AI IN EVERYDAY LIFE

Unit 4 – Computer Vision and Face Recognition

UNIVERSITÀ DEGLI STUDI DI TRENTO
Dipartimento di Ingegneria e Scienza dell'Informazione

DataScientia
Unitas per Varietatem

OPEN UNIVERSITY OF CYPRUS

CY. center for algorithmic transparency

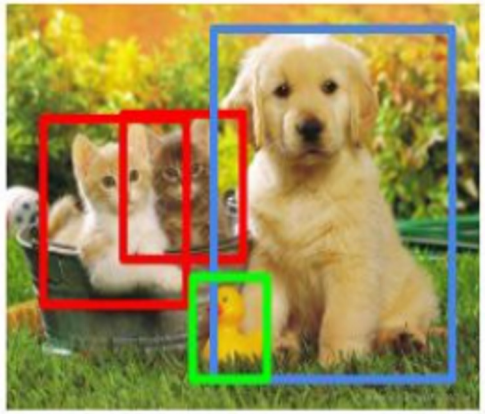
OUTLINE

- What is computer vision?
- How does it work?
- Risks and challenges
- Examples from everyday life and research

COMPUTER VISION

- Machine or computer vision is a scientific field of IT that attempts to algorithmically reproduce the sense of vision using deep learning algorithms.
- To do so CV:
  - Analyses of large volumes of data (digital images, videos) imported from cameras and sensors.
  - Uses machine learning models for processing the images and "understand" what the image depicts, and
  - Uses conditional logic to automate application-specific use cases

EXAMPLES OF COMPUTER VISION TASKS

Classification	Object Detection	Image Segmentation	Image Recognition
			
Cat	Cat	Cat, Cat, Dog, Duck	Molly, Poppy, Fido, Donald

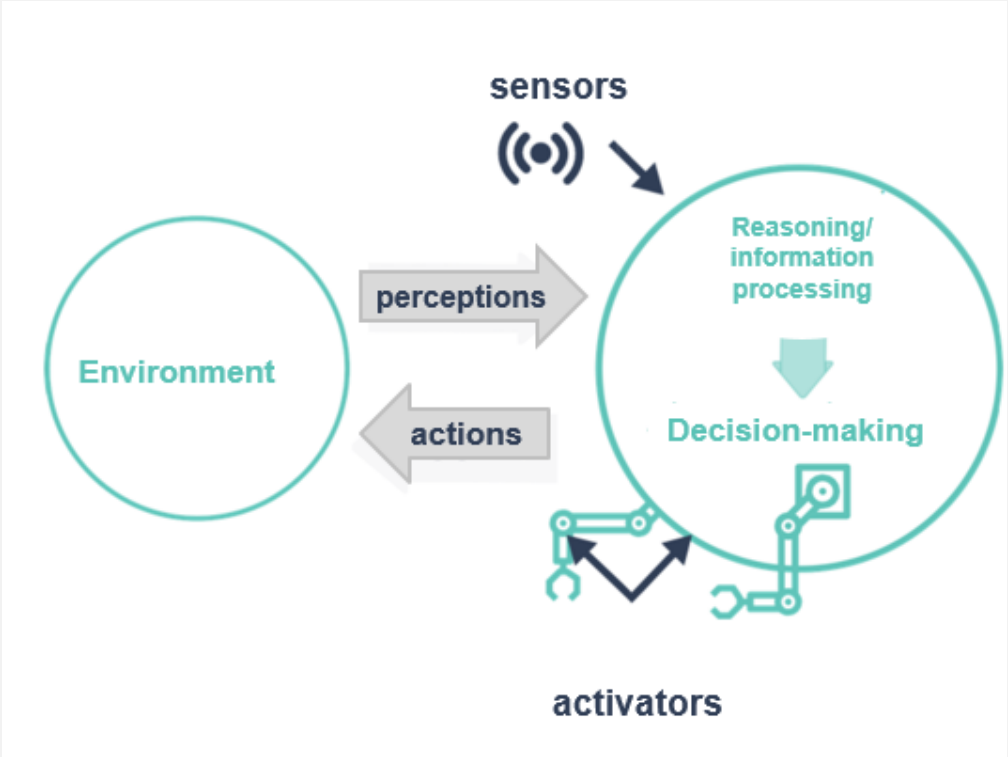
FIELDS OF APPLICATION

1. **Medical Imaging:** Diagnosis and treatment planning through the analysis of medical images.
2. **Autonomous Vehicles:** Enabling vehicles to perceive and navigate their environment.
3. **Surveillance and Security:** Monitoring and analyzing video feeds for security purposes.
    1. Face ID to access bank accounts
    2. Facial recognition at airports
    3. Identification of criminals
4. **Augmented Reality (AR):** Enhancing real-world views with digital information.
5. **Retail:** Implementing cashier-less checkout and inventory management.
6. **Image tagging:** Convert scanned files to characters (Google Lens)

HOW DOES IT WORK?

BASIC FUNCTIONS OF AI SYSTEMS

- **Perception of** their environment
- **Interpretation of** data
- **Processing** information gained
- Determine the best **action/decision** in service of their goal



FACE RECOGNITION STEPS

Face Detection

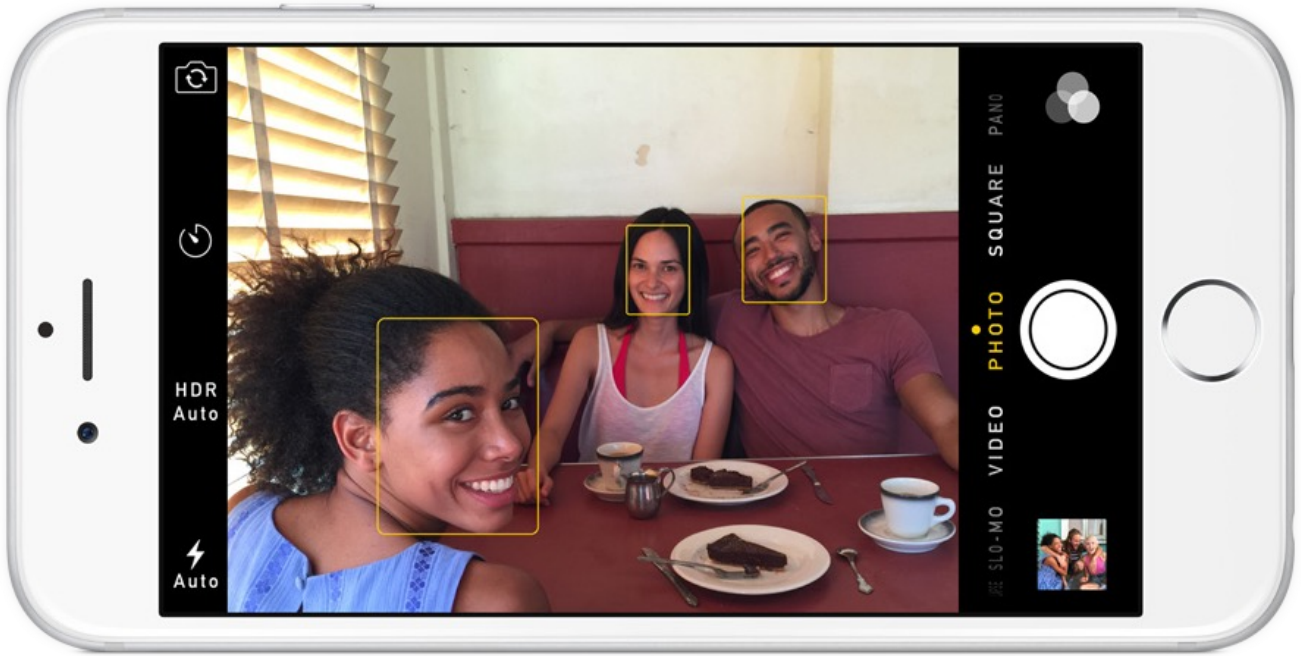
Feature Extraction

Face Matching

Recognition

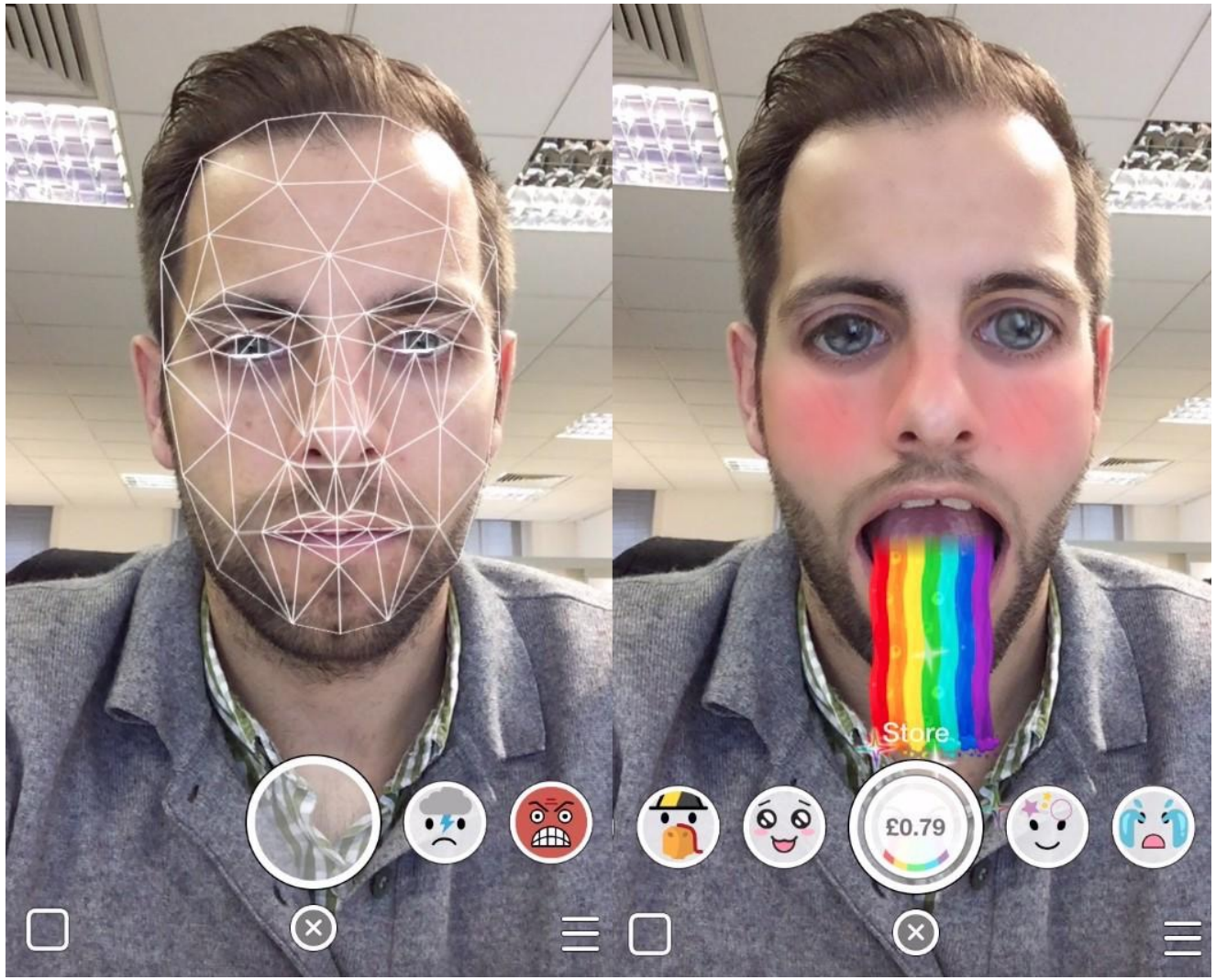
STEP 1
FACE DETECTION

The system recognize the image



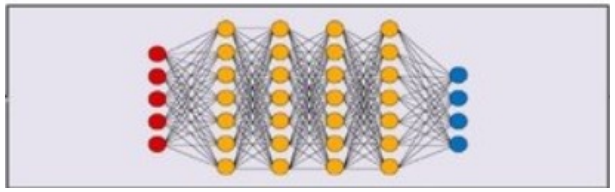
STEP 2 FEATURE EXTRACION

The system discover the patterns



STEP 3&4
FACE MATCHING AND RECOGNITION

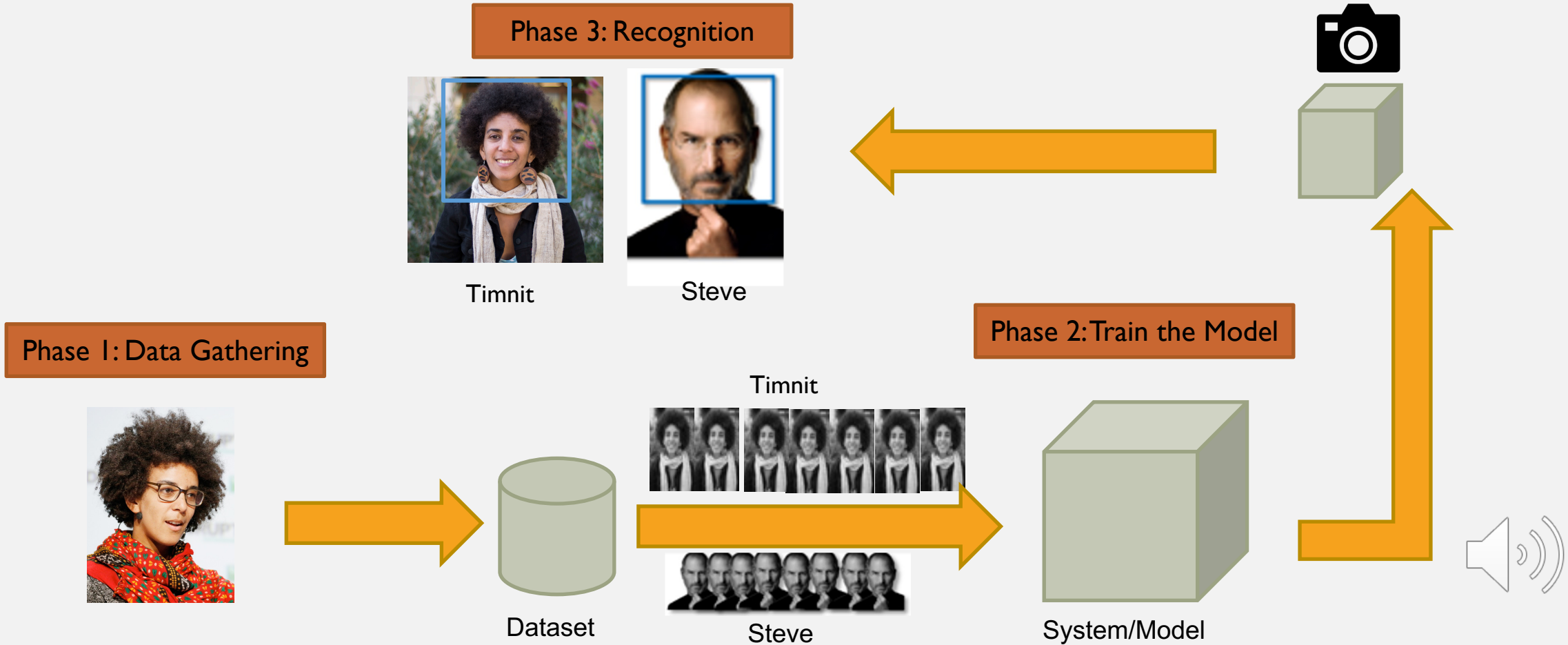
The system associate the image with a tag or other similar images



COMPUTER VISION VS MACHINE LEARNING

- Techniques for programming algorithms to "learn" from past experiences/data.
- Using machine learning methods to train computer vision systems.
  - **Deep Learning**

HOW IS A FACE RECOGNITION MODEL CREATED?



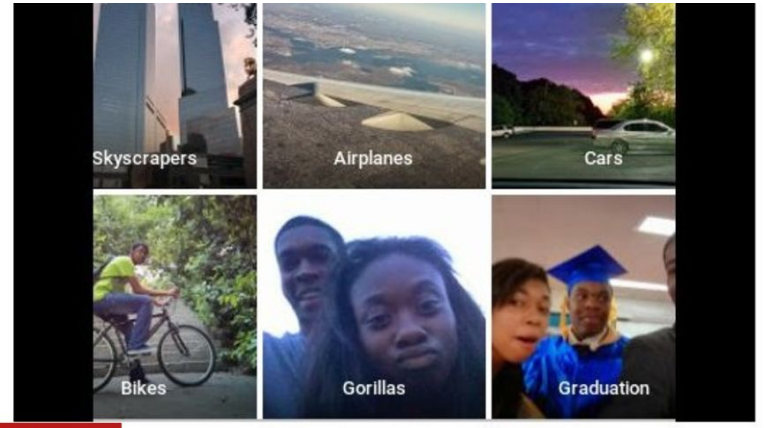
POTENTIAL RISK AND CHALLENGES

1. **Privacy Concerns:** Invasive use of facial recognition in public spaces.
2. **Consent Issues:** Lack of informed consent for facial recognition usage.
3. **Security Risks:** Potential misuse, such as unauthorized access to systems or identity theft.
4. **Accuracy and Bias:** Biases in algorithms leading to inaccurate or discriminatory results.

Google's solution to accidental algorithmic racism: ban gorillas

Google's 'immediate action' over AI labelling of black people as gorillas was simply to block the word, along with chimpanzee and monkey, reports suggest

▲ A silverback high mountain gorilla, which you'll no longer be able to label satisfactorily on Google Photos. Photograph: Thomas Mukoya/Reuters

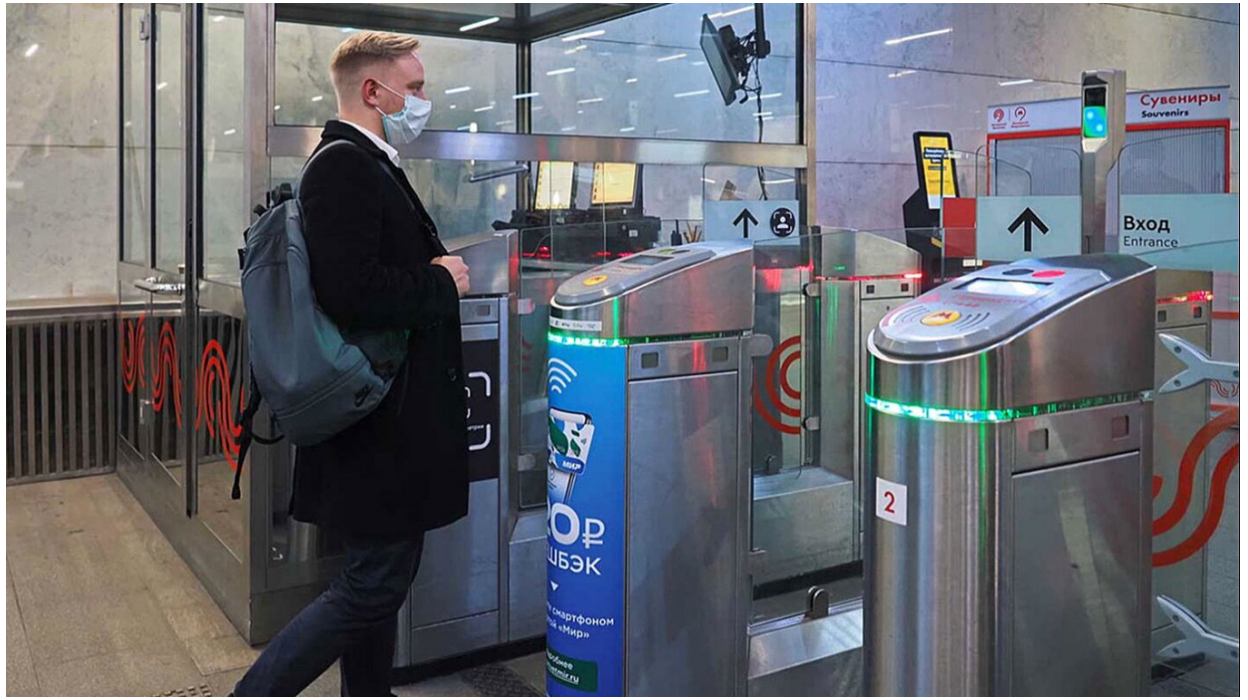


BBC NEWS

diri noir avec banan @jackyalcine · Jun 29

Google Photos, y'all [redacted] My friend's not a gorilla.

COMPUTER VISION AND BIAS

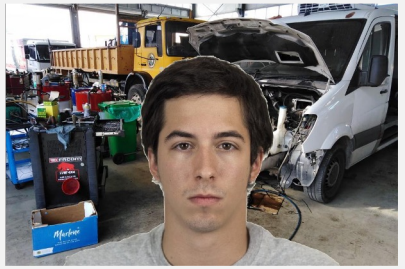


FACE PAY – PAYING AT THE METRO STATION (RUSSIA)

EXAMPLES FROM RESEARCH

GENDER AND SOCIAL CONTEXT



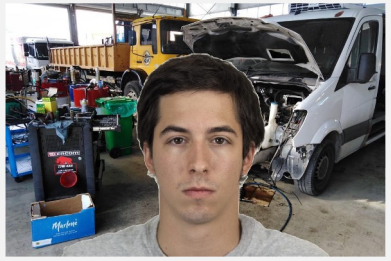



Source: Barlas, P., Kyriakou, K., Guest, O., Kleanthous, S., & Otterbacher, J. (2021). To" See" is to Stereotype: Image Tagging Algorithms, Gender Recognition, and the Accuracy Fairness Trade-off. *Proceedings of the ACM on Human-Computer Interaction*, *4*(CSCW3), 1-31. https://dl.acm.org/doi/10.1145/3432931

CONTEXT AFFECT TAGS

Image tagging tools identified more male/female features (tags) in images where the background reflected a stereotypically female/male social context.

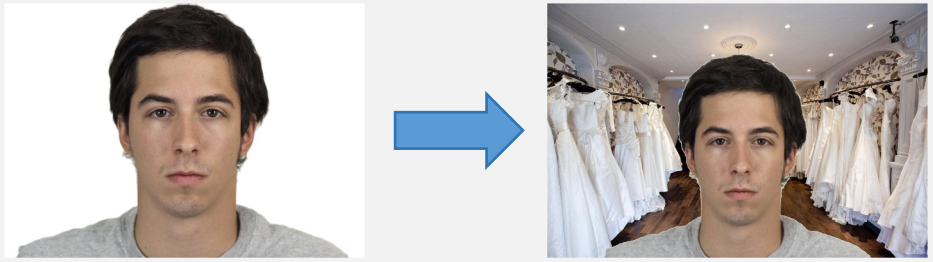
- hair
- face
- t-shirt
- handsome
- …



- car
- face
- **man**
- shop
- …

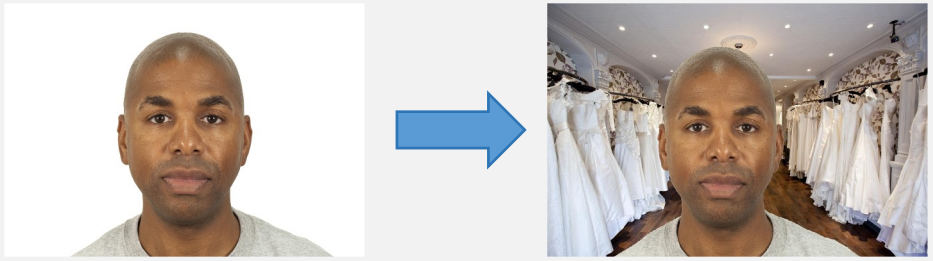
TAGS CHANGE MORE FOR SOME SOCIAL GROUPS

Descriptions of images depicting specific groups - **women, Black, Asian** - changed more than others.



- hair
- face
- man
- handsome
- ...

- hair
- face
- ~~man~~ **shop**
- handsome
- ...

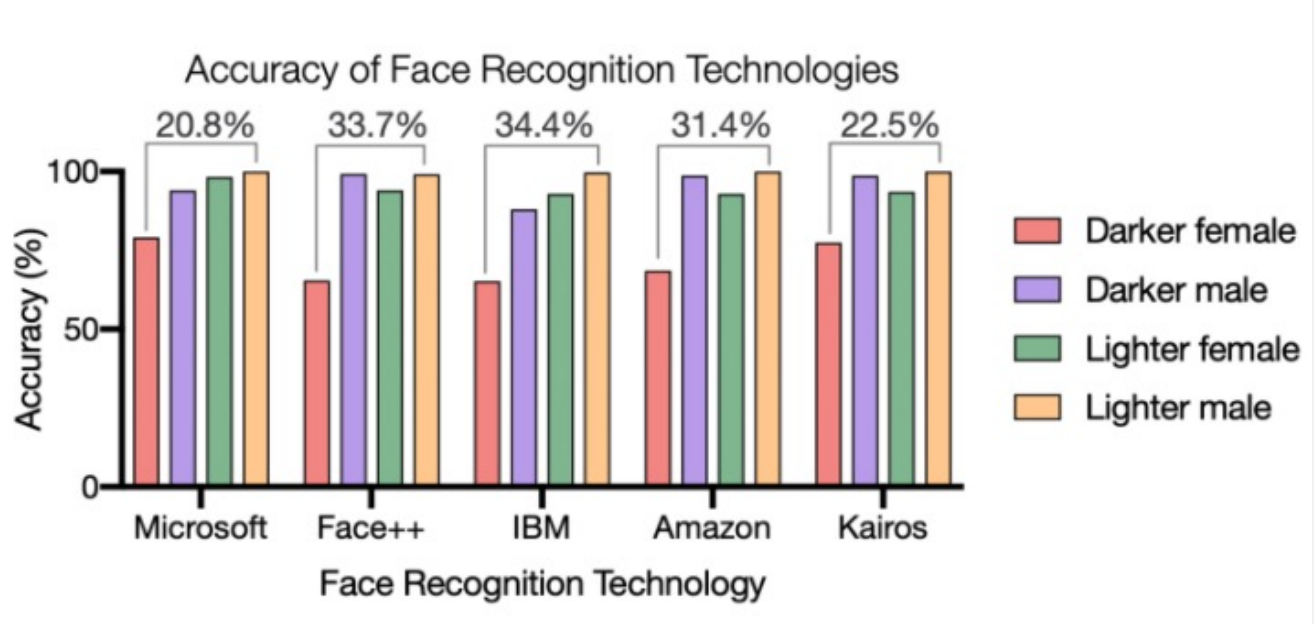


- hair
- face
- man
- eyes
- ...

- ~~hair~~ **clothing**
- ~~face~~ **smile**
- ~~man~~ **shop**
- eyes
- ...

COMPUTER VISION AND RACIAL DISCRIMINATION

- In recent years various researches have shown that the leading facial recognition algorithms have different accuracy rates for different demographic groups.

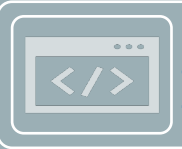


Source: https://sitn.hms.harvard.edu/flash/2020/racial-discrimination-in-face-recognition-tech[illegible]gy/

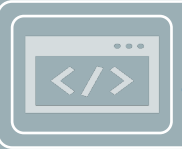
TAGS ARE RELATED TO ATTRACTIVENESS

		
Black Woman, 29.8 years Attractive: 5.08 Babyface: 1.76 Feminine: 5.63 Masculine: 1.52 Nose length: 250 Nose width: 268 Lip thickness: 162	Latino Man, 35.5 years Attractive: 1.54 Babyface: 2.21 Feminine: 1.17 Masculine: 4.71 Nose length: 182 Nose width: 230 Lip thickness: 104	White Woman, 24.9 years Attractive: 3.11 Babyface: 1.99 Feminine: 3.86 Masculine:3.01 Nose length: 251 Nose width: 188 Lip thickness: 65
Clarifai: woman, Afro, dreadlock, cute Microsoft: hairpiece, clothing, wear, smile Watson: person, woman, female Imagga: afro, attractive, pretty, model	Clarifai: man, casual, cool, friendly Microsoft: person, necktie, wearing, shirt Watson: stubble, coonskin cap, afro hair style Imagga: man, face, male, person, creation	Clarifai: face, man, casual, eye Microsoft: man, looking, shirt, wearing Watson: person, pompadour hairstyle, skin Imagga: person, face, man, male, handsome

LINKS AND CONTACTS



https://datascientiafoundation.github.io/datascientia-education-eai-2023-24-unitn



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THANK YOU!