

Syllabus

CSE 40537/60537 Biometrics

Daniel Moreira
Spring 2020



Welcome

CSE 40537/60537 Biometrics

Daniel Moreira

Contact: dhenriq1@nd.edu, [@dmoreira](https://twitter.com/dmoreira)
Office: 150D Fitzpatrick Hall



Course Hours

Lectures: TUE and THR, 5:05 to 6:20 PM, 125 DeBartolo Hall
Office: MON and WED, 2 to 4 PM (and by appointment), 150N Fitzpatrick Hall

Communication

Webpage: <https://danielmoreira.github.io/teaching/biometrics-spr20/>
Slack: <https://cse-biometrics-spr20.slack.com>

Disclaimer

Panopto is ON

This course is being recorded.

Links with videos will be shared only
with members of the course, ASAP.



Is everybody ok with it?

If a single student does not agree with it, I will ask to turn it off.

Please refer to

<https://danielmoreira.github.io/courses/biometrics-spr20/panopto.pdf>
for more details.

Today you will...

Get to know what is ahead of you
in the course.

About me

Computer Scientist

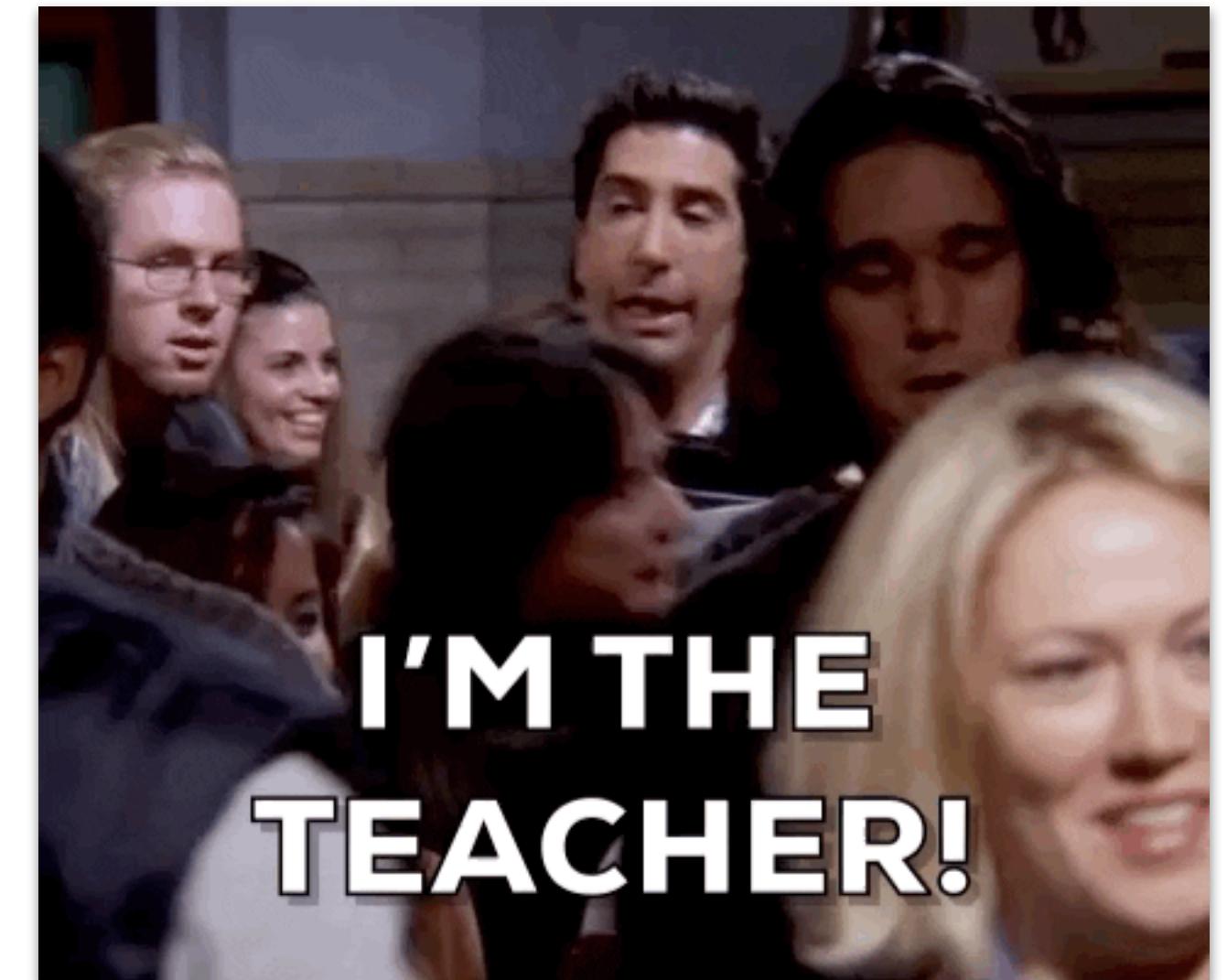
PhD from the University of Campinas (Brazil)

Theme: Sensitive-Video Analysis

University of Notre Dame

Post-doctoral researcher

Joined in 2016



Research

Computer Vision, Image Forensics, Machine Learning

Webpage: <https://danielmoreira.github.io>

(see next slides)

Sensitive-Video Analysis

<https://danielmoreira.github.io/project/sma/>

The background of the slide is a collage. On the right side, there is a portrait of Kurt Cobain, the lead singer of Nirvana, looking slightly upwards with a serious expression. On the left side, there is a red baseball cap with the letters 'NY' on it. The overall aesthetic is grunge.

The Notorious B.I.G.
NY scene rapper

Media Forensics

<https://danielmoreira.github.io/project/medifor/>

Kurt Cobain
Grunge scene musician







Synthesis of Realistic Example Faces

<https://danielmoreira.github.io/project/srefv/>

Does this person
exist?



Yes
(original)



No
(nose and
mouth
replaced)

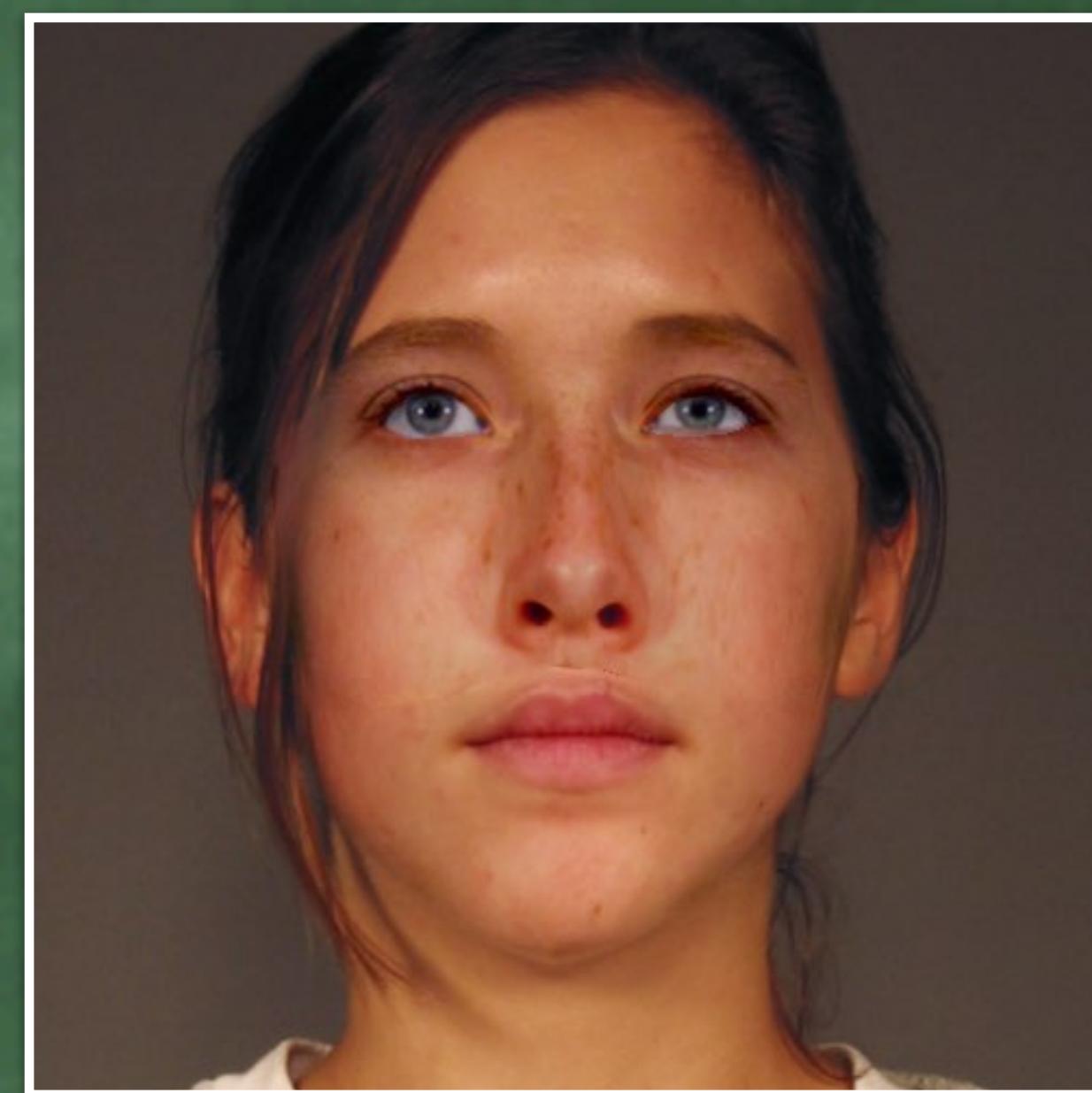
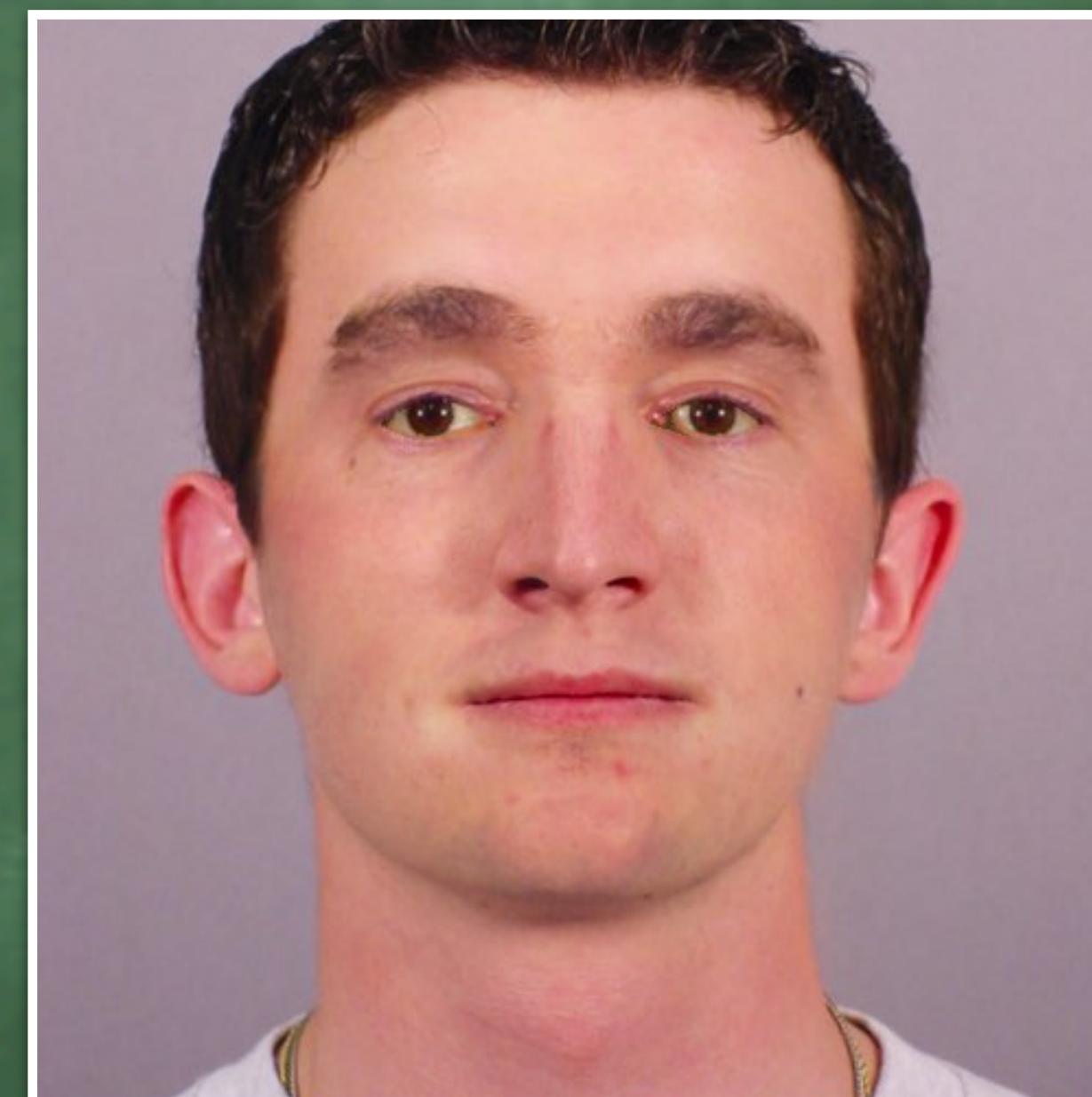


No
(eyes,
nose
and mouth
replaced)



No
(eyes
replaced)





Load irises

Load examination

Save examination

Save report

Quit program



Tool Supporting the Human Examination of Post-Mortem Iris Images

<https://danielmoreira.github.io/project/tshepii/>

Human-Interpretable Features

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Manual Annotation

- Annotate... Matching Regions Non-Matching Regions
- Show Matching Regions Show Non-Matching Regions

Non-Human-Interpretable Features

Gabor Filters thr: 0.4461

BSIF Filters thr: 0.4216

Global match score

How about you?

Background

Anybody outside the CSE department?
S'up undergrads? S'up grad students?
Can everybody program?
What programming languages do you use?



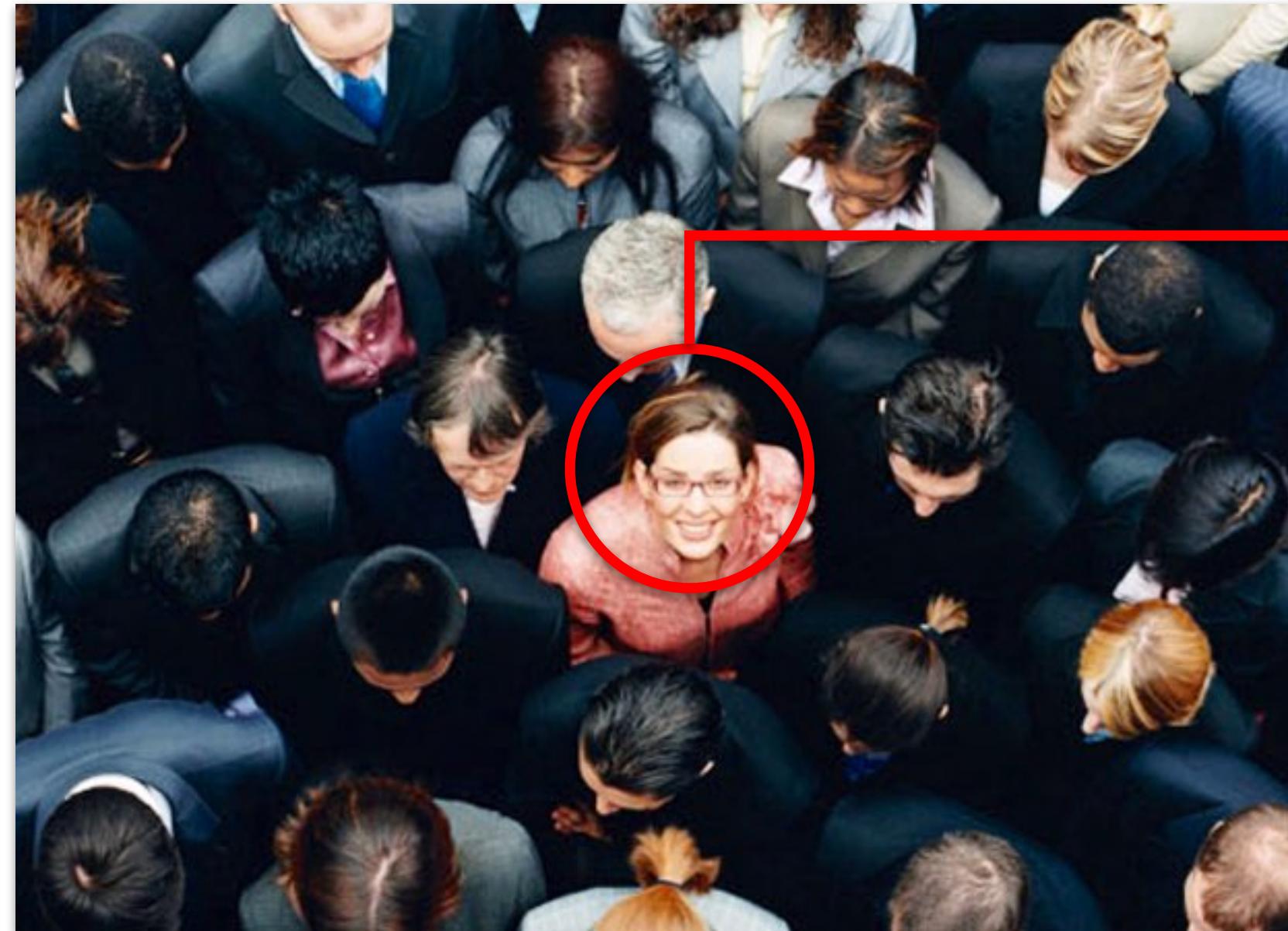
Motivations

What interests you about Biometrics?

Disabilities

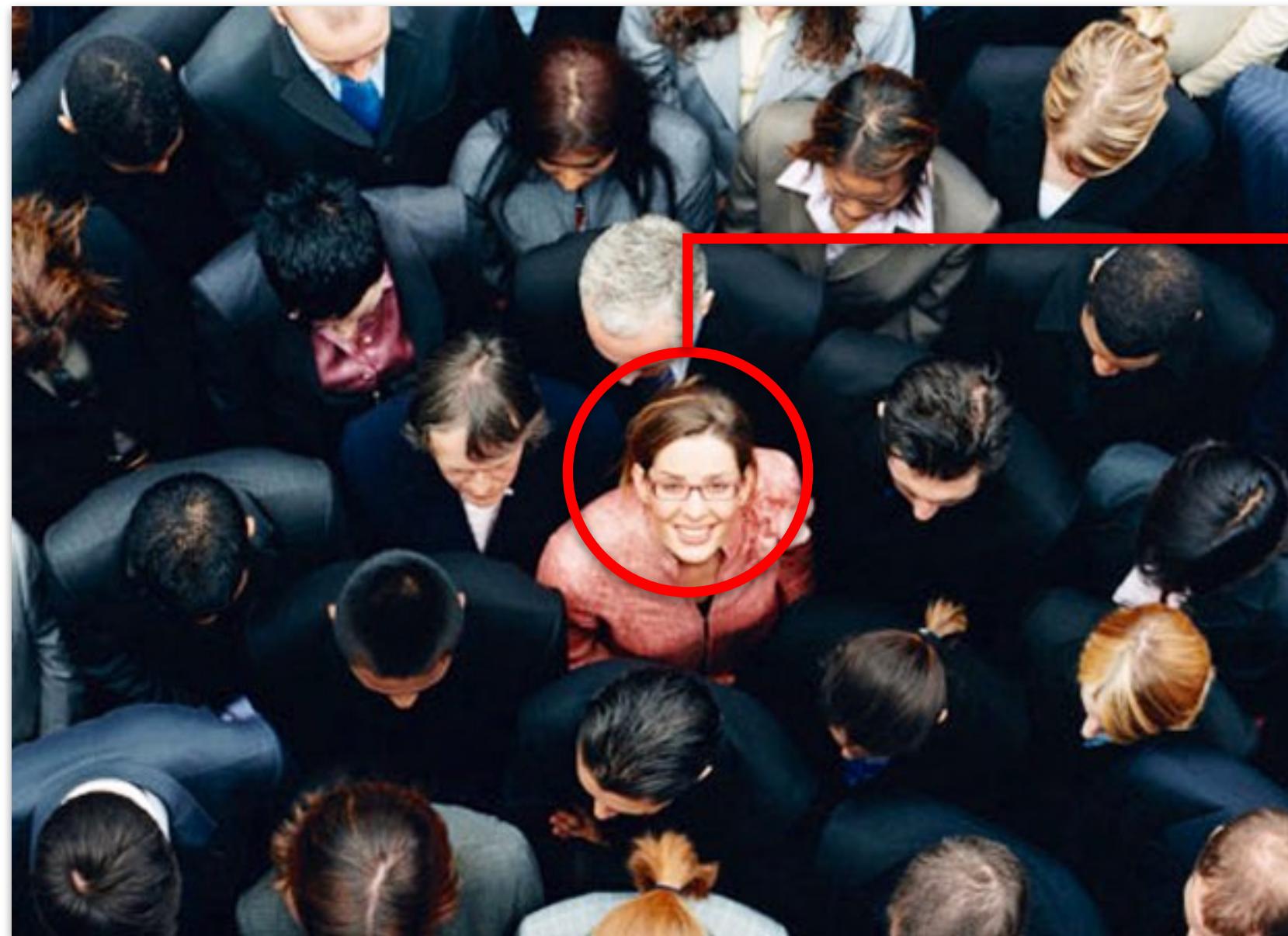
Please reach me out in private ASAP.
We'll make things work.

What is Biometrics?



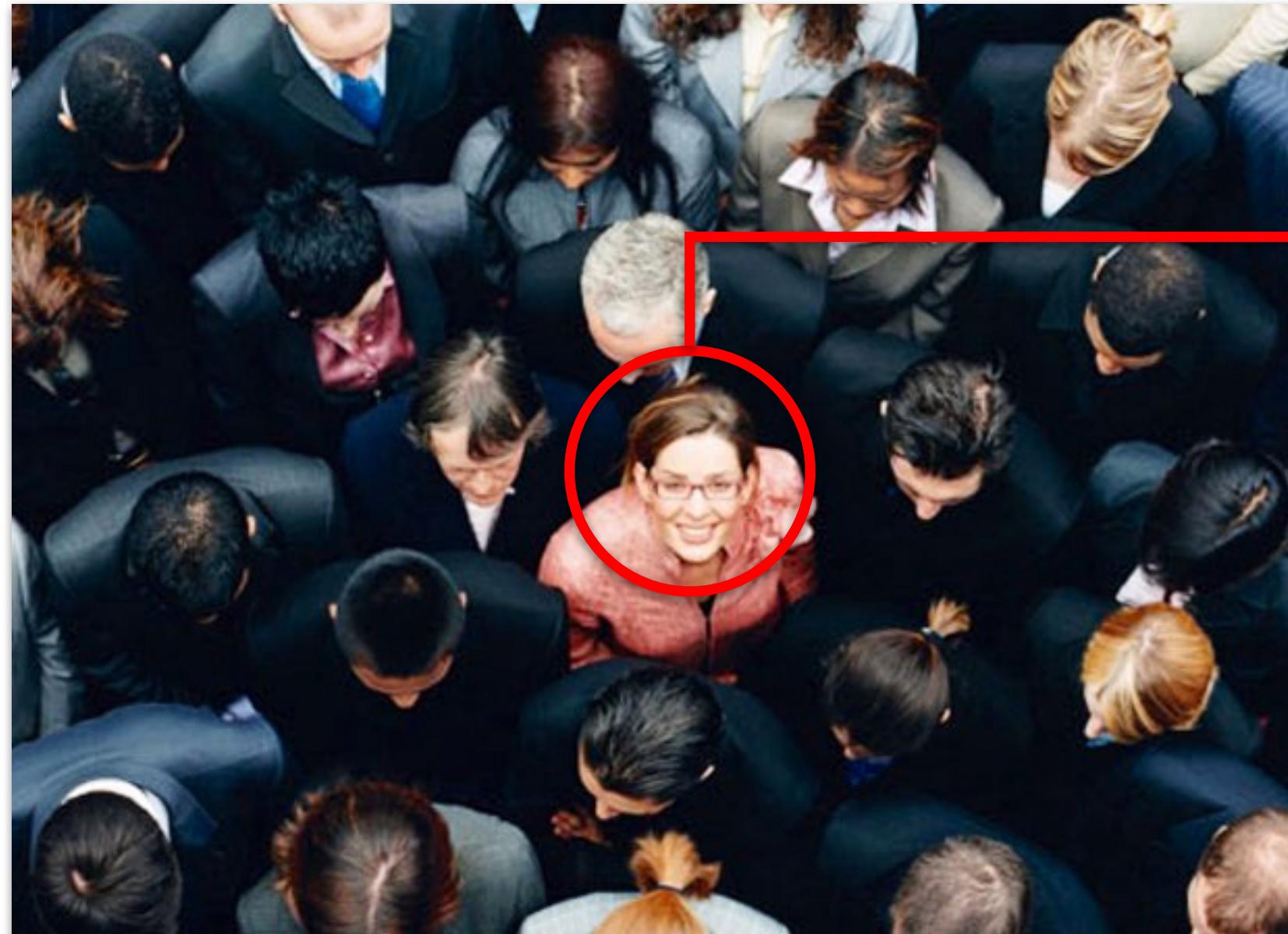
- **7 billion people**
Who is this person?
Is this person Jane Doe?

What is Biometrics?



- **7 billion people**
Who is this person? (*Identification*)
Is this person Jane Doe? (*Verification*)

What is Biometrics?



- **7 billion people**
Who is this person? (*Identification*)
Is this person Jane Doe? (*Verification*)

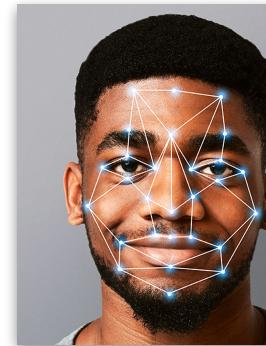
Biometrics aims at *identifying* or *verifying* the claimed identity of an individual based on their *physical*, *chemical* or *behavioral* traits.

What is Biometrics?

Identity verification through:



A unique trait
of yours.



physical



chemical



behavioral



Not something
you have.



Not something
you know.



What is Biometrics?



In this course, we aim at
computer-aided Biometrics.

We'll focus on **software solutions**
rather than hardware.

But we'll get to use some
cool devices, I promise.

Why use Biometrics?

Consumers prefer biometric authentication to traditional passwords, Visa says

⌚ Jan 6, 2020 | [Chris Burt](#)

CATEGORIES [Biometrics News](#) | [Financial Services](#)



Almost 70 percent of U.S. shoppers did not go through with an online purchase because they either forgot the password, couldn't log in or couldn't receive a one-time passcode, according to research conducted by [Visa](#), while another report from Verizon found that as many as 80 percent of data breaches are caused by compromised and weak passwords.

<https://www.biometricupdate.com/202001/consumers-prefer-biometric-authentication-to-traditional-passwords-visa-says>

Course Overview

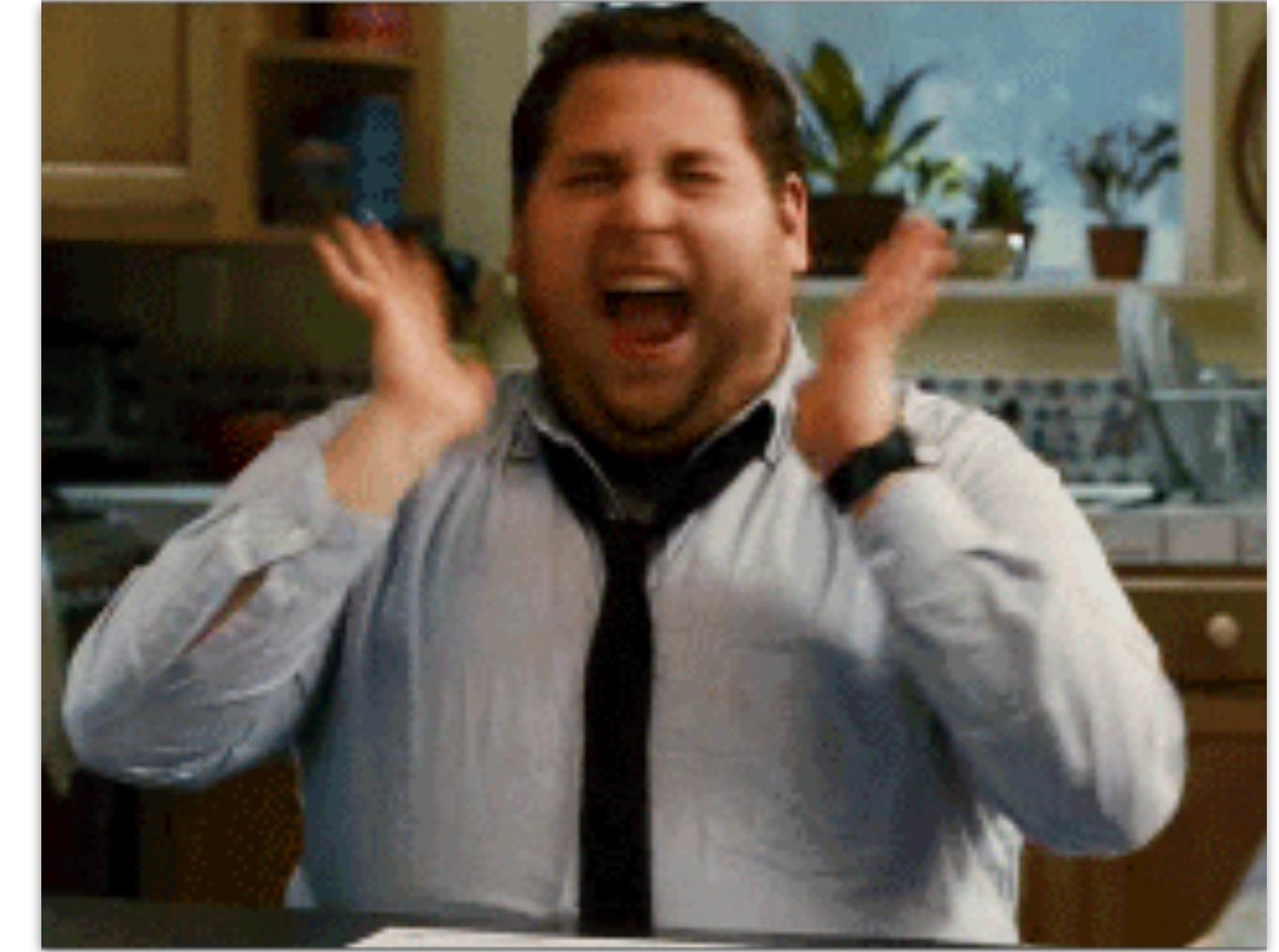
Structure

27 lectures

4 in-class coding days

3 in-class data-collection days

2 invited talks



Work

4 assignments

(each student will do 3 assignments:

1 as a *developer*, 1 as an *attacker*, 1 in a *response team*)

1 exam (final)

Course Overview

Grading

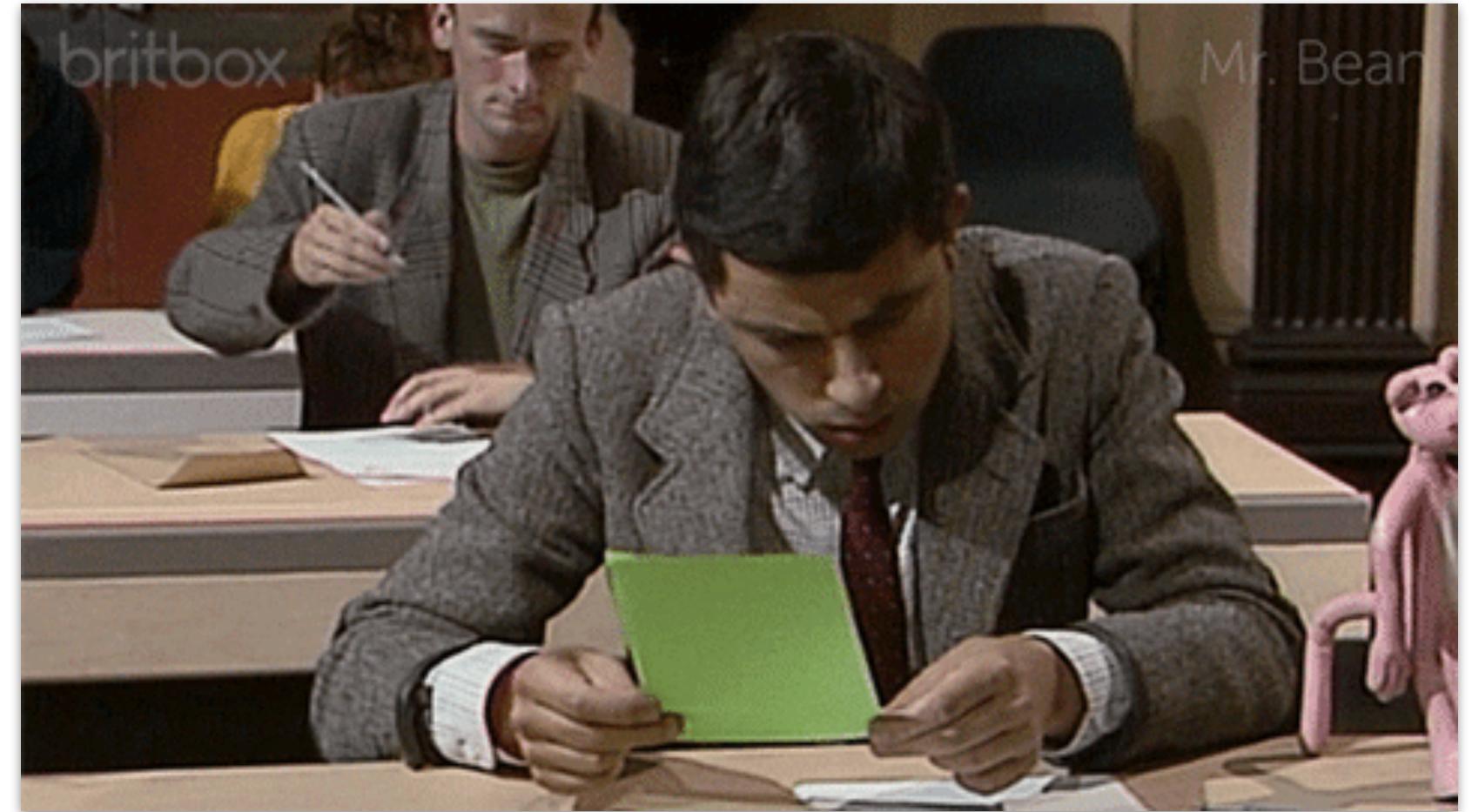
Total: 100 points

Each assignment: 25 points (x3)

Final exam: 25 points

Late assignments: -1 point per day

Extra points: interest, participation, collaboration, assignment video



Concepts

A: above 85 points

B: above 75 points

C: above 65 points

D: above 50 points

E: above 25 points

F: really?

Code of Honor

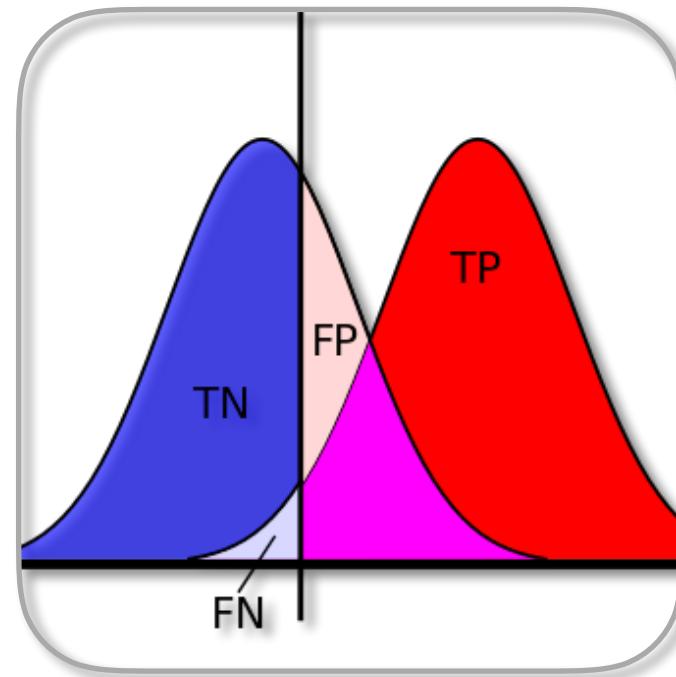
Break it and get an F.

Please refer to

<https://honorcode.nd.edu/>

Course Overview

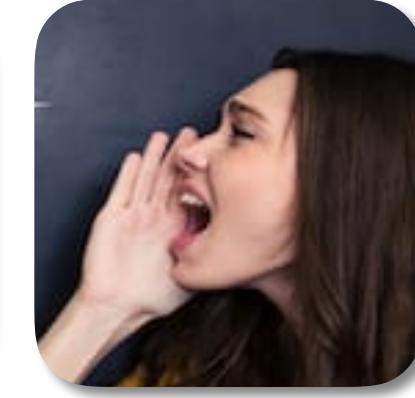
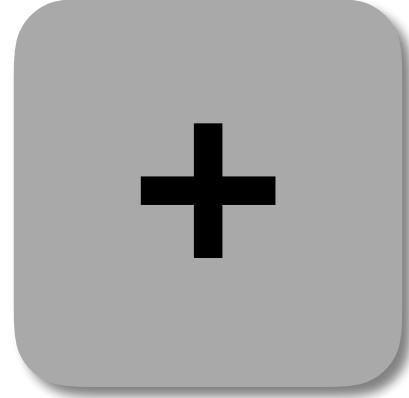
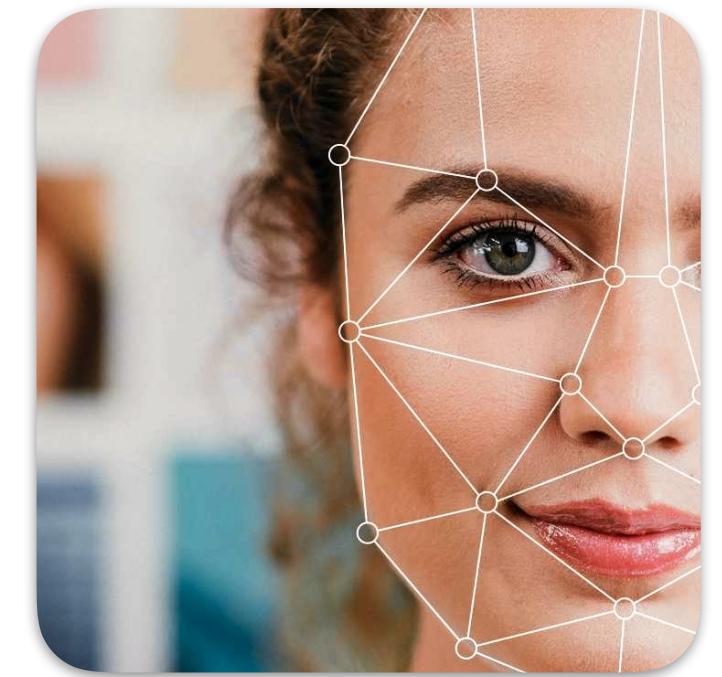
Content



Basics
Concepts
Metrics
Metric implementation



Core Traits (3)
Concepts
Baseline implementation
Data collection
Evaluation
Attacks
Assignments



Alternative Traits and Fusion Concepts



Invited Talks (2)
State of the art
Future work

Course Overview

Prerequisites

Essential

Programming, basic statistics,
and data structures

Team work



Desired

Python, numpy, OpenCV

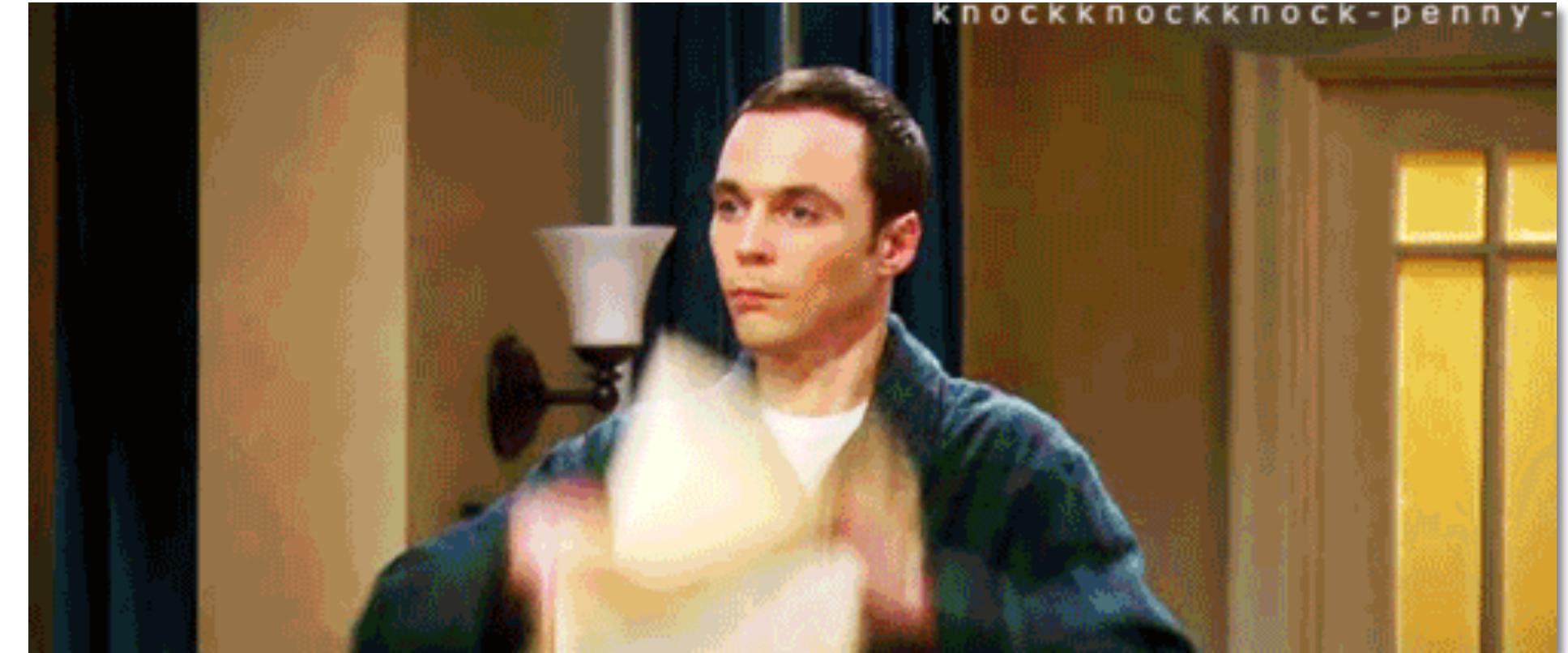
Not sure?

Please talk to me in private.

Course Overview

Bibliography

Jain, Ross, and Nandakumar
Introduction to Biometrics
Springer Books, 2011



Jain, Flynn, and Ross
Handbook of Biometrics
Springer Books, 2008

Papers will be posted in the **#papers** Slack channel.

Course Overview

Assignments

Work in groups

Each group will work with 2 traits.

Planned traits: fingerprints, faces, irises

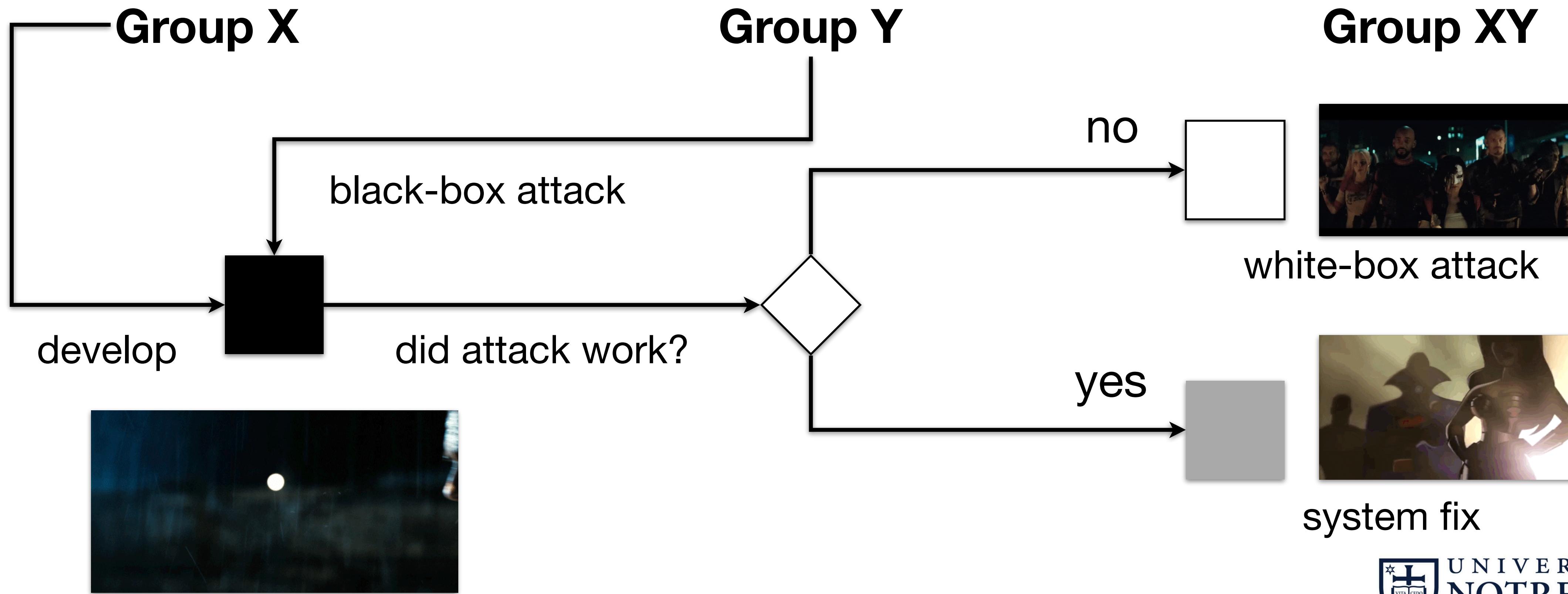


Each group will work on 3 assignments:

1. Development assignment (improve available trait baseline)
2. Attack assignment (perform black-box attack to one trait)
3. Response team assignment (see next slide)

Course Overview

Assignment Details



Course Overview

Data Collection

We'll collect only **our own biometric data** (instructor's and students').

Our data **will only be used** for the purpose of the course.

Our data **will not be shared** with anybody outside the course.

Our data **will be deleted** after the course.

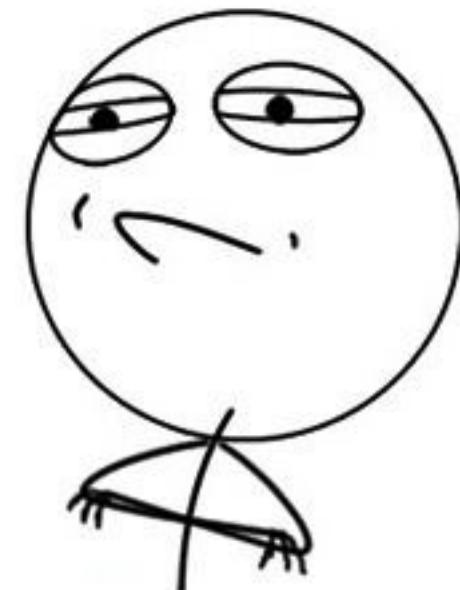


During assignments, folks in need of other publicly available biometric databases are welcome to contact me, so we can take care of privacy and copyright issues.

Your next tasks

Be happy

Any issues? Please come and talk to me.



Sign-in to our Slack

Please provide me your name and preferred e-mail
(paper sheets should be passing around).

Form groups of 2 folks

Be ready, assignment traits and dates
will be provided next class.

Upcoming Talk

Dr. Christoph Busch*

Hochschule Darmstadt (HDA), Germany

Norwegian University of Science and Technology (NTNU), Norway

Biometrics expert

Strong contributions to the standardization of Biometrics.

When and where?

148 Fitzpatrick Hall

Wednesday, Jan 15, 2020, at 4:00 p.m.

*Invited by the CSE department, not related to this course.



Acknowledgments

This material is heavily based on
Dr. Adam Czajka's and Dr. Walter Scheirer's courses.
Thank you, professors, for kindly allowing me to use your material.

<https://engineering.nd.edu/profiles/aczajka>
<https://www.wjscheirer.com/>