Project Work

Face Recognition

Business And Project Management

IN SUPREMÆ DIGNITATIS
1343
UNIVERSITÀ DI PISA

Team

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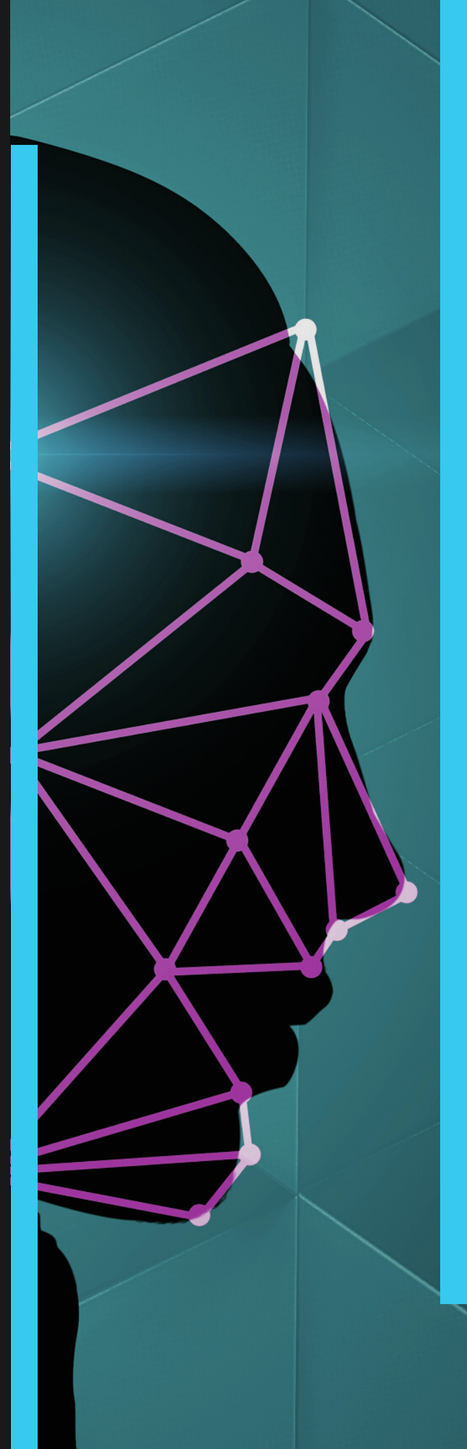
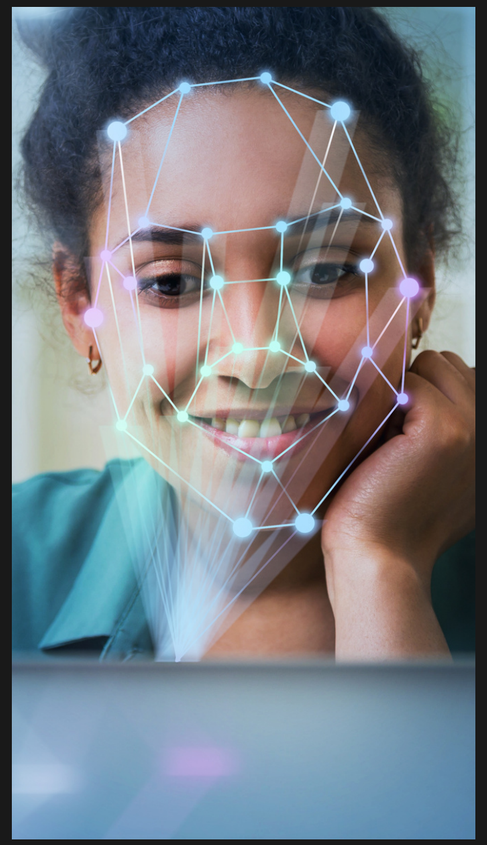
WHAT IS FACE RECOGNITION?



FACE RECOGNITION

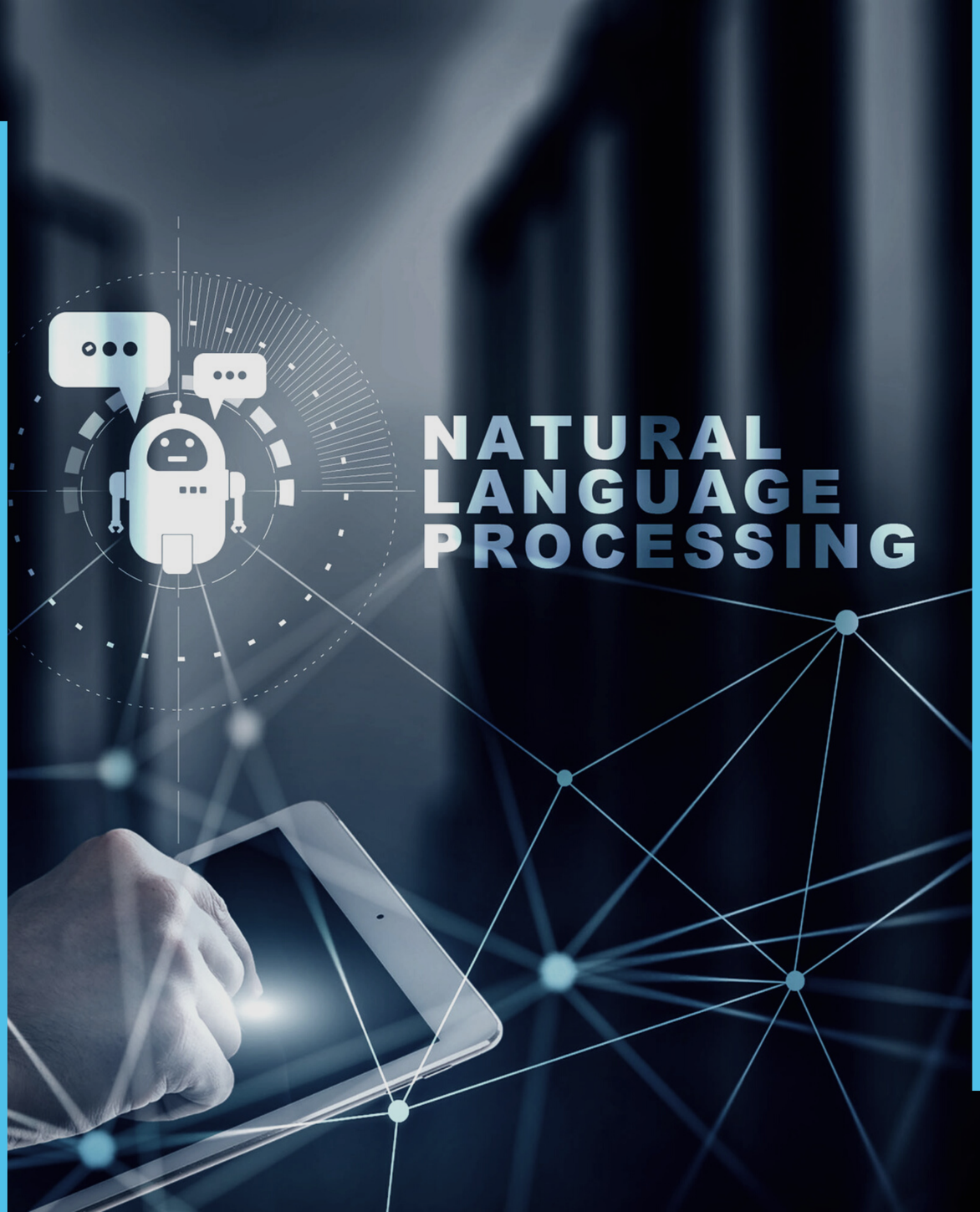
A facial recognition system is a technology capable of matching a human face from a digital image or a video frame against a database of faces.

Facial recognition systems are employed throughout the world today by governments and private companies.



WHAT IS OUR GOAL?

- Which are the main themes of the technology?
- Who are the users of technology?

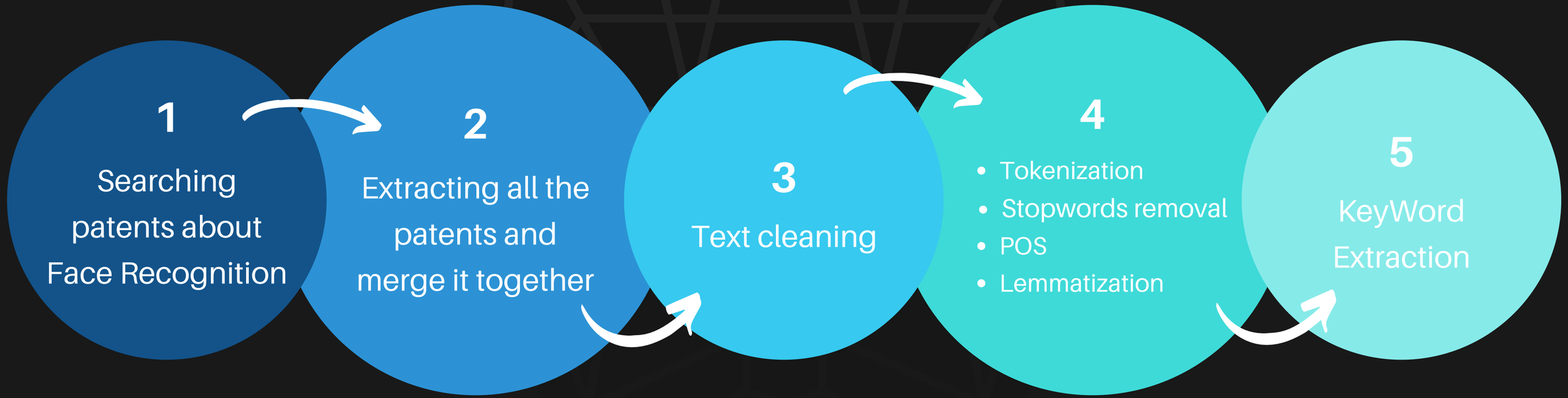


HOW WE EXPLOITED NLP FOR OUR STUDIES

- **Patent Extraction**
- **Patent Processing**

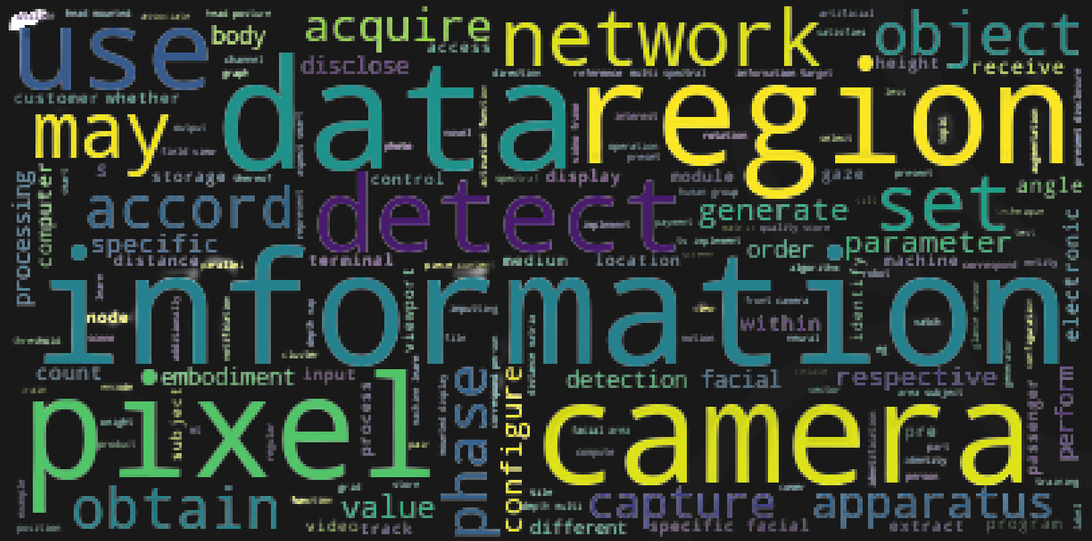
PATENT EXTRACTION AND PROCESSING

From all available material, through NLP, we extract information on "Face Recognition".



GRAPH OF WORD FREQUENCIES

We decided to extract the information of two specific tags of the patents: abstract and claims



Abstract

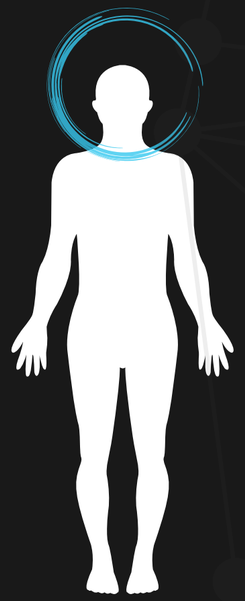
Claims

WHICH ARE THE MAIN THEMES OF THE TECHNOLOGY?

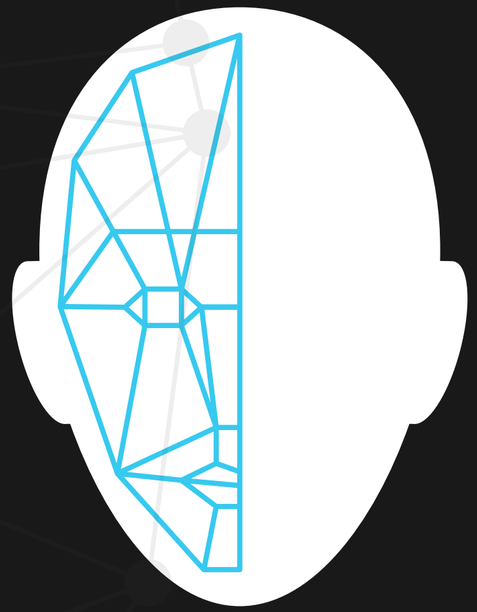
- Face Recognition Systems
- Keypoint Heatmap
- Fusion Methods
- Neural aggregation networks
- Face Clustering

FACE RECOGNITION SYSTEMS

A complete face recognition system includes two steps:



Face Detection



Face Recognition

FACE RECOGNITION SYSTEMS

Application fields overview

Gallery App

- To search and recognize people in a gallery app, and then, for instance, group them together in a folder or search for a friend through his face

FACE RECOGNITION SYSTEMS

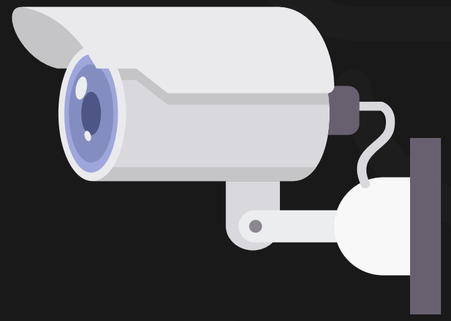
Application fields overview

Access control

- To validate access in various protected places, for instance, a bank can exploit face recognition for employee’s authentication.
- To unblock the smartphone, this kind of technologies is often use.
- For a network multimedia information access, network security, in order to makes hackers virtually impossible to steal one's password

FACE RECOGNITION SYSTEMS

Application fields overview



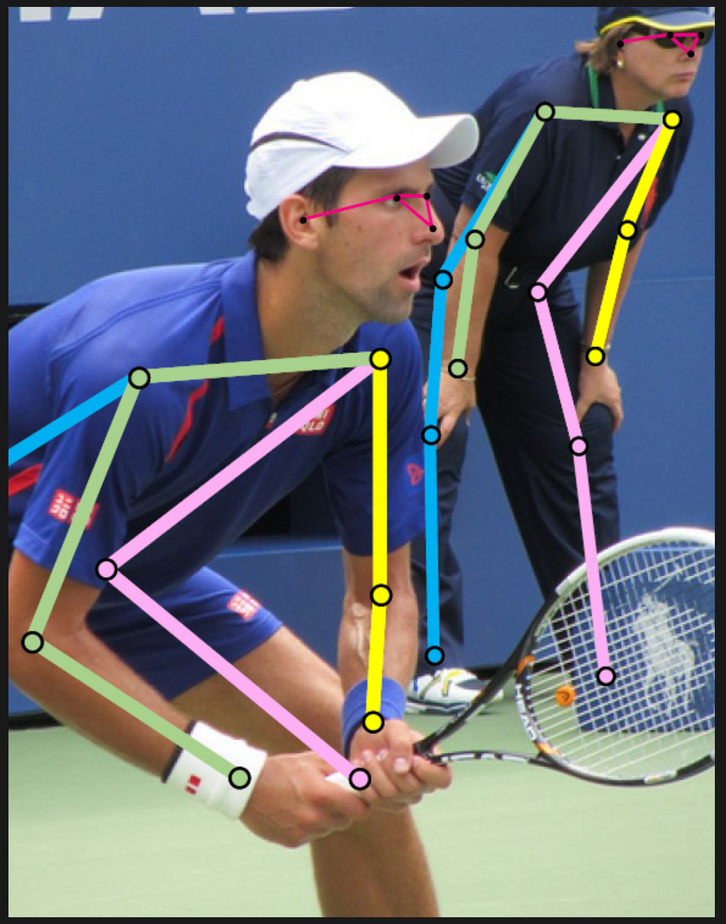
Security Camera and
Criminal activities detection

- To identify the identities and other information according to the visual features of face image. It is widely used in authentication, criminal investigation, video surveillance.

KEYPOINT HEATMAP

The keypoint heatmap is crucial for estimating the human pose.
For perform this task is typical use a bottom-up human pose estimation which two stages

- Keypoint detection
- Grouping



Feature extraction or image representation

IR and VI feature fusion or image fusion

Reconstructed and fused face image

Face recognition

FUSION METHOD

Infrared and visual image fusion is designed to fuse multiple source images into a comprehensive image to boost imaging quality and reduce redundancy information

FUSION METHOD

Problem:

Poor illumination and various skin color may degrade the recognition rate of visual face-based method

Solution:

Thanks to the characteristic of IR image, the fusion method work well even when there is no control over illumination

NEURAL AGGREGATION NETWORKS

Neural aggregation networks are a family of methods which is nowadays very commonly used for trying to solve the Facial Expression Recognition task

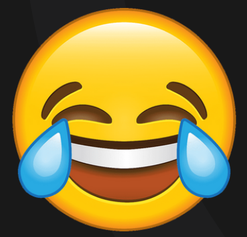


NEURAL AGGREGATION NETWORKS

Study on nonverbal communication reveals that 55% of a person’s emotional or intentional information is conveyed through facial expressions.

In general, facial expressions can be categorized into six basic expressions:

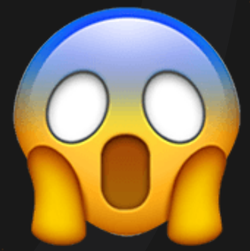
Surprise



Happiness

Disgust

Anger

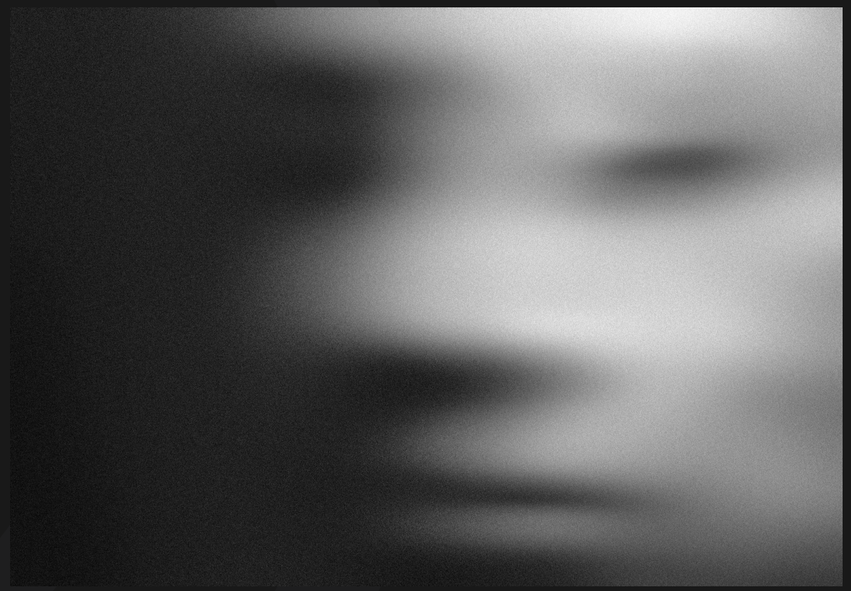


Fear

Sadness

NEURAL AGGREGATION NETWORKS

One of the main field of interest is the face recognition in a video, but video frames may suffer severe motion blur and out-of-focus blur due to camera jitter and small oscillation in the scene

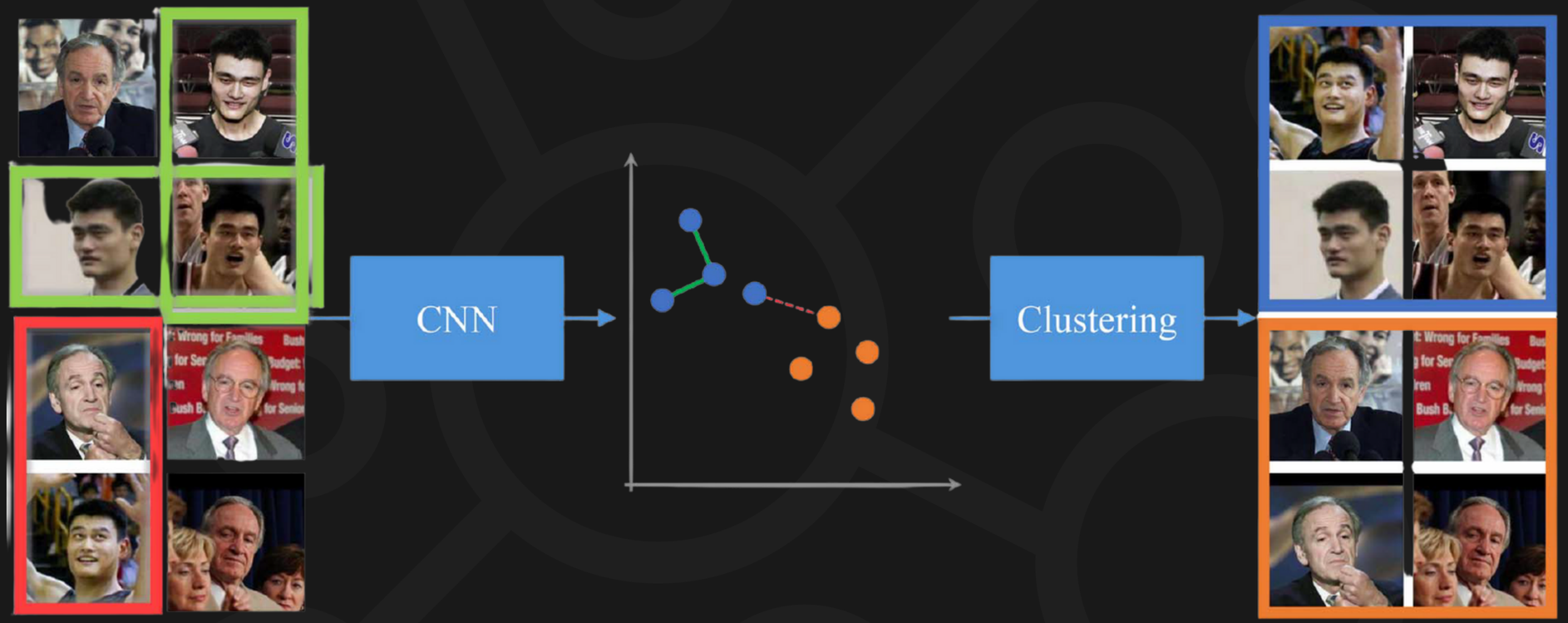


Some of the proposed algorithms:

- Multi-mode Aggregation Recurrent Network (MARN)
- Deep Neural Networks (DNNs)
- Convolutional Neural Network (CNN)
- Set-based face recognition

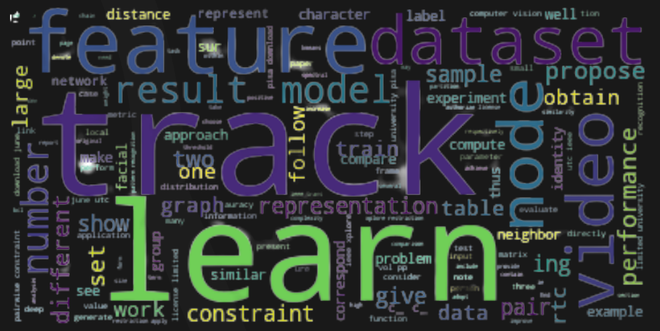
FACE CLUSTERING

Face clustering aims to cluster the given facial images into their underlying groups.

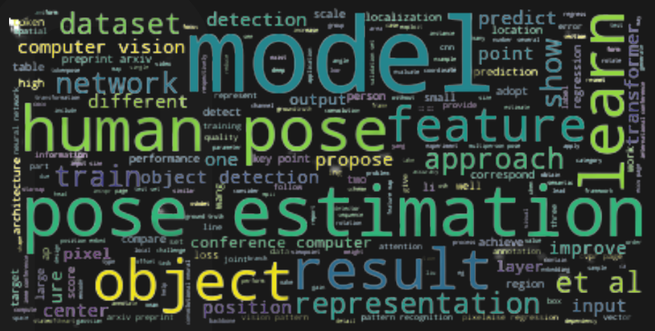


WORD CLOUD

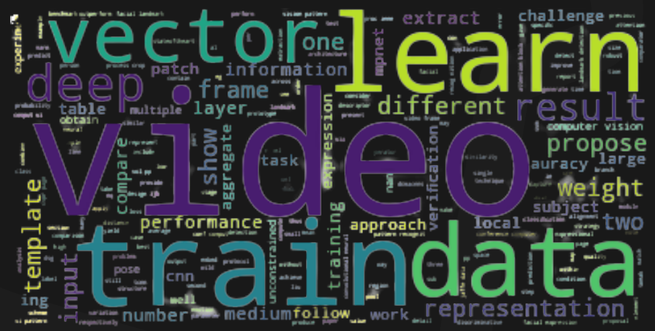
Face Recognition Systems



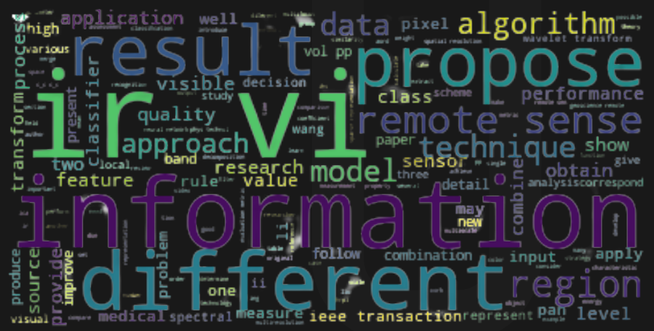
Face Clustering



Keypoint Heatmap

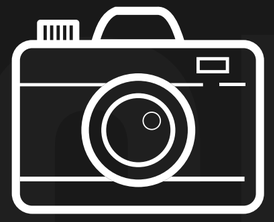


Neural aggregation networks



Fusion Methods

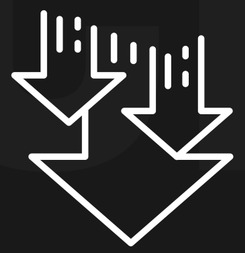
CHALLENGES



Camera distortion and noise

Complex background

Illumination



Translation, rotation, scaling, and occlusion

Facial expression

Makeup and hair style

MAIN TOPICS AND APPLICATION FIELDS

- Personal Authentication
- CCTV security cameras
- Criminal activities detection
- Mobile Phones Photo Applications
- Emotion Recognition
- Movie casting

PERSONAL AUTHENTICATION

Application

- Authentication for monetary transactions
- Mobile phones authentication

Topic

- FER and face feature extraction
- Illumination and quality frames

CRIMINAL ACTIVITIES DETECTION

Application

- Identify a person in a crowd of people in different locations

Topic

- Keypoint heatmap methods

CCTV SECURITY CAMERAS

Application

- Security facilities

Topic

- Video face recognition based on CNN

MOBILE PHONES PHOTO APPLICATIONS

Application

- People in the photos are recognized

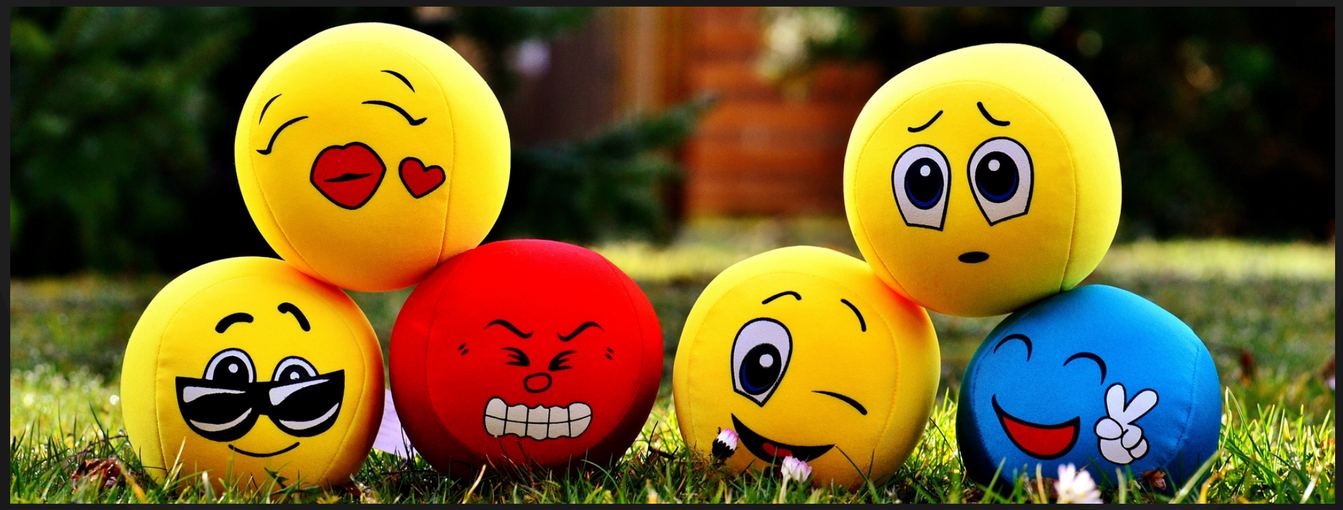
EMOTION RECOGNITION

Application

- Distinguish human emotions
- Improving customer-service based

Topic

- FER



MOVIE CASTING

Application

- Identify a pattern in characters faces

Topic

- Face Clustering

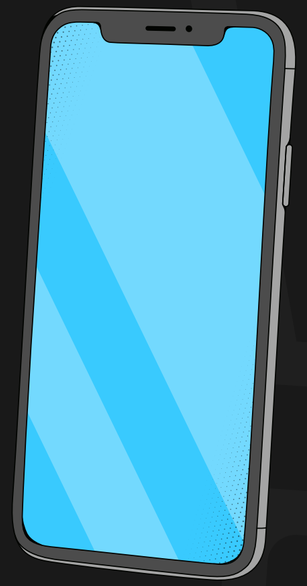
WHO ARE THE USERS OF TECHNOLOGY?

- **Bank**
- **Mobile Phone Users**
- **Security Facilities**
- **Newspapers reporters and analysts, Police, Investigation institutions**

BANK

- Face recognition for employees’ identification
- Face recognition for users identification to access at the bank's services

MOBILE PHONE USERS



- Photo applications
- Authentication mechanisms

SECURITY FACILITIES

- Monitoring convicts and external people

NEWSPAPERS REPORTERS AND ANALYSTS, POLICE, INVESTIGATION INSTITUTIONS

- Face recognition for criminal activities detection

POSSIBLE STRATEGIES

- Improve current solutions
- Propose new applications

IMPROVE CURRENT SOLUTIONS

What limitations we can improve?

- Environment illumination
- Blurred video frames and other camera variations
- Color of the skin or any kind of disguise on the face
- The color of the skin
- Any kind of disguise on the face
- ...

What we have to do?

- Trying different datasets for training or different feature extraction and selection algorithms
- Improving the tradeoff between efficiency and costs

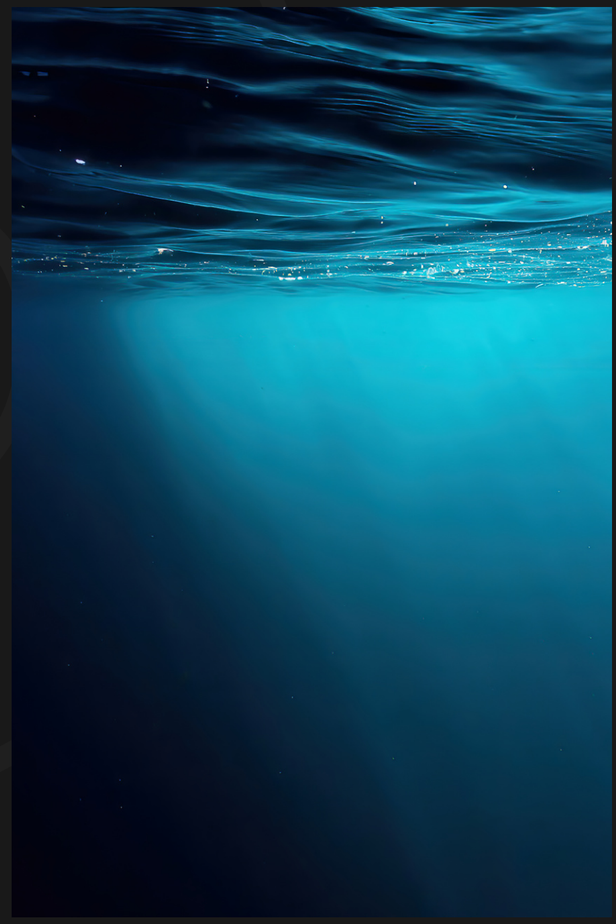
PROPOSE NEW APPLICATIONS

Why do we need new solutions?

- Current solutions already have good performances
- Face recognition is a subject of research in many unexplored fields

Possible ideas:

- The Blue Ocean of Emotion recognition




Thank
You