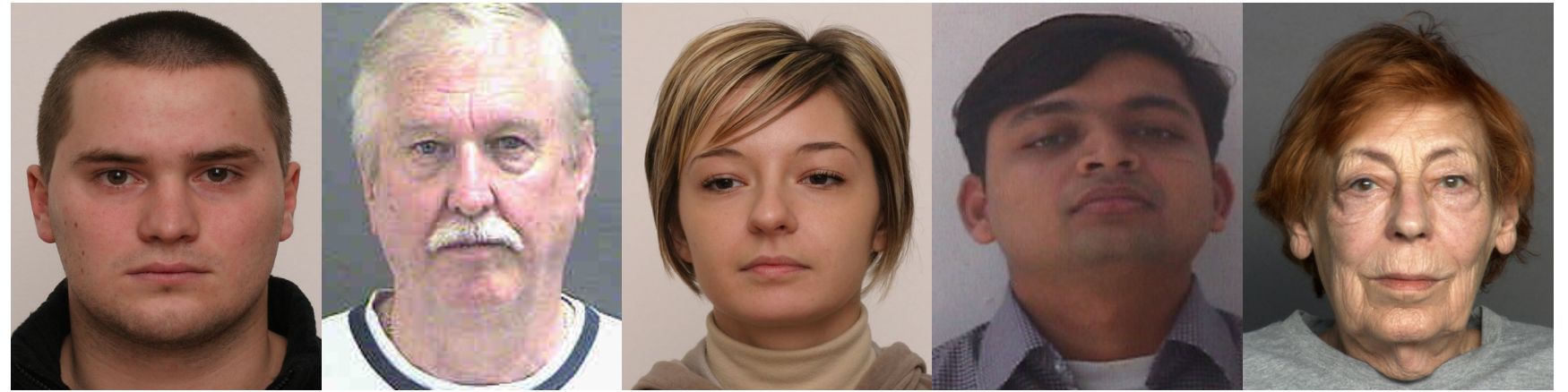
- One to many (1:N Search)
- Compares the acquired and processed facial trait of an individual with all the stored templates in the database and gives a ranked list of matches.

Identity Matching

Probe

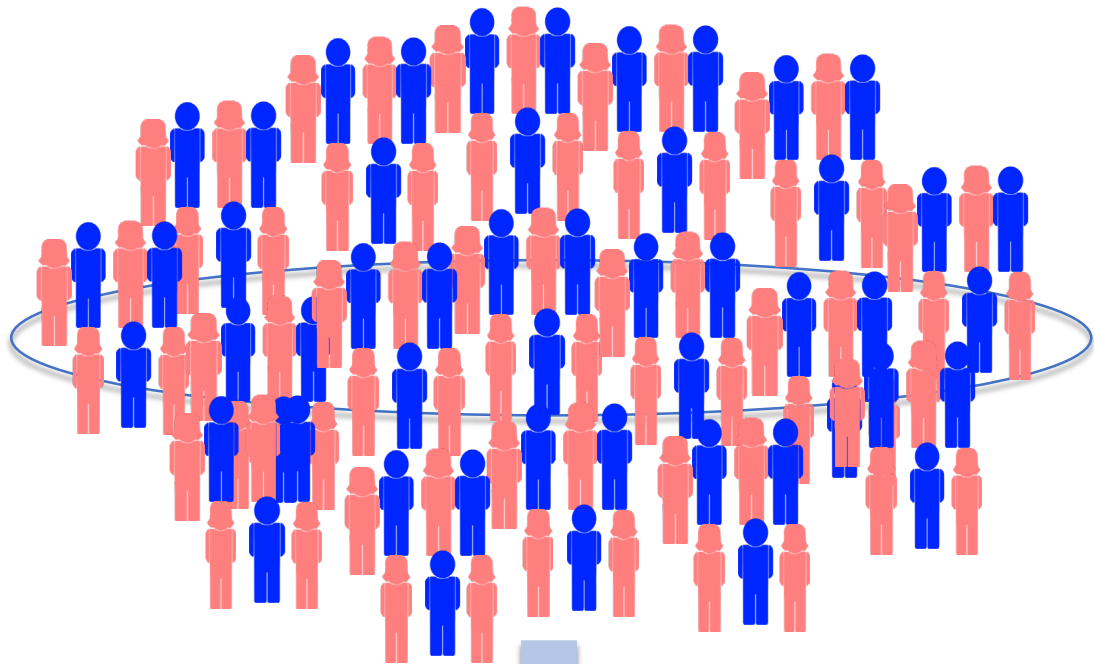


Response Rank-10



Gender Parsing

Gallery



Females Only

Facial Analytics
Gender Parsing



Males Only

Probe

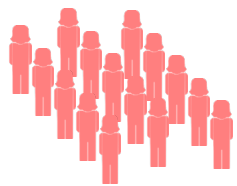
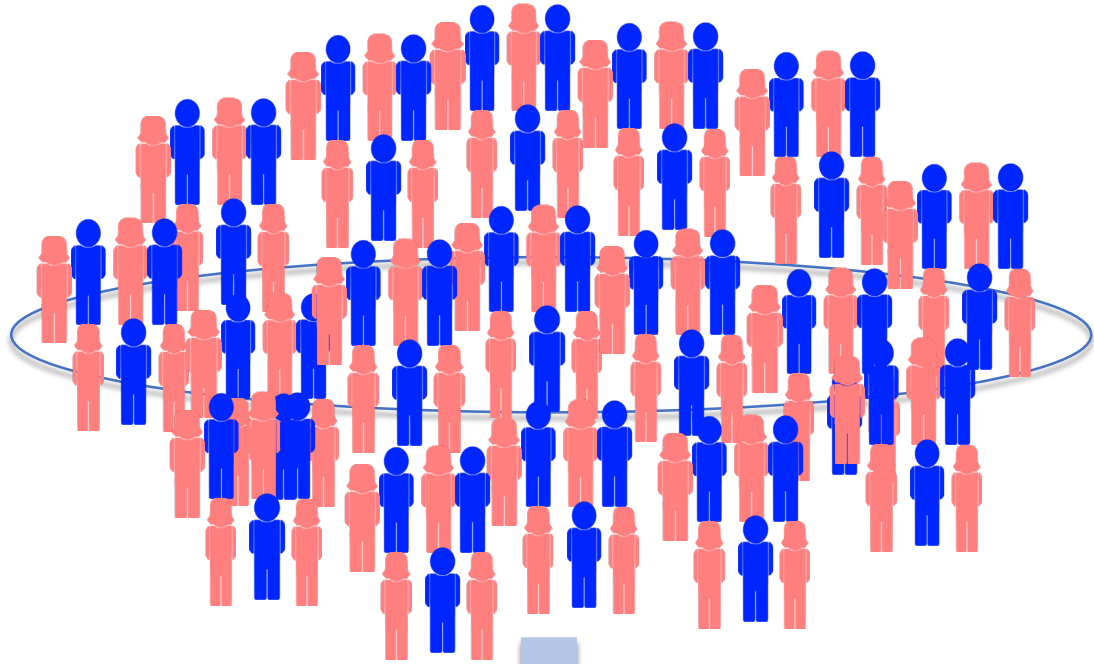


Response

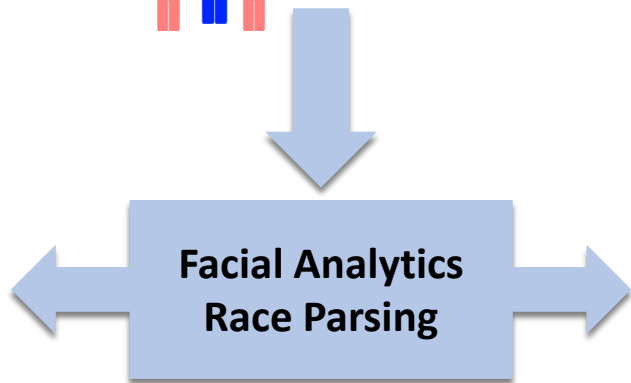


Race Parsing

Gallery



White



Non-white

Probe



Response



Facial Analytics

- Facial analytics first appeared in IEEE Computer September 2012.
- Facial analytics is an emerging research space born from biometrics that provides contextualize information images of people without encroaching on their privacy.

Facial Analytics: From Big Data to Law Enforcement

Karl Ricanek Jr., University of North Carolina Wilmington
Chris Boehnen, Oak Ridge National Laboratory



Facial analytics is an emerging soft-biometric technology that examiners can use to contextualize images of people without encroaching on their privacy.

The September 2011 Identity Sciences column introduced the concept of soft biometrics and outlined potential applications (K. Ricanek Jr. and B. Barbour, "What Are Soft Biometrics and How Can They Be Used?," pp. 106-108). Soft biometrics are biometric signals that convey distinctive information about an individual short of identity.

FACIAL ANALYTICS

Face-based soft-biometrics systems extract, store, and compare person-specific templates containing attributes of the face or that the face expresses. These include physical features (large nose, goatee, scar, and so on), medical or behavioral markers (for example, paralysis from a stroke or the moon face produced by Cushing's syndrome), or elements that describe the face's position in the image from which the attributes were extracted.

substantial pushback from the public regarding how Google would integrate these technologies with its own applications induced the company to hold off on implementing PittPat systems.

Facial analytics is an emerging soft-biometric technology that examiners can use to contextualize images of people without encroaching on their privacy. A facial analysis system explicitly divorces the recognition component from attribute generation: it doesn't attempt to identify individuals or confirm their identity but instead generates descriptive metadata about them based on their face. This metadata includes elements like facial expressions, face position, face shape, face age, and other nonunion information.

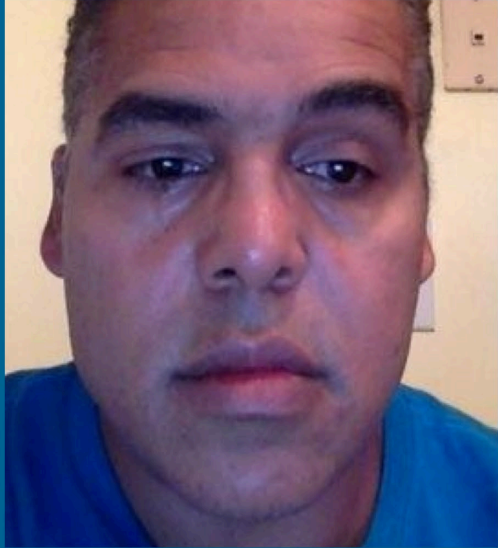
Although face-based soft biometrics could be a useful tool for, among other things, automated gender identification and age estimation in numerous consumer, business, and government applications, civil libertarians have raised concerns about potential misuse in conjunction with face recognition.

Commercial Apps

First Facial
Analytics
Application
July 2014

Face My Age™ Meet the Scientists How We Age FAQs

1. FIND FACE > 2. OUTLINE FACE > 3. LIFESTYLE QUESTIONS > 4. FACE YOUR AGE



Time to Face My Age!

Face Age:

41


Expected Lifespan:	79.5 Years
Remaining Days:	13,348
Probability of Surviving to 65:	87.3%
Probability of Surviving to 85:	41.5%

How'd You Calculate This?

Don't like your age estimate? It's probably not you! Sometimes image quality can cause problems. Please see our [FAQ](#) to learn about image factors that can distort results.

Want to help us test updates to FaceMyAge? Submit your email address to be notified!

Please Tell A Friend



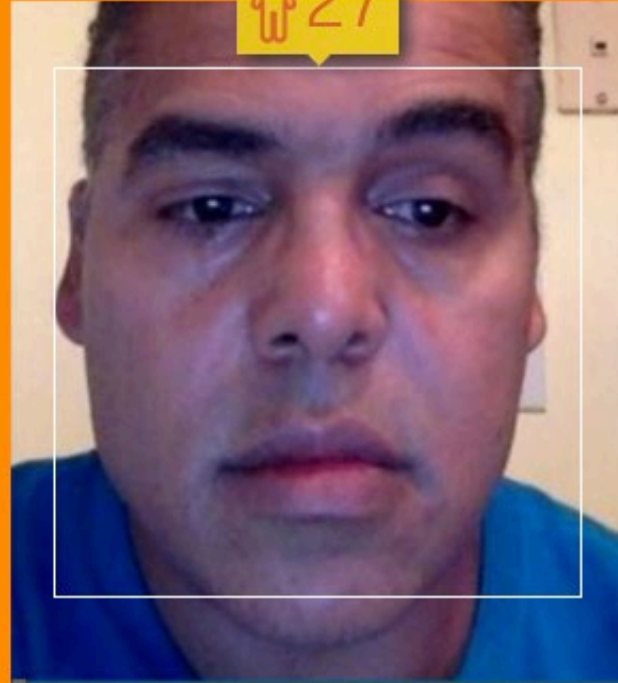
Developed by university research lab: www.FaceAging.com



How-Old.net

How old do I look? #HowOldRobot

 27



Sorry if we didn't quite get it right - we are still improving this feature.

[Try Another Photo!](#)



P.S. We don't keep the photo

[Share 20K](#) [Tweet](#)

The magic behind How-Old.net

[Privacy & Cookies](#) | [Terms of Use](#) | [View Source](#)

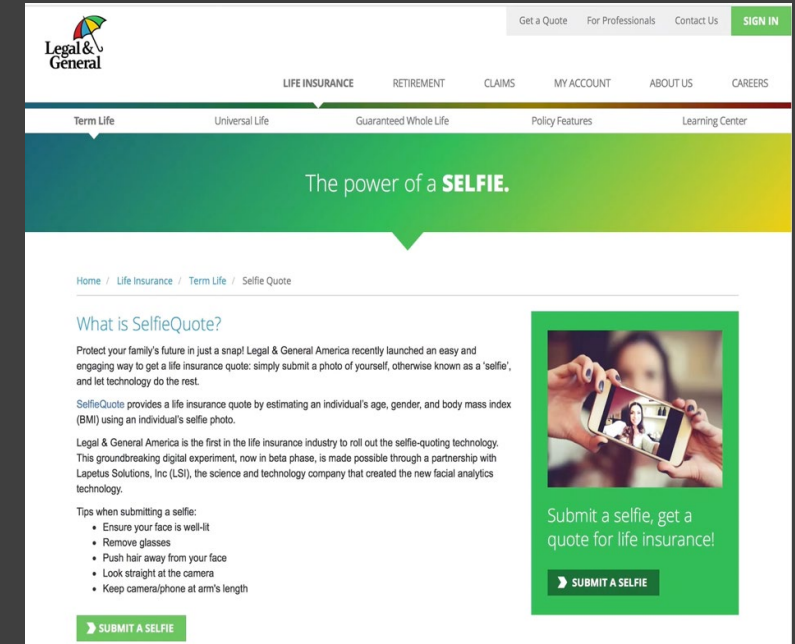
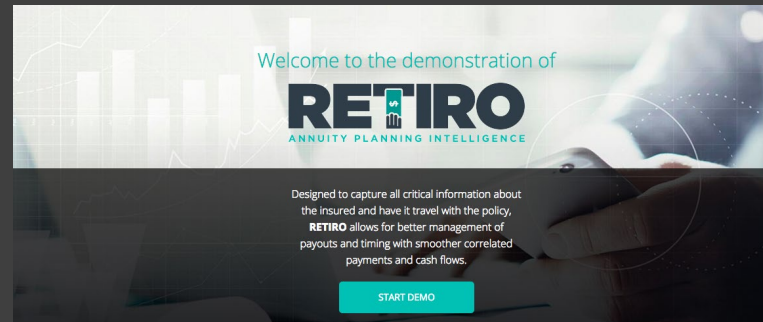
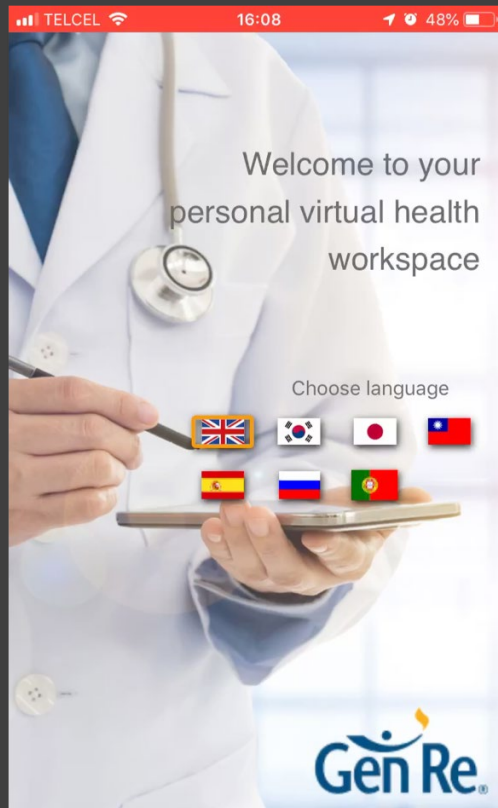
Second FA
Application
Circa 2015

Market

A study published in June 2019, estimates that by 2024, the global facial recognition market would generate \$7 billion of revenue, supported by a compound annual growth rate (CAGR) of 16% over the period 2019-2024.

For 2019, the market is estimated at \$3.2 billion.

The two biggest drivers of this growth are surveillance in the public sector and numerous other applications in diverse market segments.



Defining Solutions in Other Markets

Dr. Ricanek, co-founder Chief AI Scientist, Lapetus Solutions

CASE STUDY:



University Research

Improve Identity Matching in Face Recognition



Ideation Labs

What's broken in face recognition? Sanity checks for Sex/Age/Race
How can it be solved? AI & Data



Incubation

Datasets: MORPH I, MORPH II, Commercial MORPH, etc.
Patents: 2 Seminal U.S. Patents



Spinout

Many startups: EnterFace, Lapetus Solutions etc.
Acquisitions: Google, Facebook, Dropbox, etc.



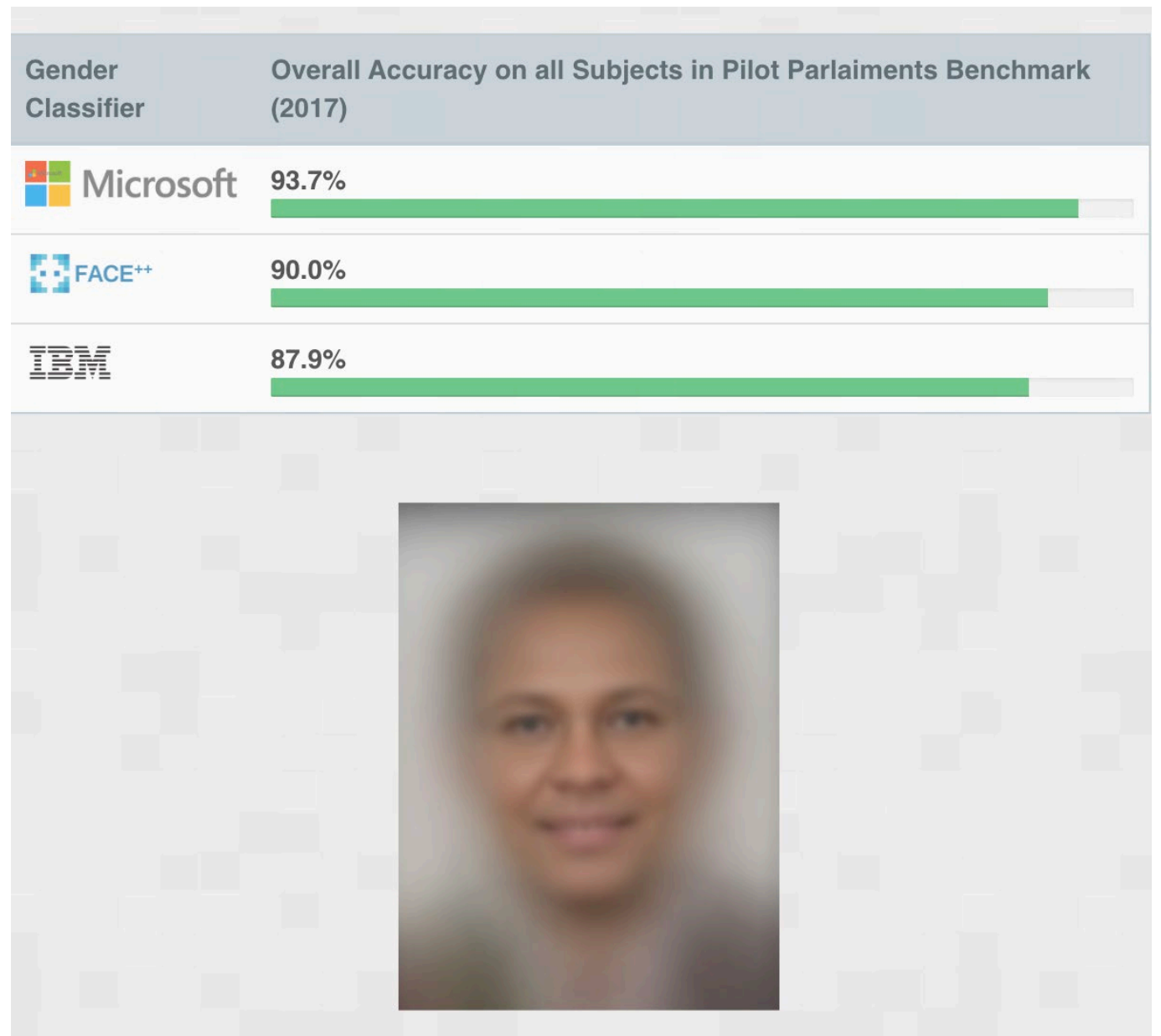
Commercial Adoption

Dozens provide Face Processing, Computer Vision, NLP, &more

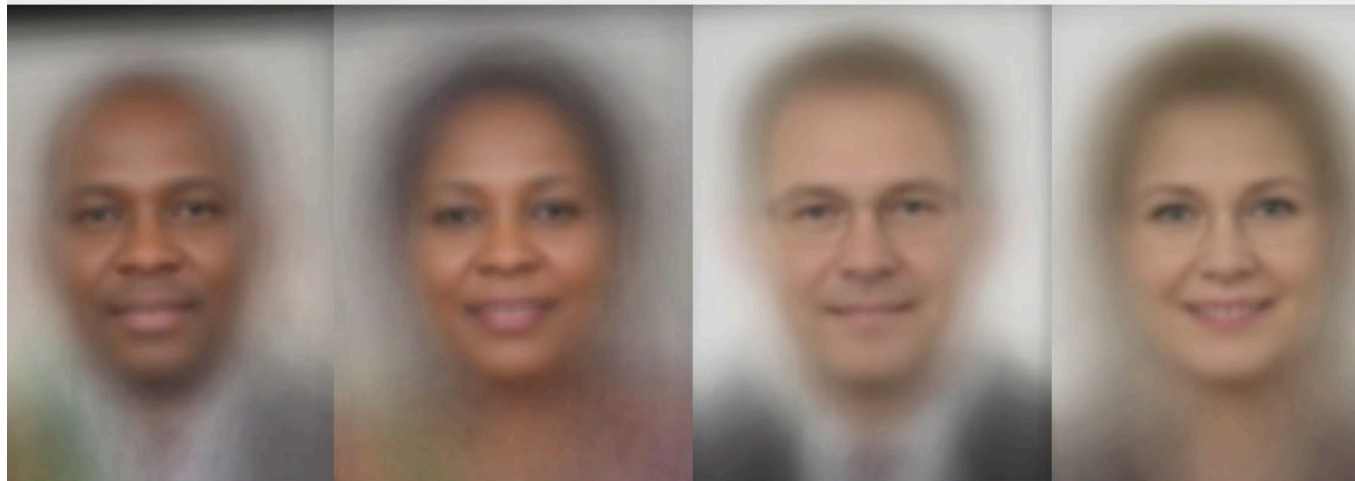
The Next Chapter: AI Bias

University Research Problem

AI Bias Facial Analytics



Gender Classifier	Darker Male	Darker Female	Lighter Male	Lighter Female	Largest Gap
Microsoft	94.0%	79.2%	100%	98.3%	20.8%
FACE++	99.3%	65.5%	99.2%	94.0%	33.8%
IBM	88.0%	65.3%	99.7%	92.9%	34.4%



AI Bias Facial Analytics

AI Bias Face Recognition

Lawmakers Can't Ignore Facial Recognition's Bias Anymore

Amazon has marketed its Rekognition facial recognition system to law enforcement. But in a new ACLU study, the technology confused 28 members of Congress with publicly available arrest photos.

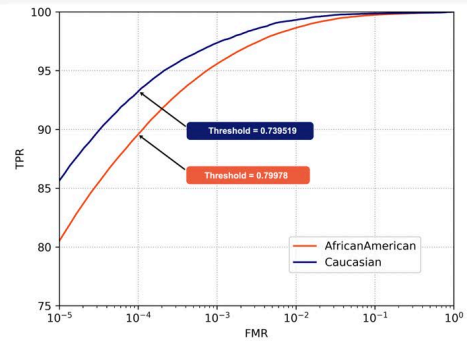


THE WASHINGTON POST/GETTY IMAGES

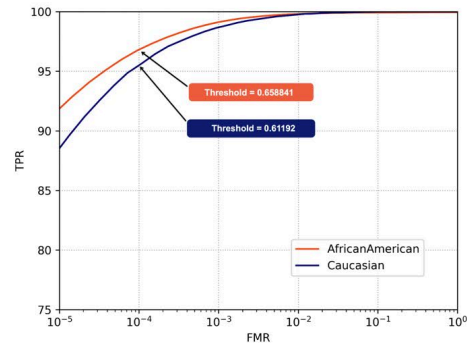
AI Bias: Face Recognition

05 ROC Curves

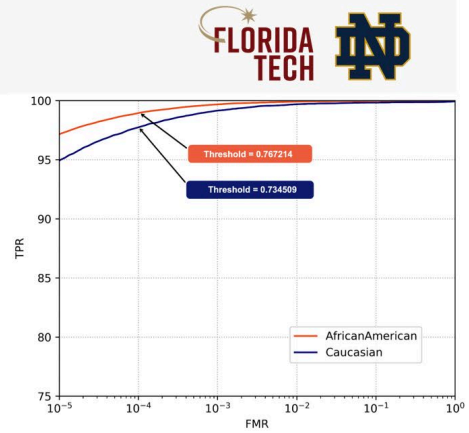
- » COTS-A and VGG show better accuracy for Caucasians than for African-Americans.
- » However, COTS-B and ResNet show better accuracy for African-Americans than for Caucasians.
- » Important point here is that ROC curves are generally not an appropriate way to compare face recognition accuracy across demographic cohorts.



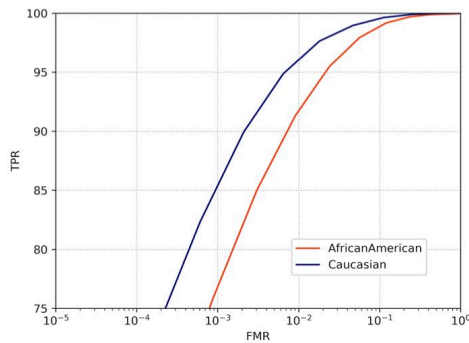
COTS-A



ResNet



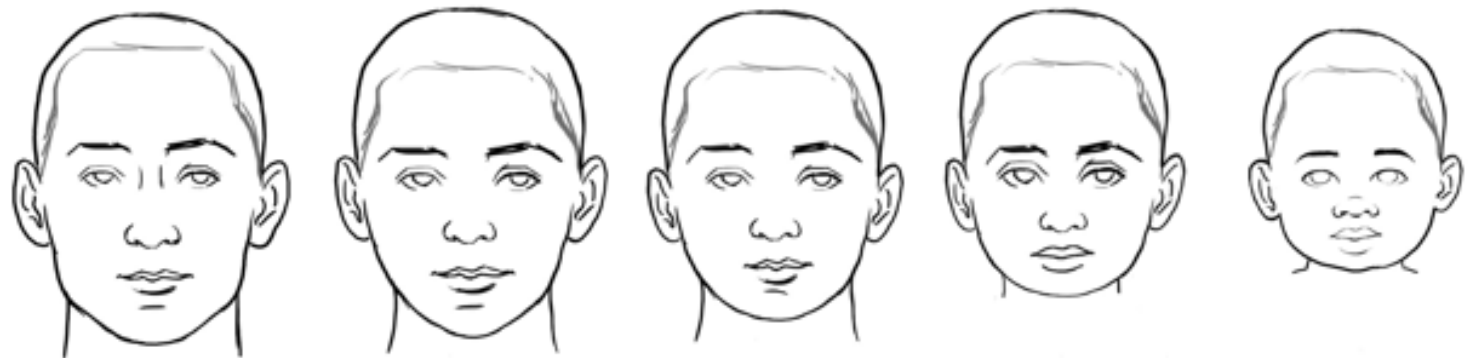
COTS-B

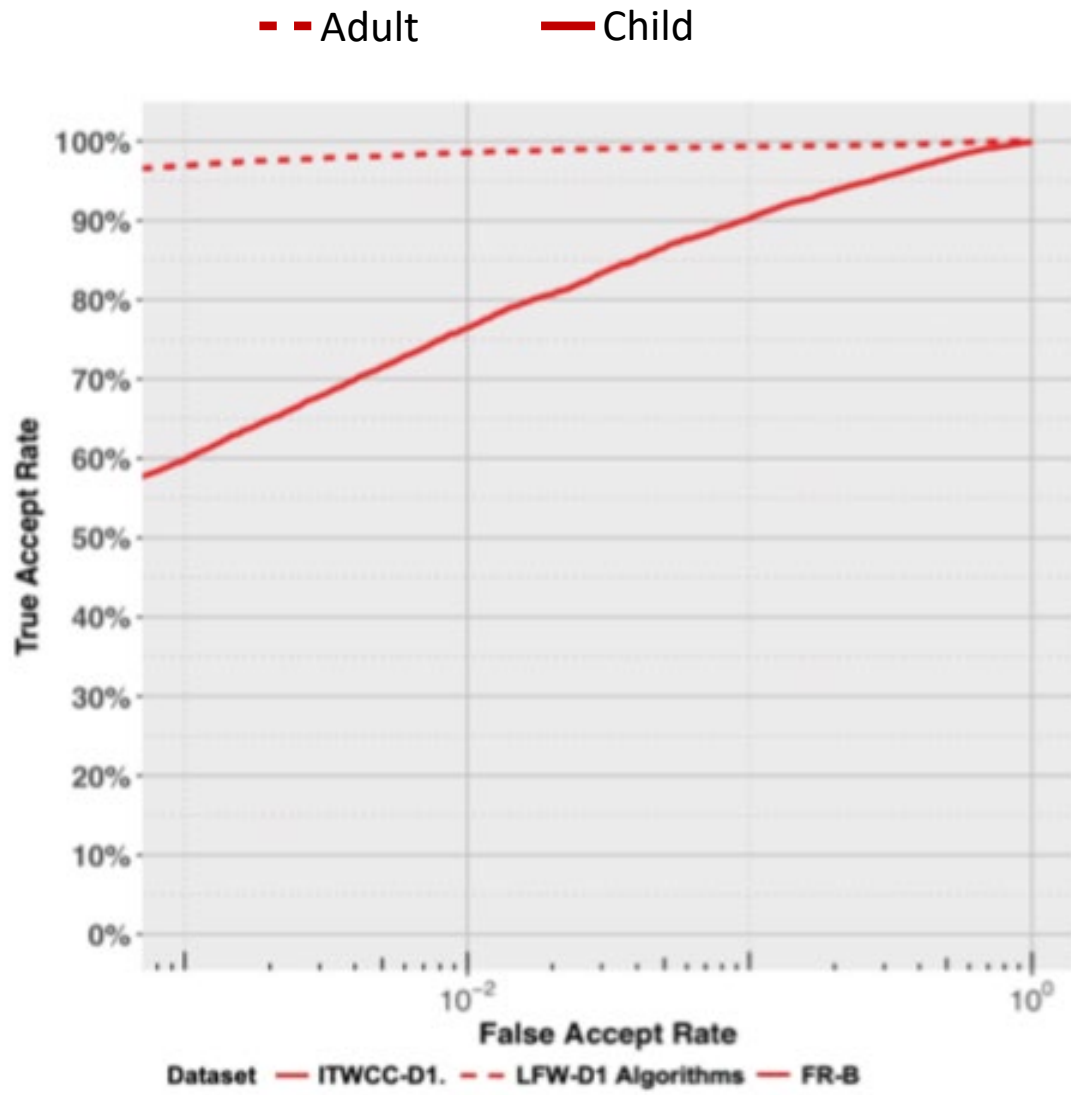


VGG



Child Face
Recognition





Adult vs Child Face Recognition

Questions

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