

# Syllabus

CSE 40537/60537 Biometrics

**Daniel Moreira**  
Spring 2020



# Today you will...

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

# Welcome

## CSE 40537/60537 Biometrics

### Daniel Moreira

Contact: [dhenriq1@nd.edu](mailto: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>

# About me

## Computer Scientist

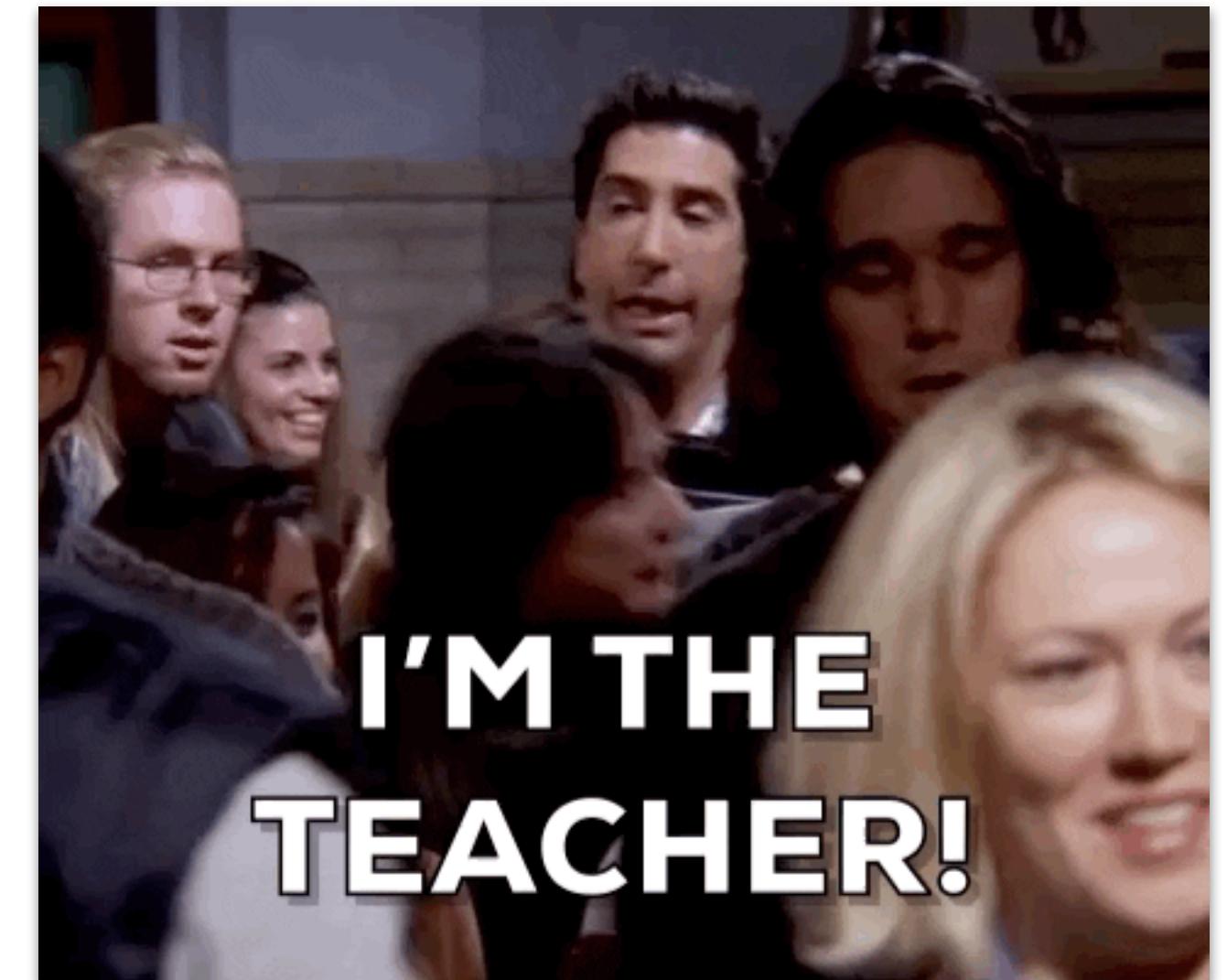
PhD from the University of Campinas (Brazil)

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)

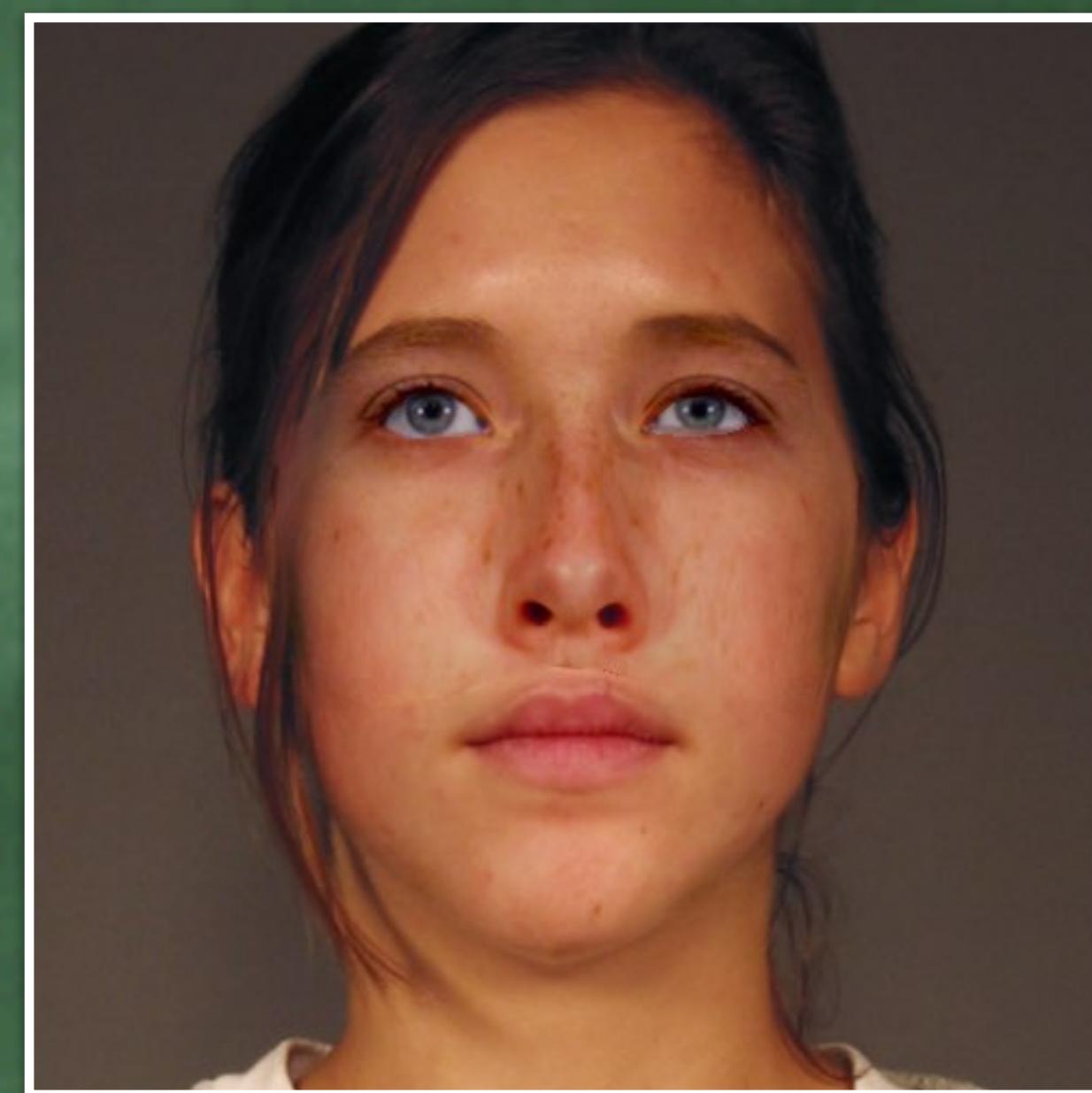
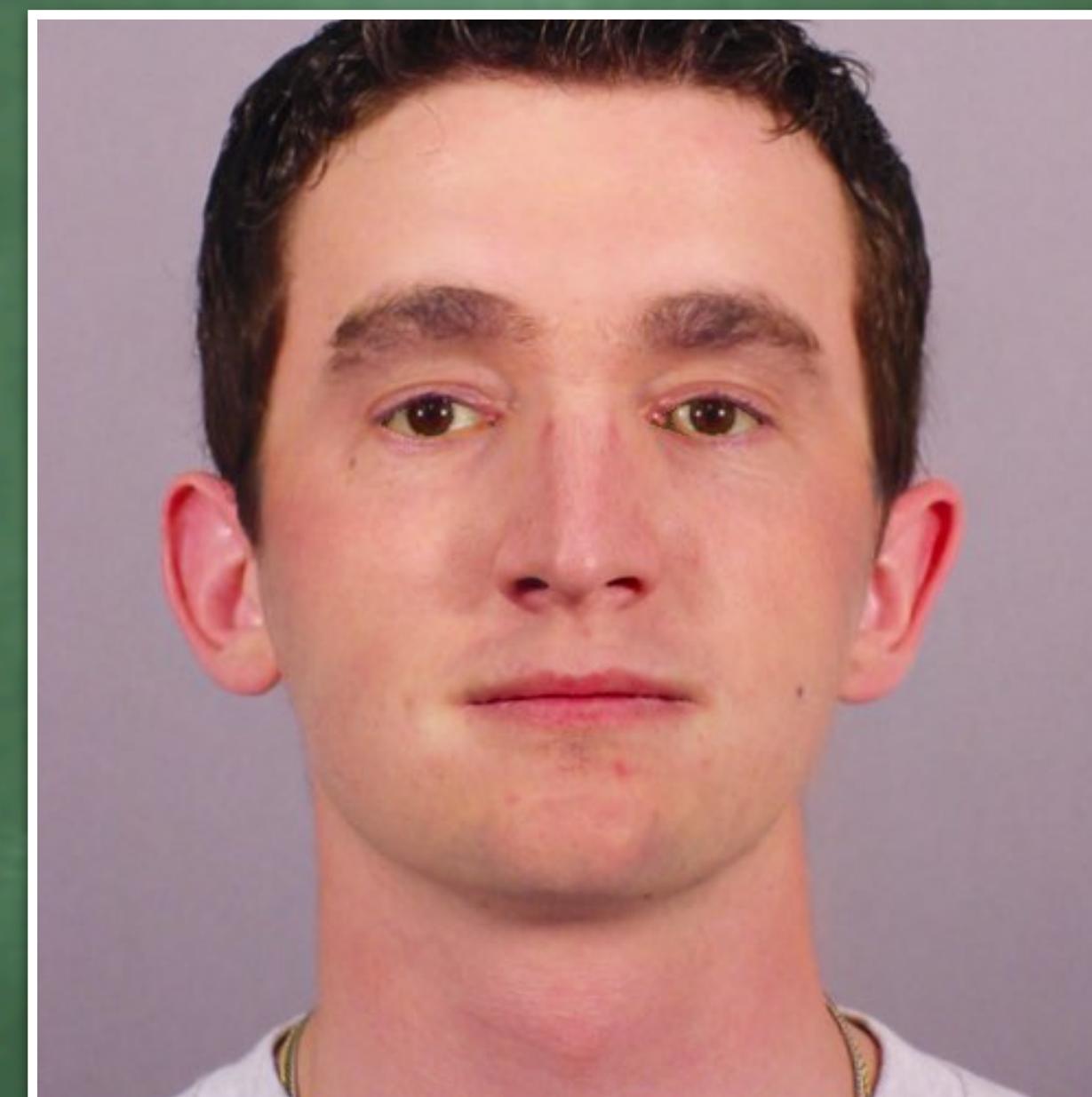


**No**  
(eyes,  
nose  
and mouth  
replaced)



**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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1x

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
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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?



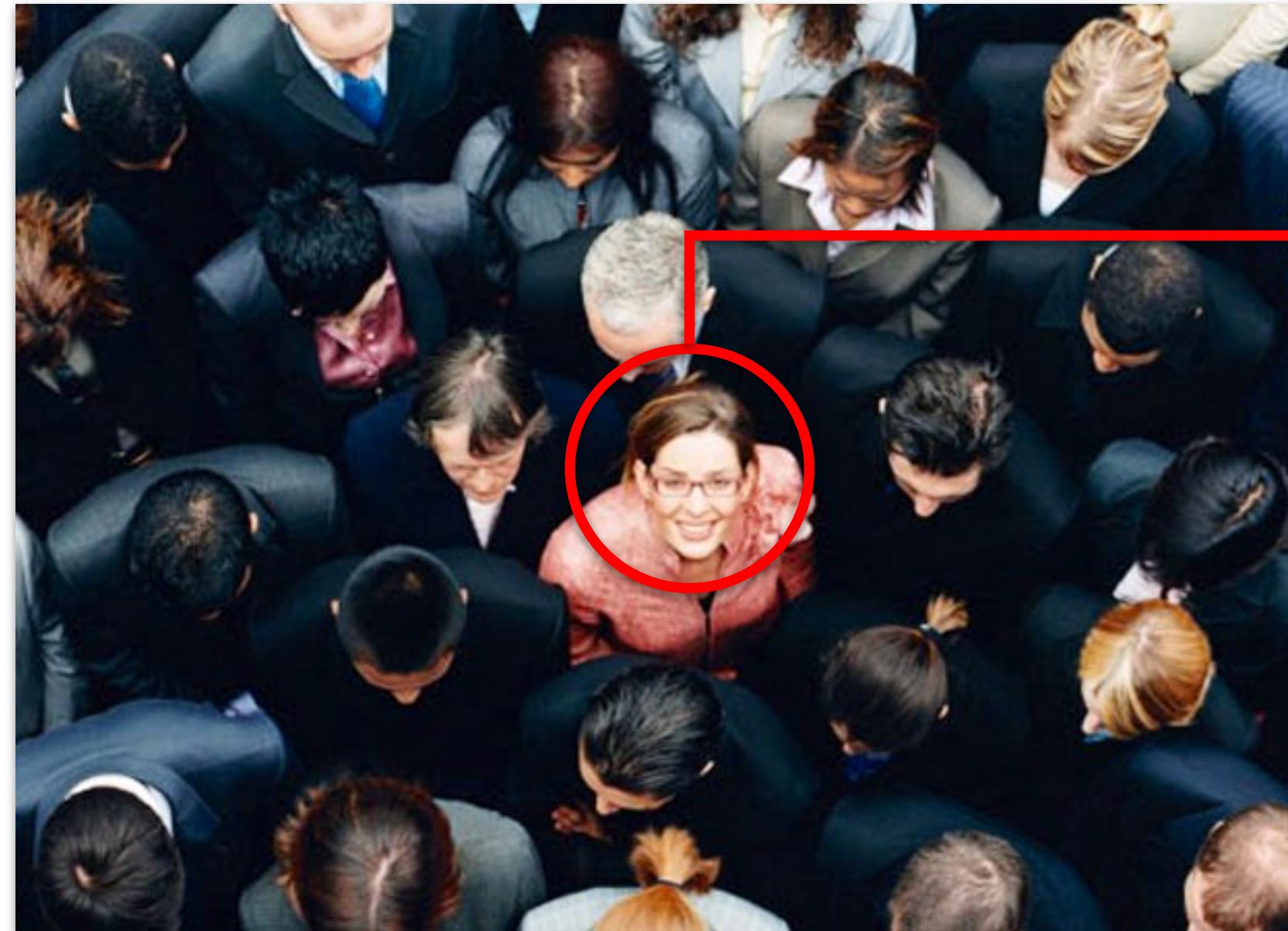
## Motivations

What interests you about Biometrics?

## Disabilities

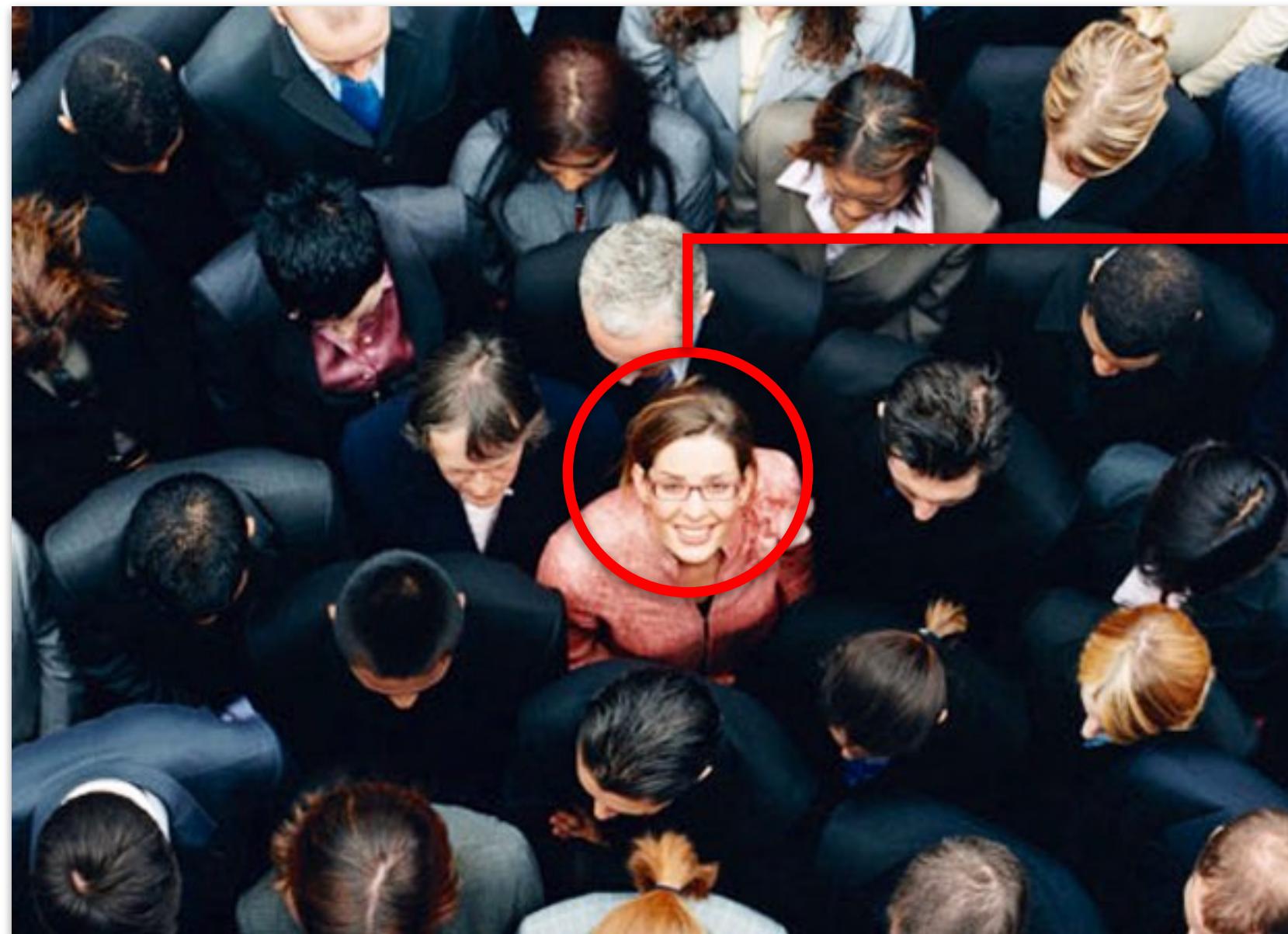
Please reach me out in private ASAP.  
We'll make things work.

# What is Biometrics?



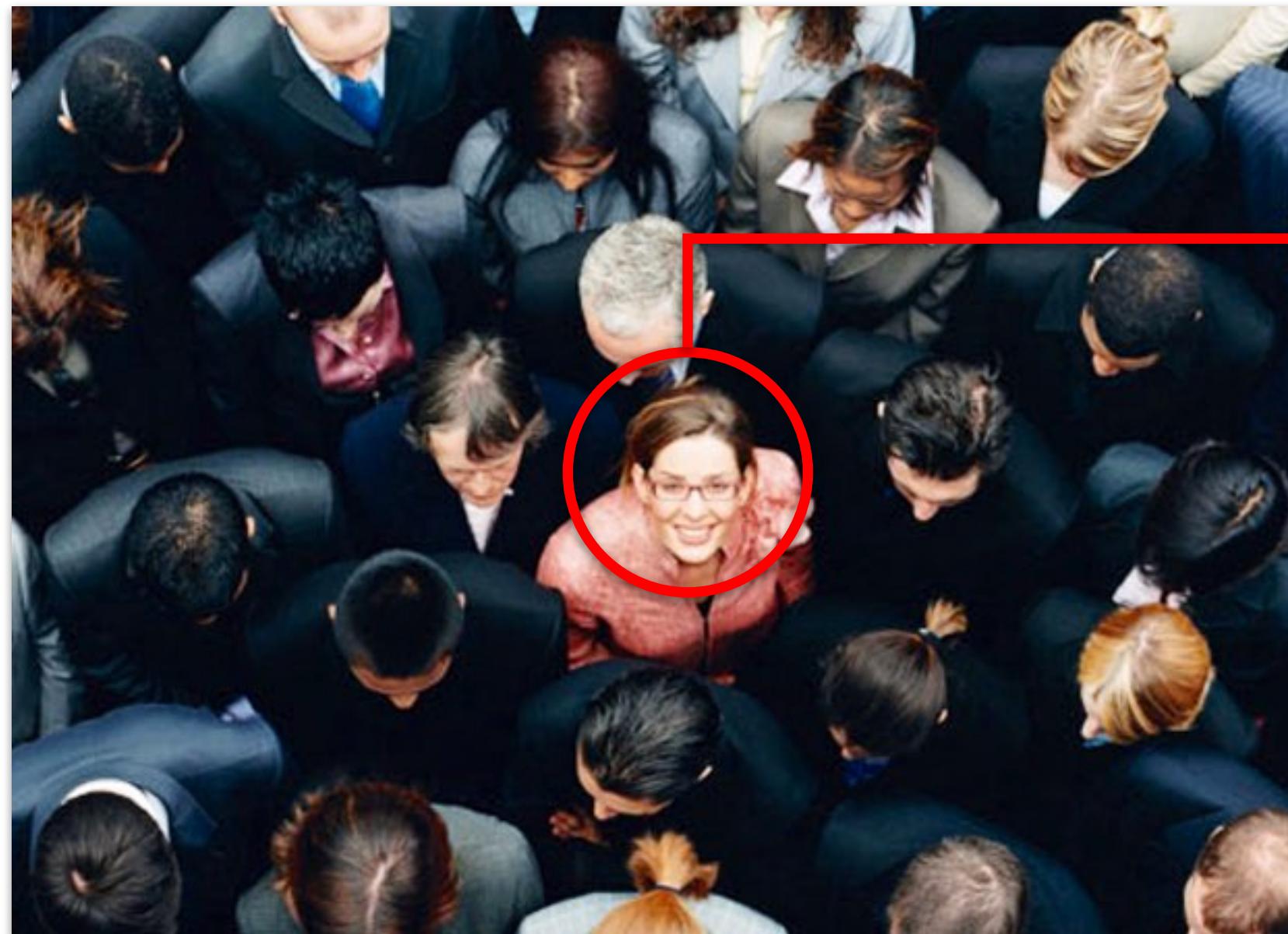
- **7 billion people**  
Who is this person?  
Is this person Jane Doe?

# 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*)

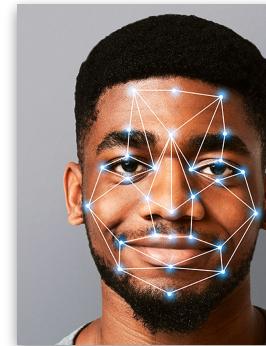
Biometrics aims at *identifying* or *verifying* the claimed identity of an individual based on their *physical*, *chemical* or *behavioral* traits.

# 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

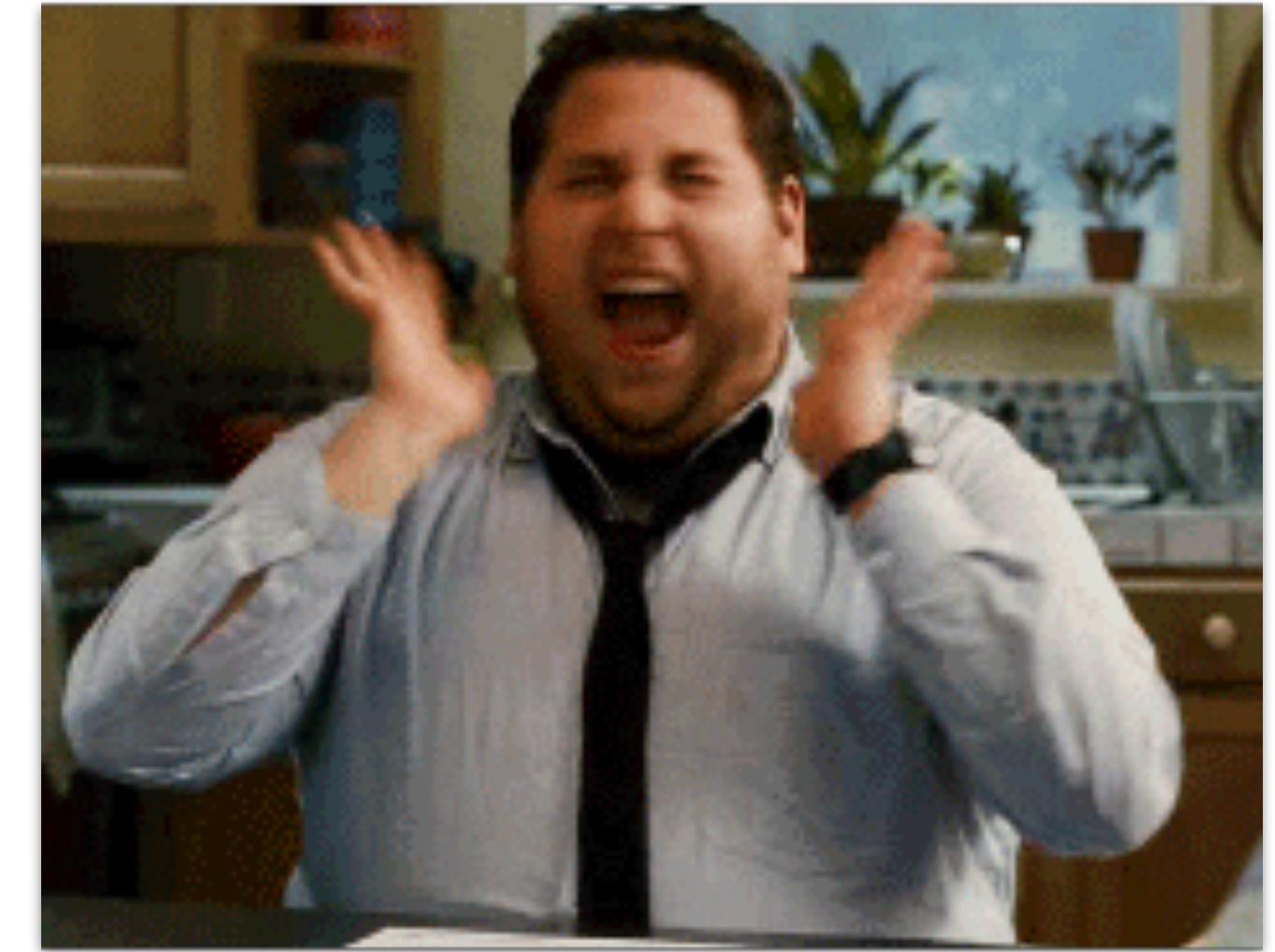
## Structure

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

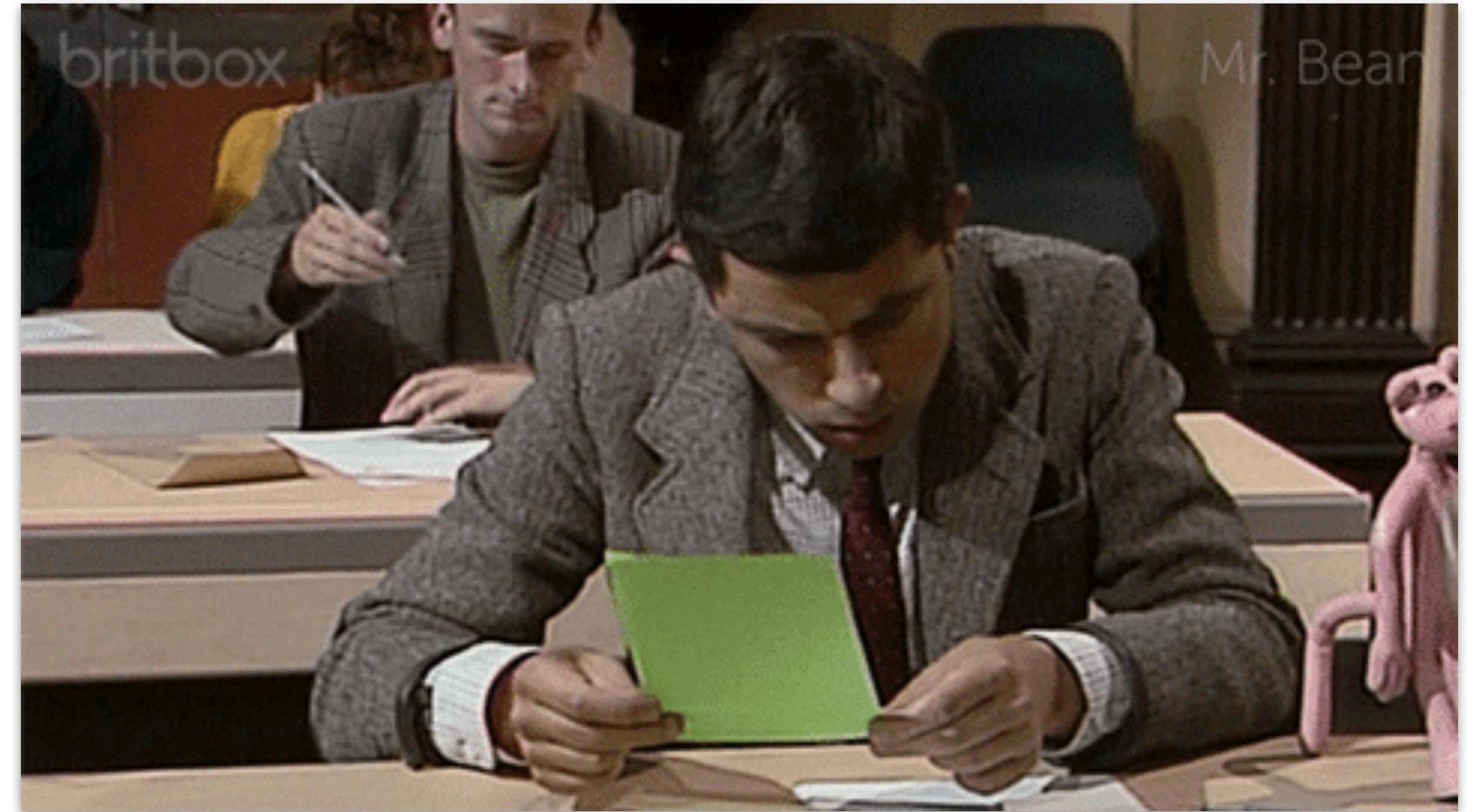
Total: 100 points

Each assignment: 25 points (x3)

Final exam: 25 points

Late assignments: -1 point per day

Extra points: quizzes, interest,  
participation, collaboration



## 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

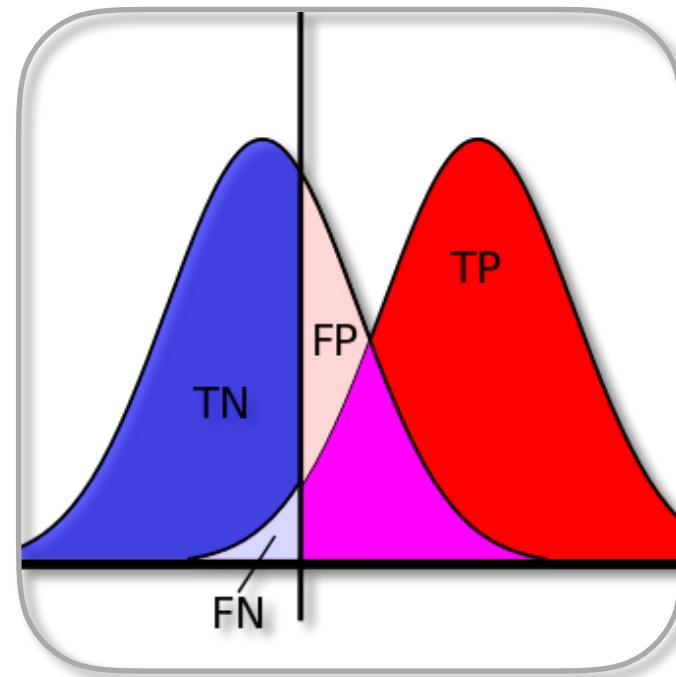
Break it and get an F

Please refer to

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

# Course Overview

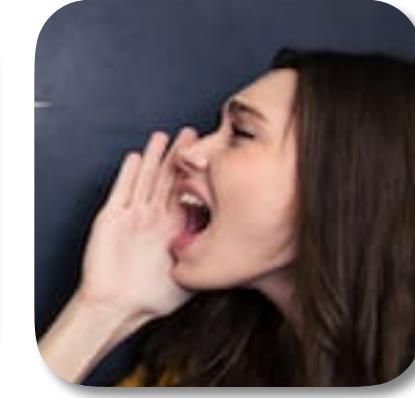
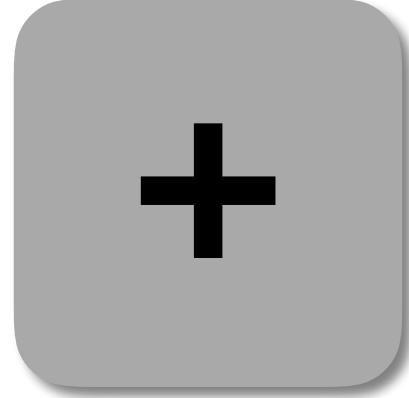
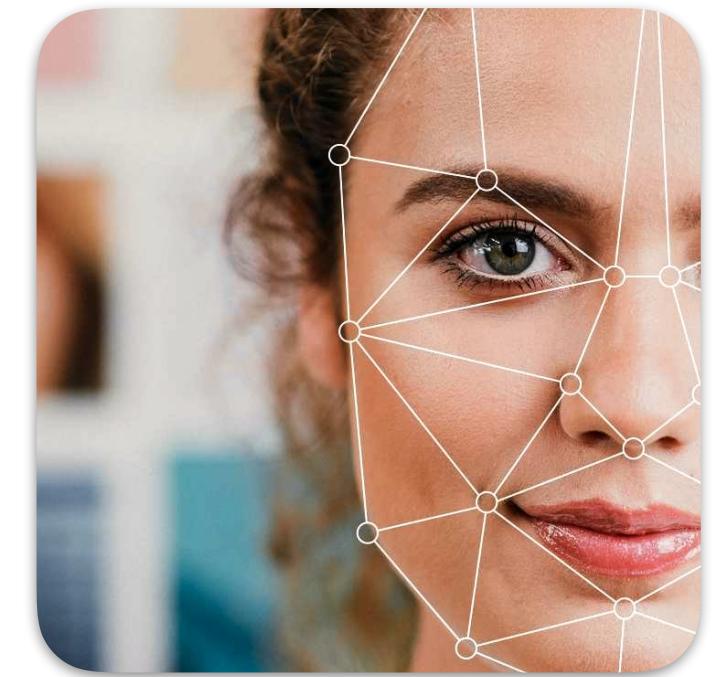
## Content



**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

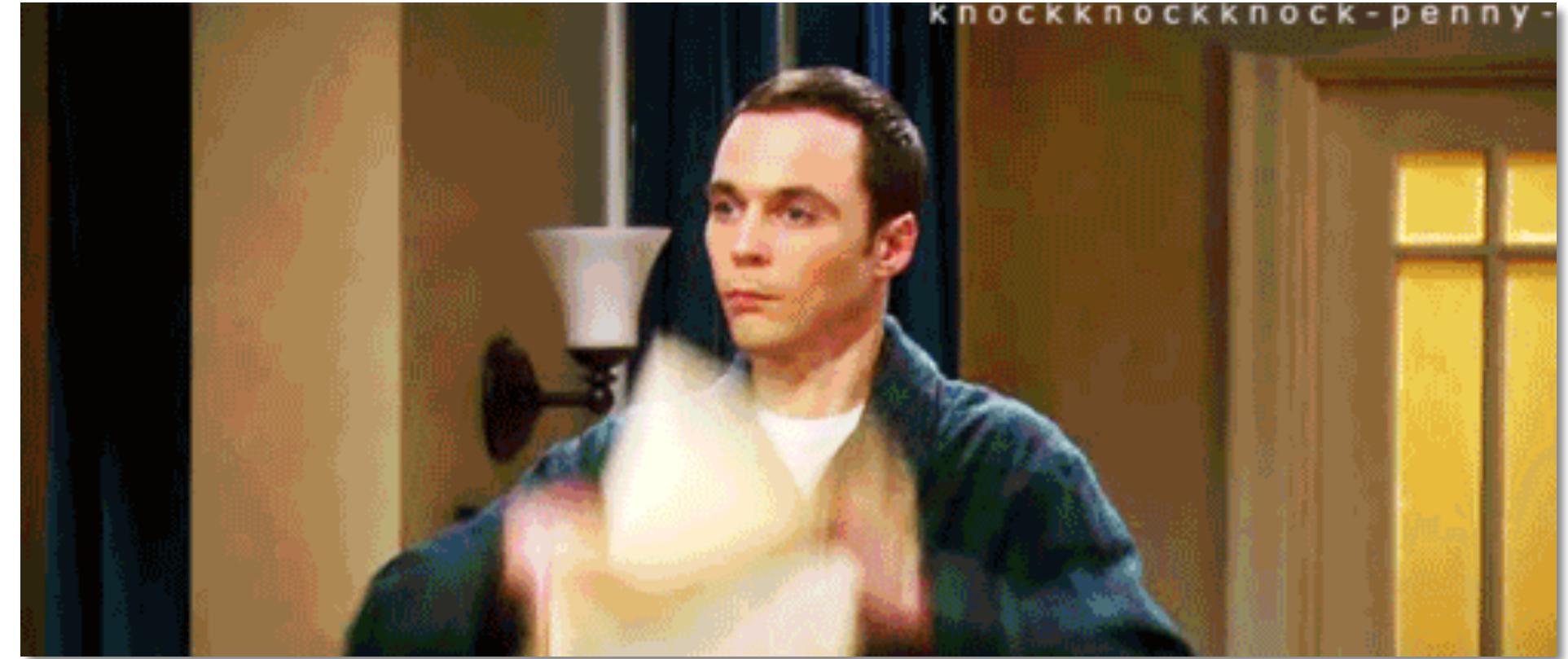
### Not sure?

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

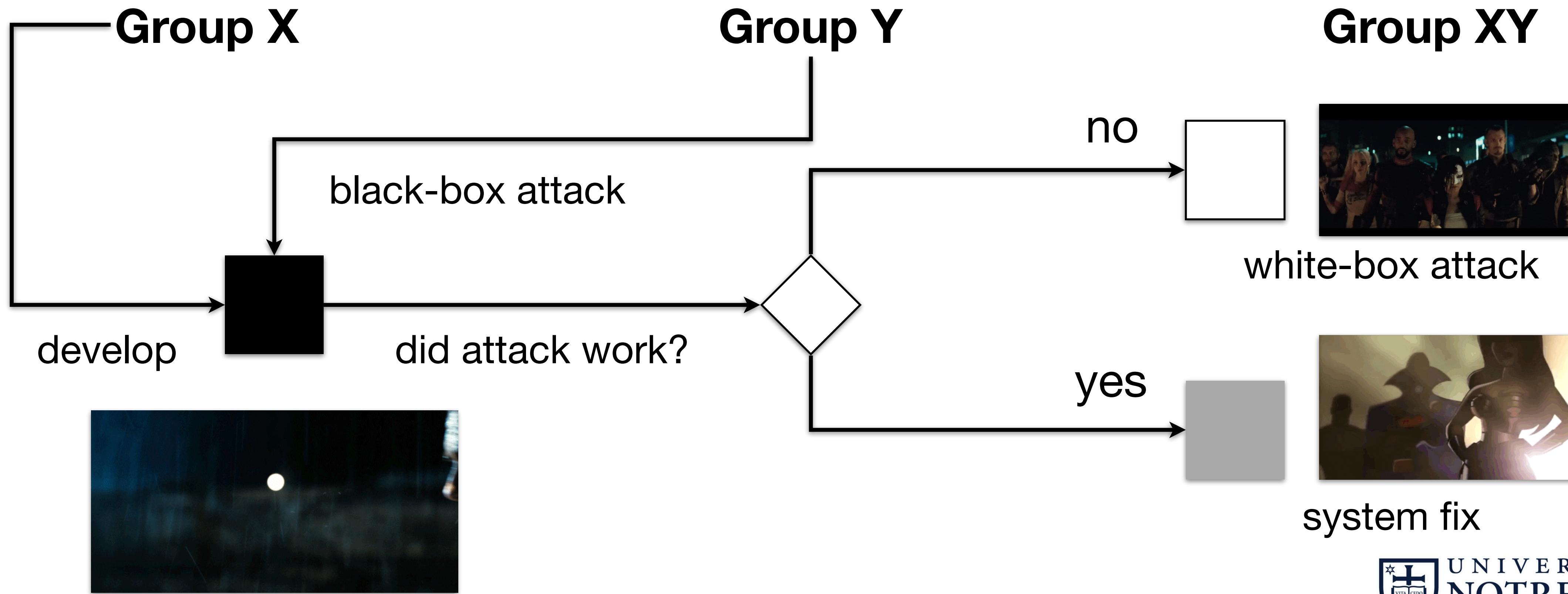


Each group will work on 3 assignments:

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.

