

# FACIAL EMOTION RECOGNITION

*A field that intersects psychology, technology, and human interaction*

**TECHNO**

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**Sanaz Khanjani**

# *OutLine*

- 
- A photograph of a man with long brown hair and a full brown beard, looking directly at the camera with wide eyes and an open mouth, as if surprised or excited. He is wearing a light blue button-down shirt. The background is white, and the edges of his shirt appear to be torn, revealing a red and white patterned fabric underneath.
- Background and Theory
  - Technology and Methods
  - Applications
  - Challenges and Future Directions

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## Background and Theory

What are emotions?

How do we define them?

Are emotions learned?

Are they consistent across cultures?



## Background and Theory

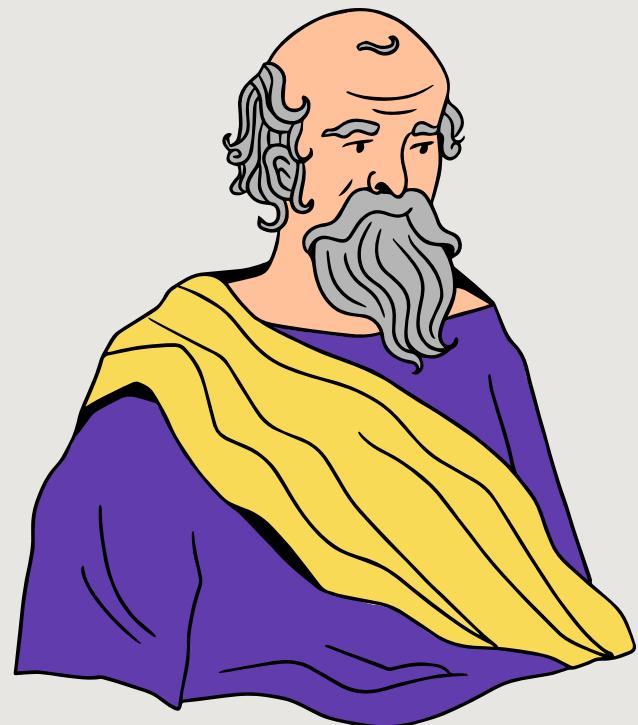
- Emotions are **subjective** experiences.
- Emotions are **distinct from sensory** experience



Plato

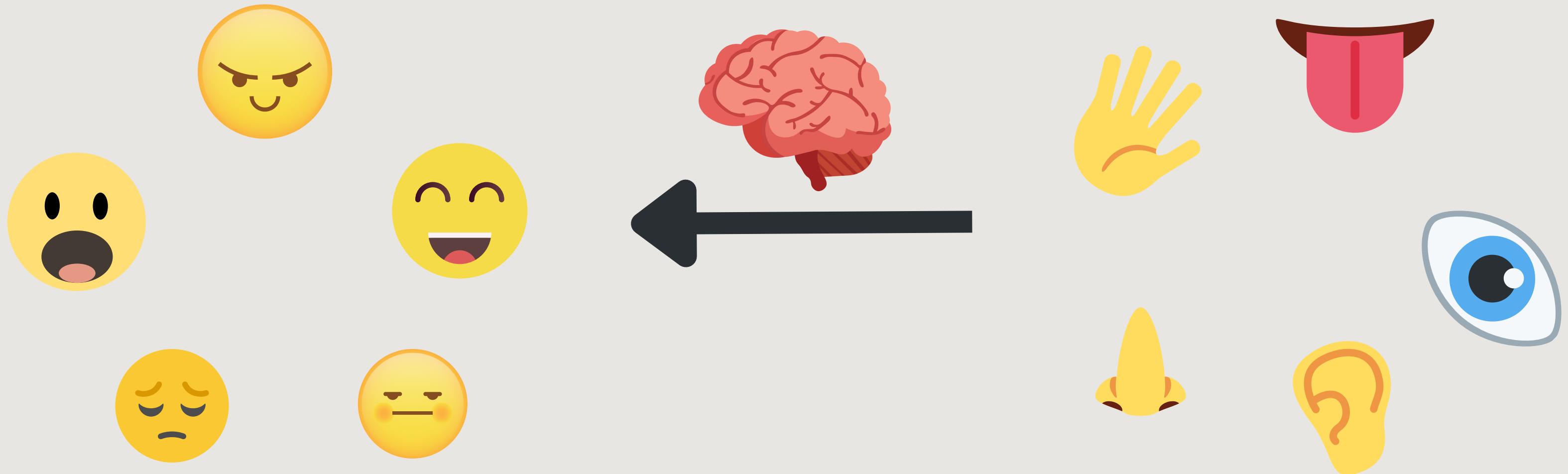


Descartes



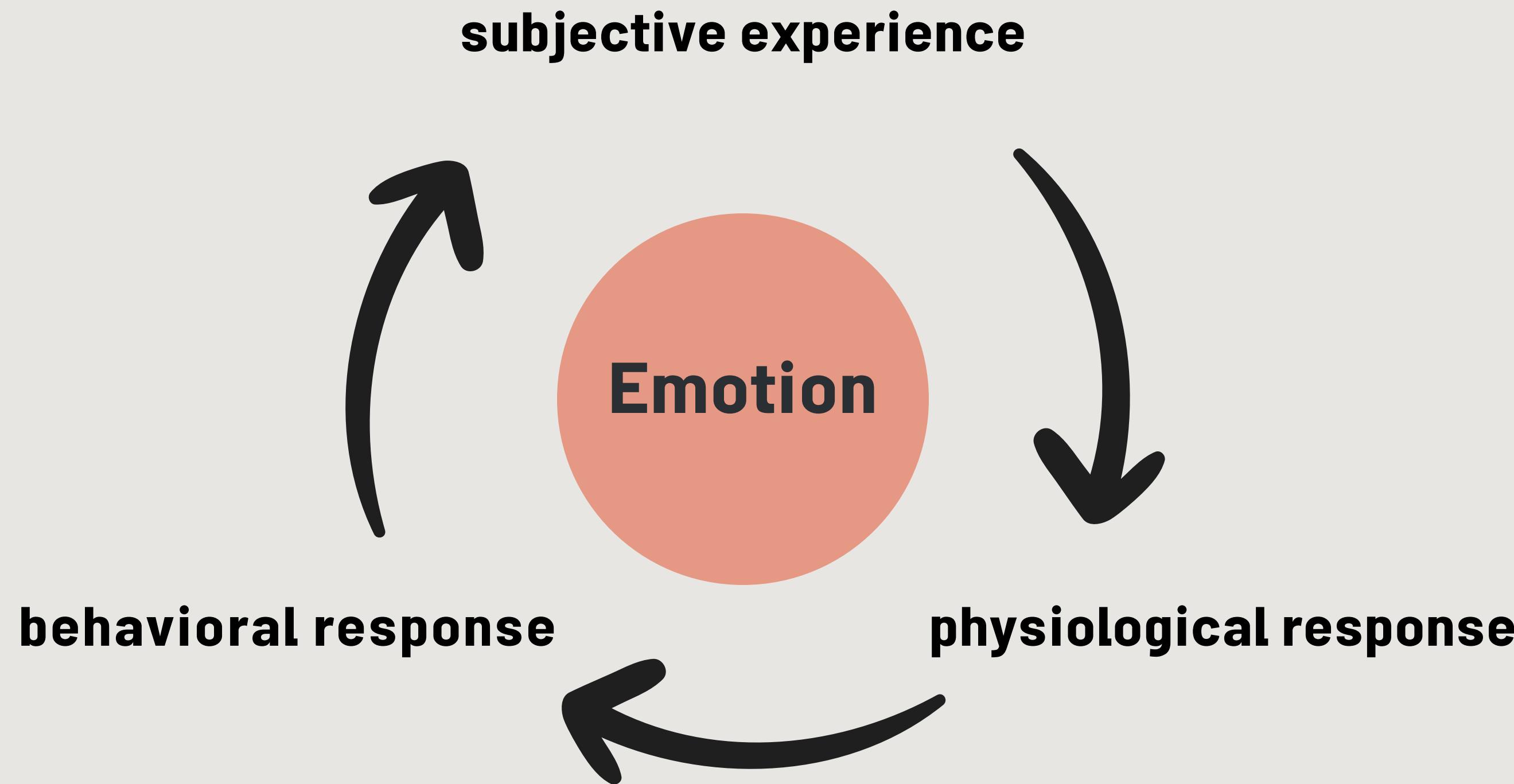
Aristotle

# James-Lang Theory



# Cannen-Bard Theory





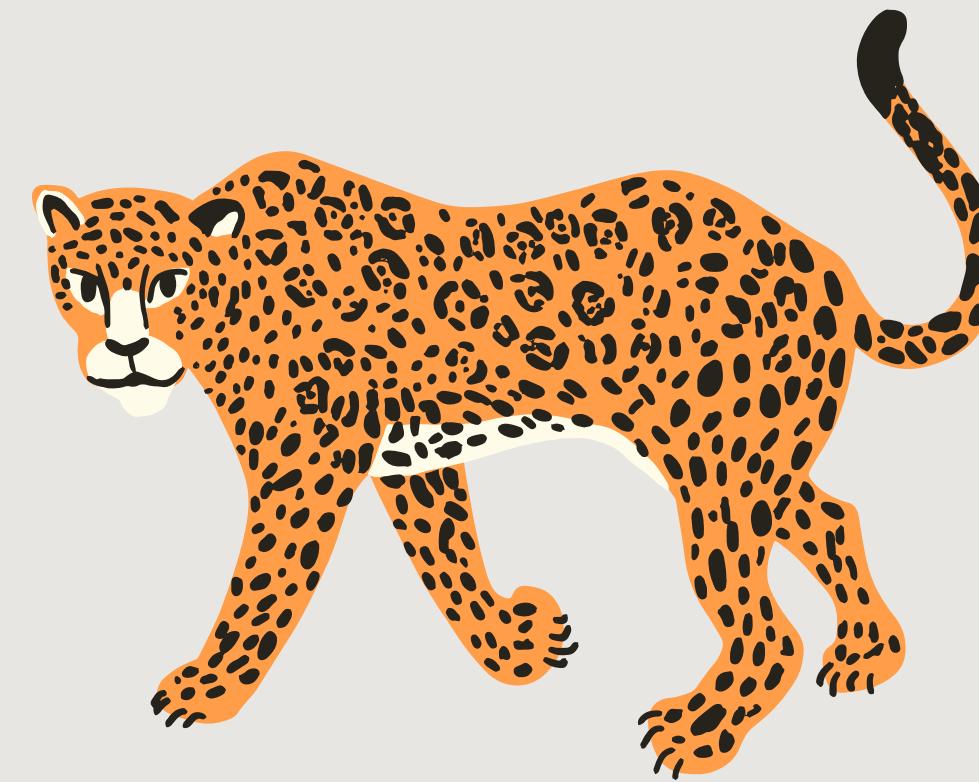
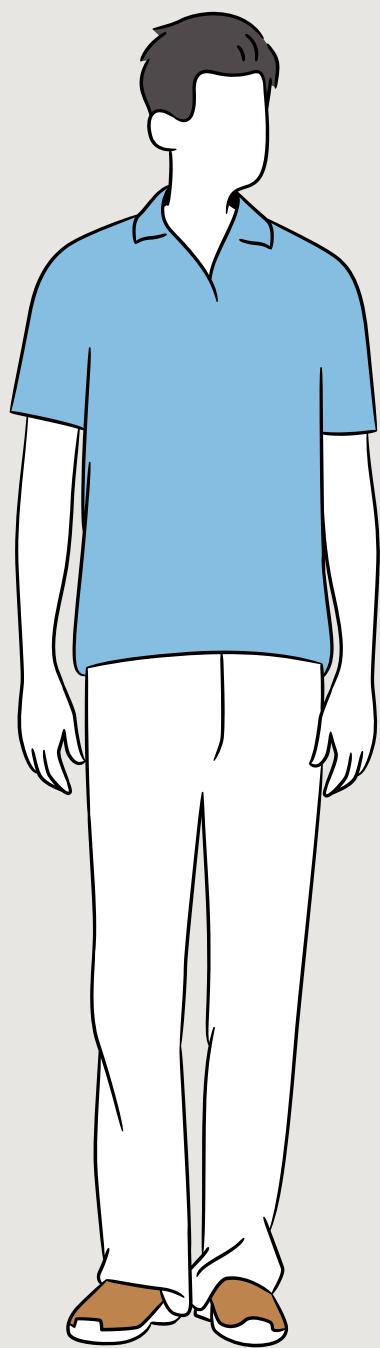
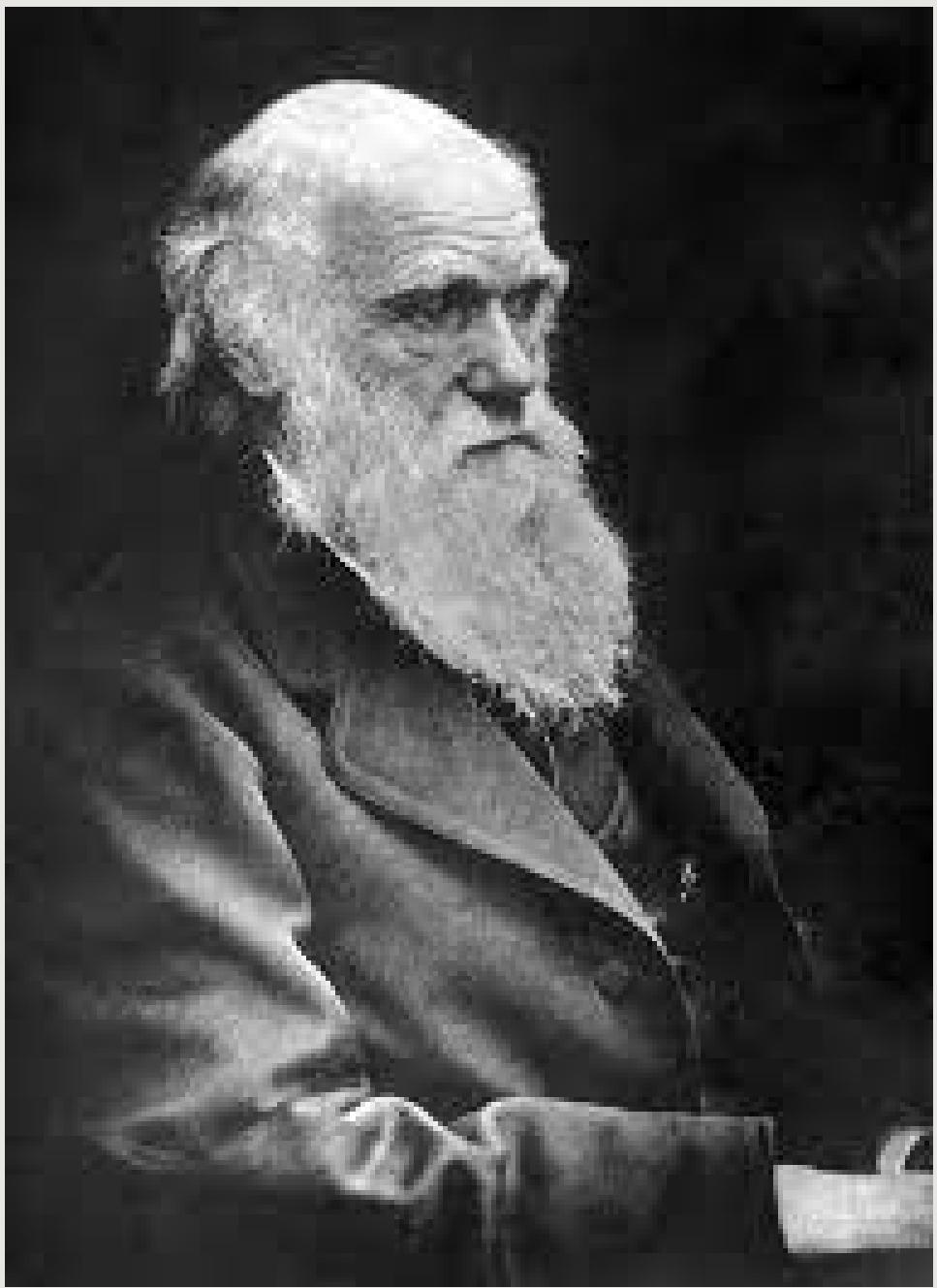
## Background and Theory

Emotion



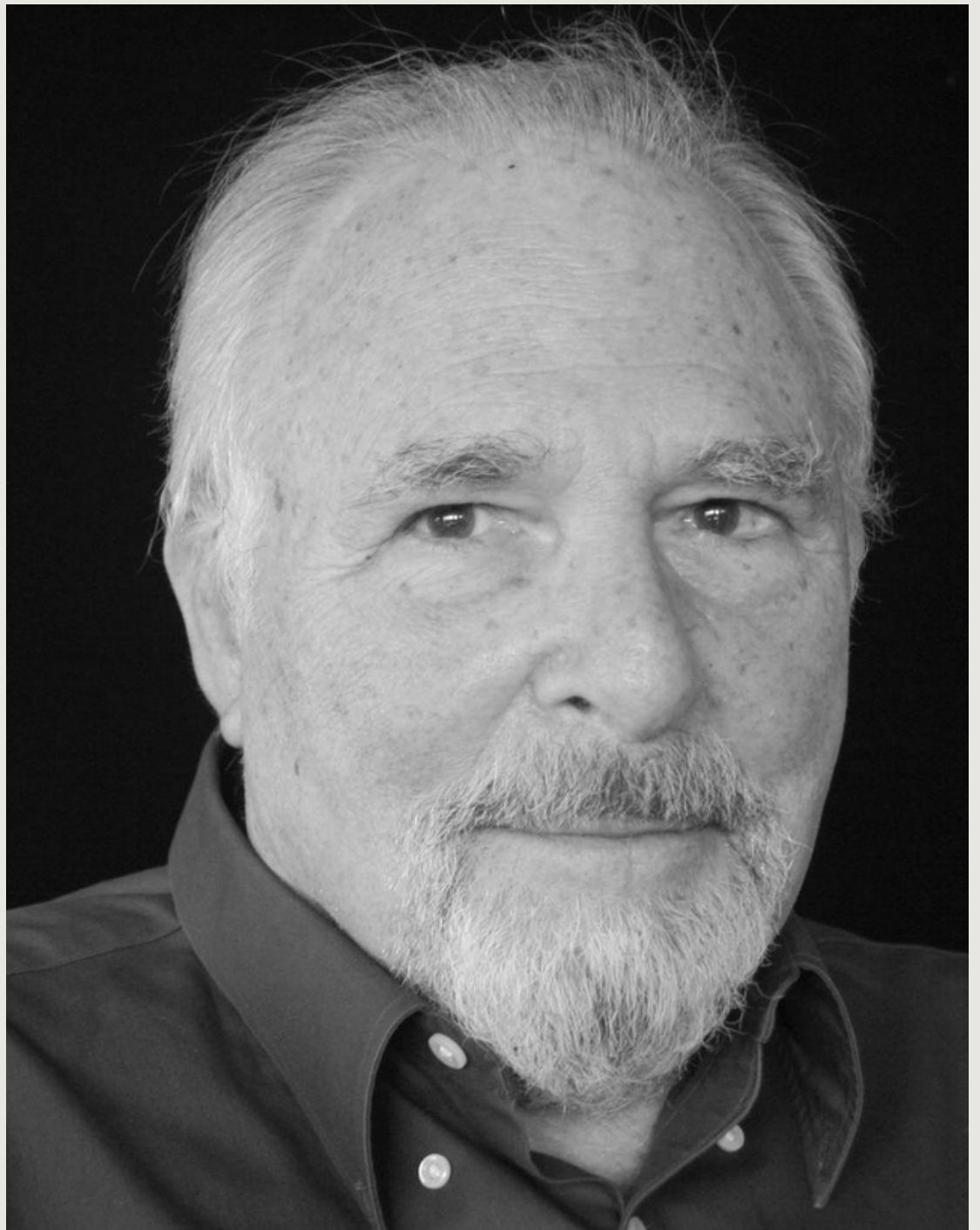
Mood

## Background and Theory



**Charles Darwin**

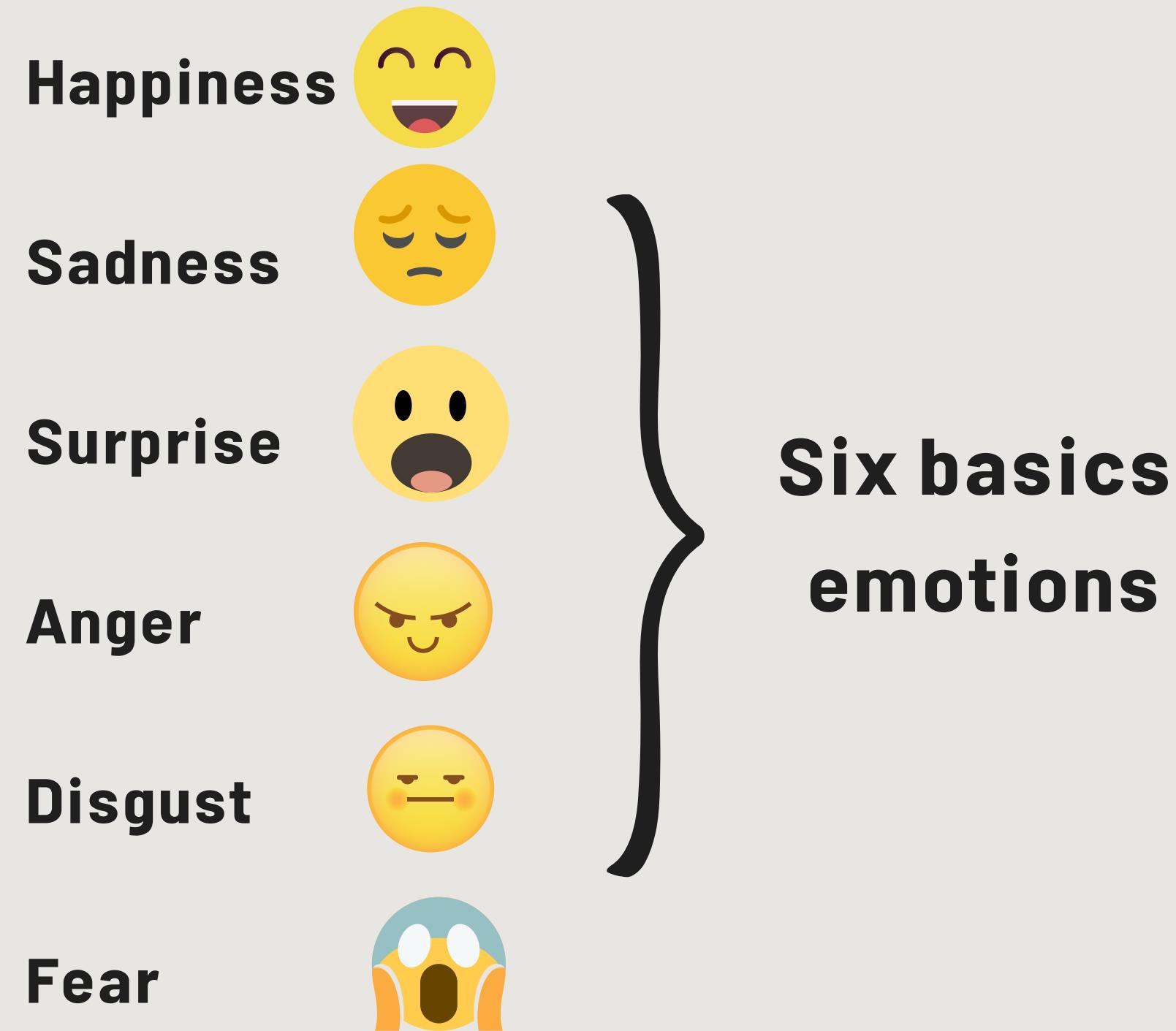
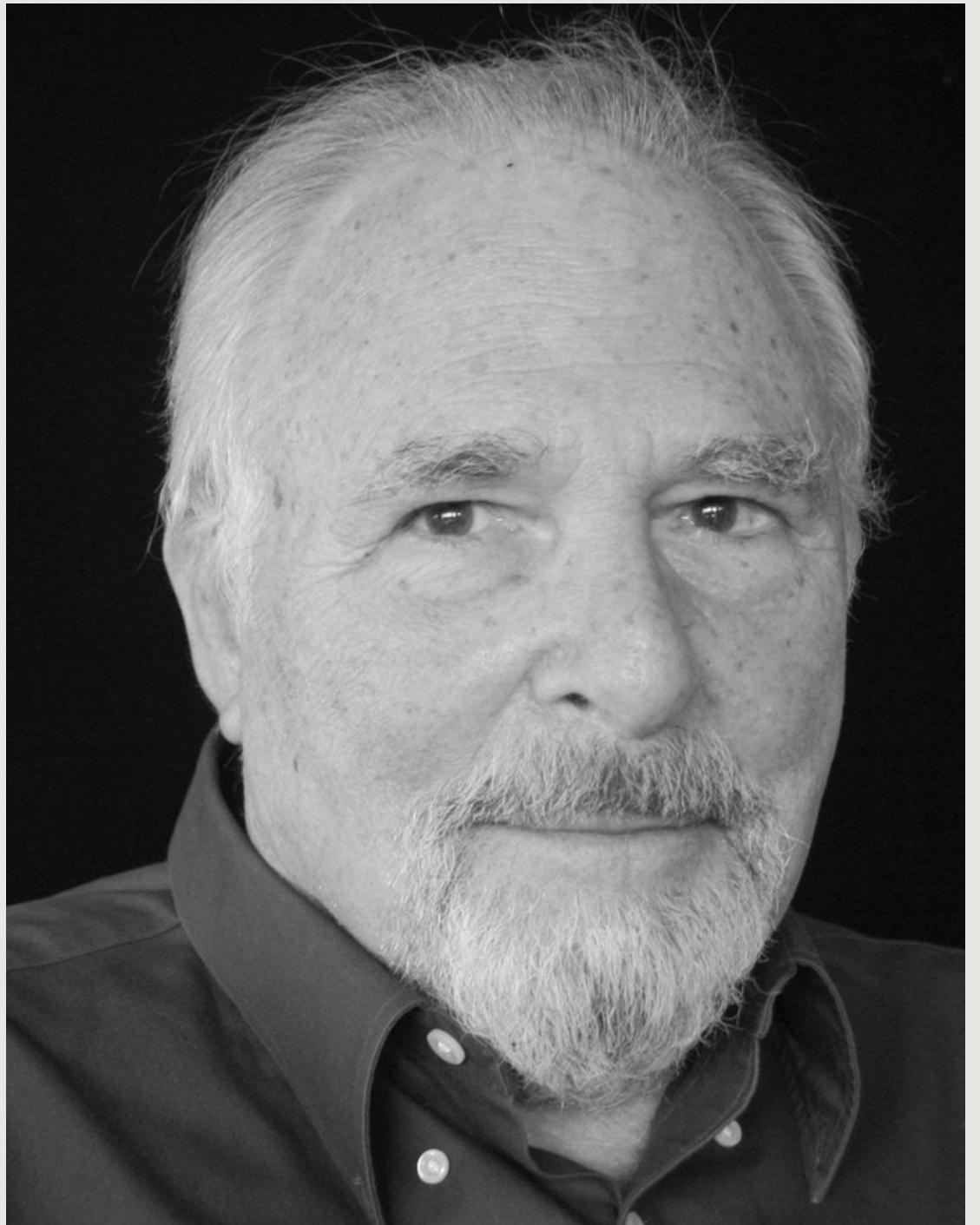
## Background and Theory



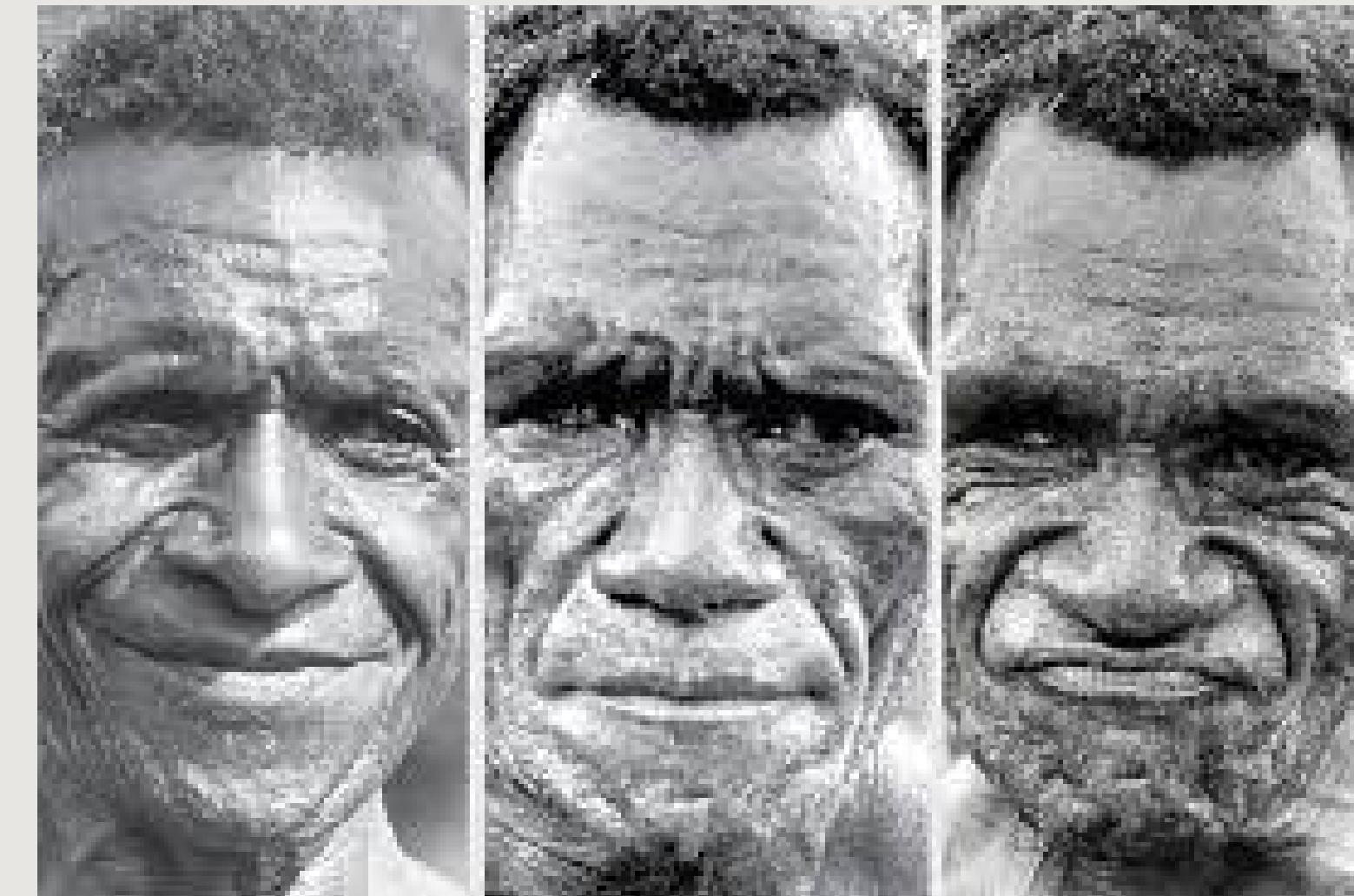
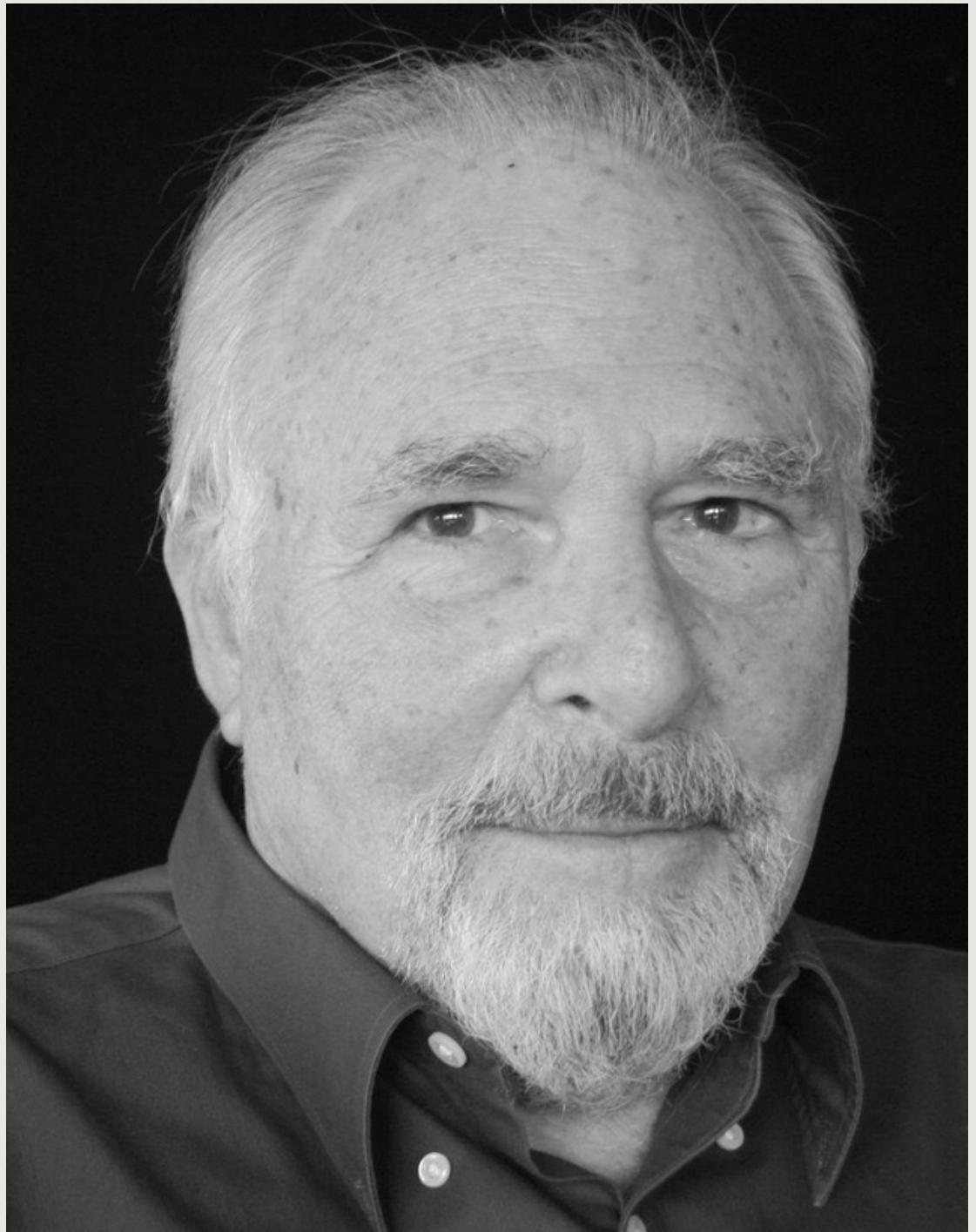
**Paul Ekman**



## Background and Theory



## Background and Theory



**Complex** emotions are mixtures of the six basic emotions

## Six basics Emotions

Jealousy



Grief

# Tired is an emotion?



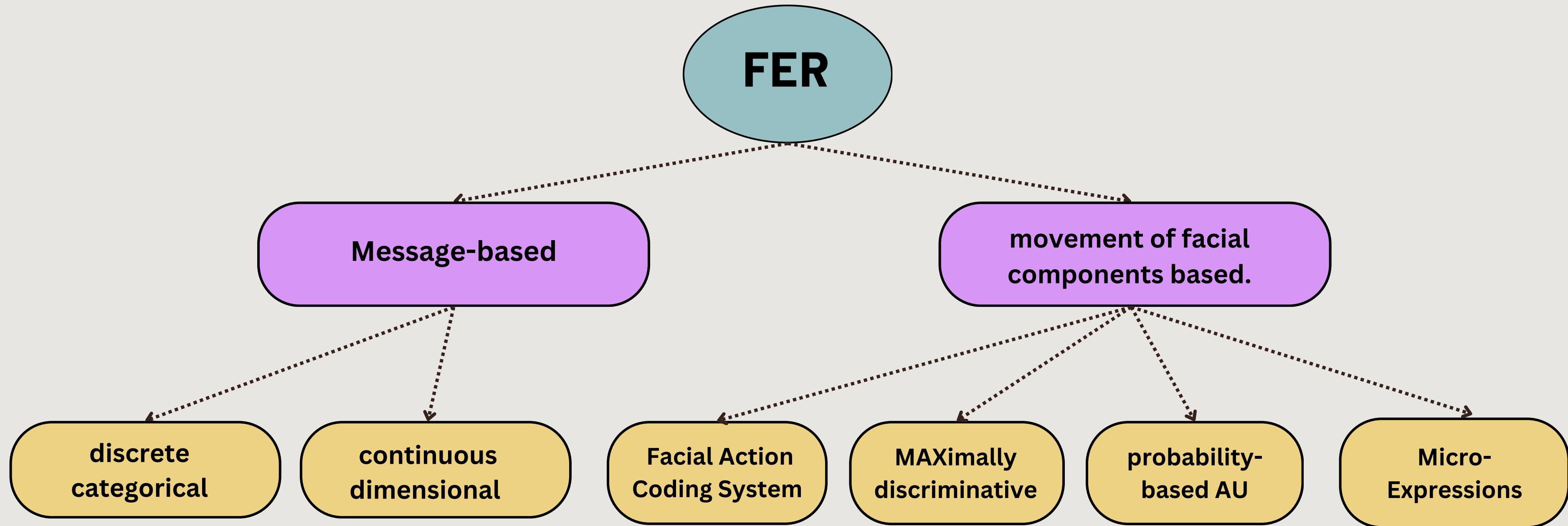
# How we can detect emotions?

- Facial Expressions
- Body Language and Gestures
- Voice Analysis
- Physiological Responses
- Brain Imaging and Neurological Activity
- Psychological Measures
- Contextual Analysis
- Behavioral Analysis
- Artificial Intelligence and Machine Learning

## Facial emotional

The term "facial emotion" refers to the expression of emotions through facial movements and expressions. Human faces are capable of making a vast array of expressions, which can convey a wide range of emotions without the need for words. These expressions are a fundamental part of human communication and are often universal across cultures.

# Methods for Representing Facial Expressions



# Discrete categorical

six basic emotional states

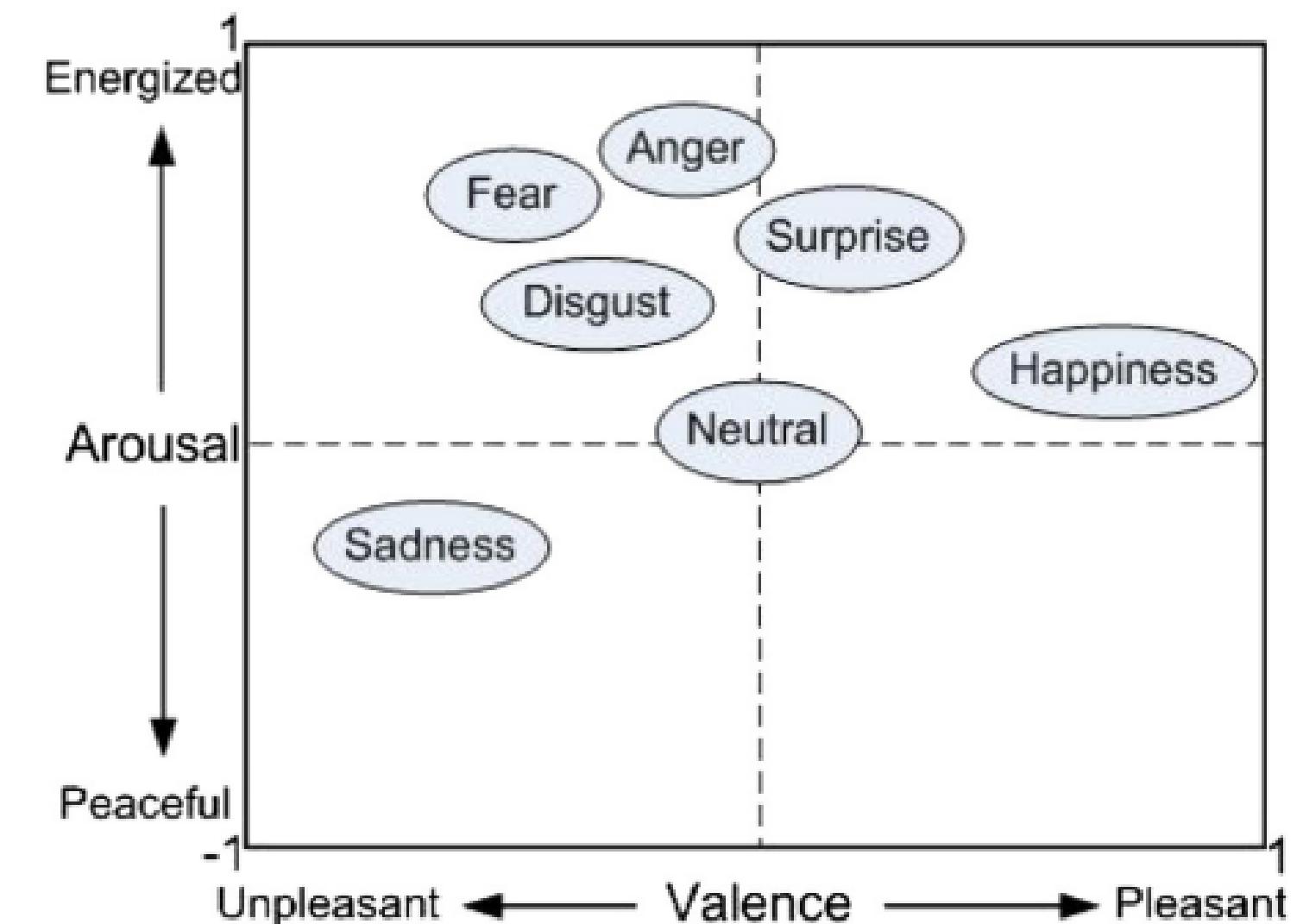
- anger (AN)
- disgust (DI)
- fear (FE)
- happiness (HA)
- sadness (SA)
- surprise (SU)

non-basic emotional states:

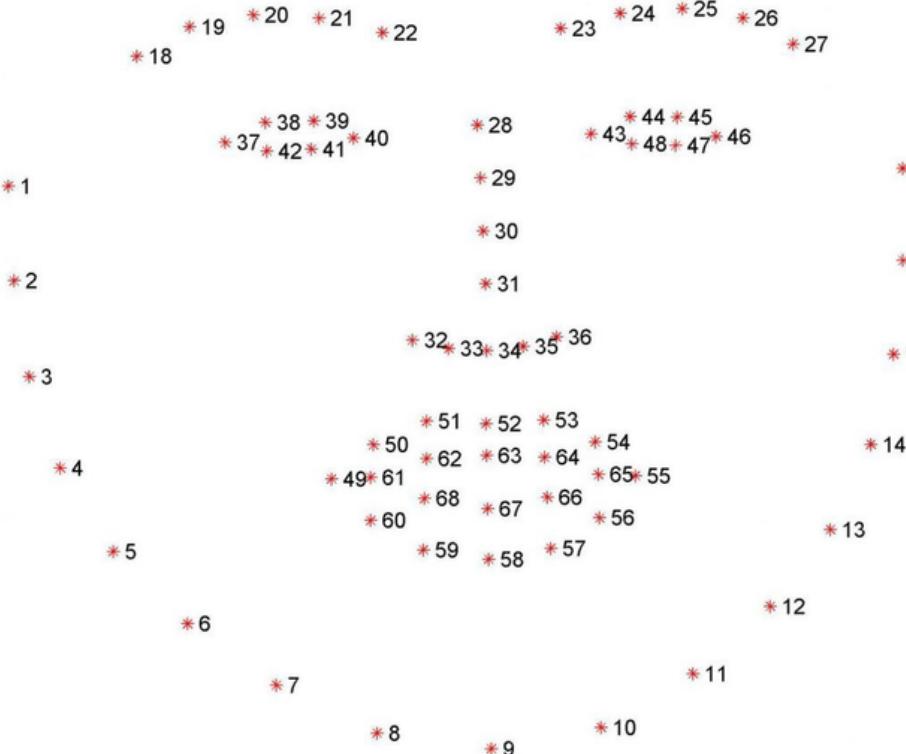
- depression,
- agreement
- distress
- disappointment

## Continuous dimensional

It describes facial expressions using continuous axes in a multiple dimensional space and represents each expression as a point or a region in the space.



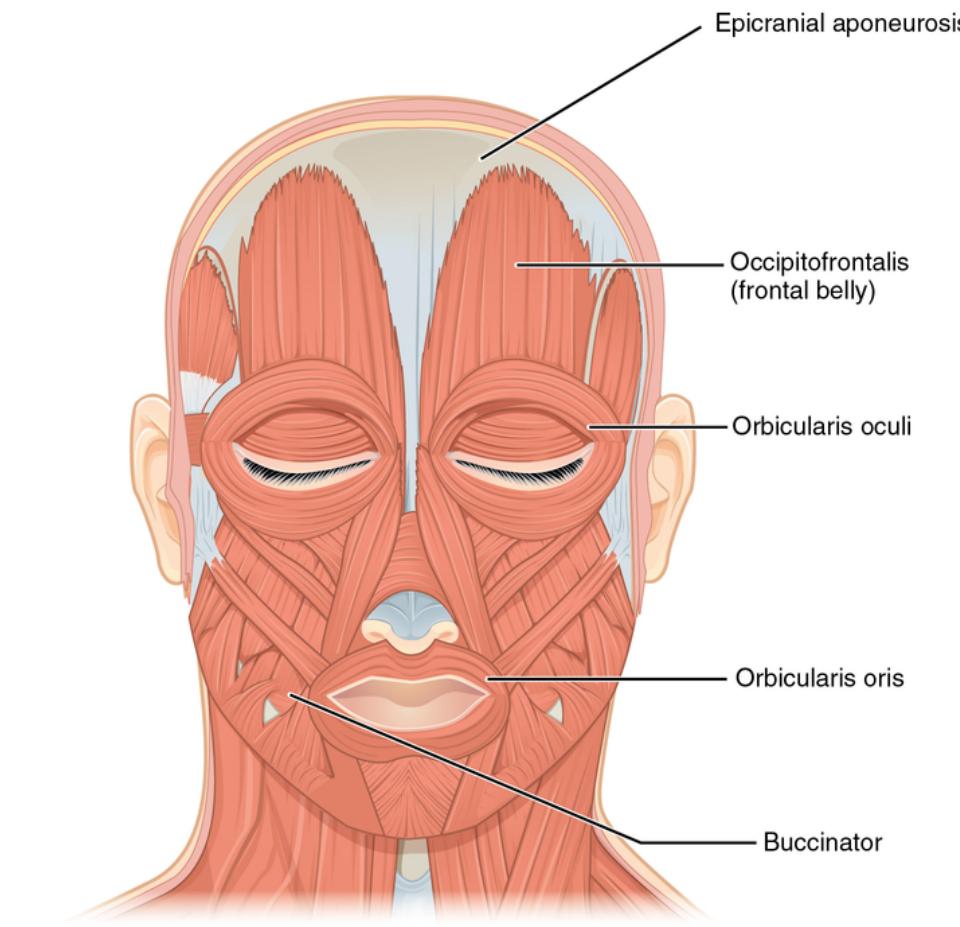
# Facial Action Coding System



AU	Full name	Illustration
AU1	Inner Brow Raiser	
AU2	Outer Brow Raiser	
AU4	Brow Lower	
AU5	Upper Lid Raiser	
AU6	Cheek Raiser	
AU7	Lid Tightener	
AU9	Nose Wrinkler	
AU10	Upper Lip Raiser	
AU12	Lip Corner Puller	
AU14	Dimpler	
AU15	Lip Corner Depressor	
AU17	Chin Raiser	
AU20	Lip stretcher	
AU23	Lip Tightener	
AU25	Lips part	
AU26	Jaw Drop	
AU45	Lip Suck	

# Emotional Facial Action Coding System (EFACS)

The FACS defines AUs, as contractions or relaxations of one or more muscles.



## **MAXimally discriminative facial movement coding system (MAX)**

Designed to code discrete emotional states such as interest, joy, surprise, contempt, and physical distress or pain, based on a set of facial movement formulas.

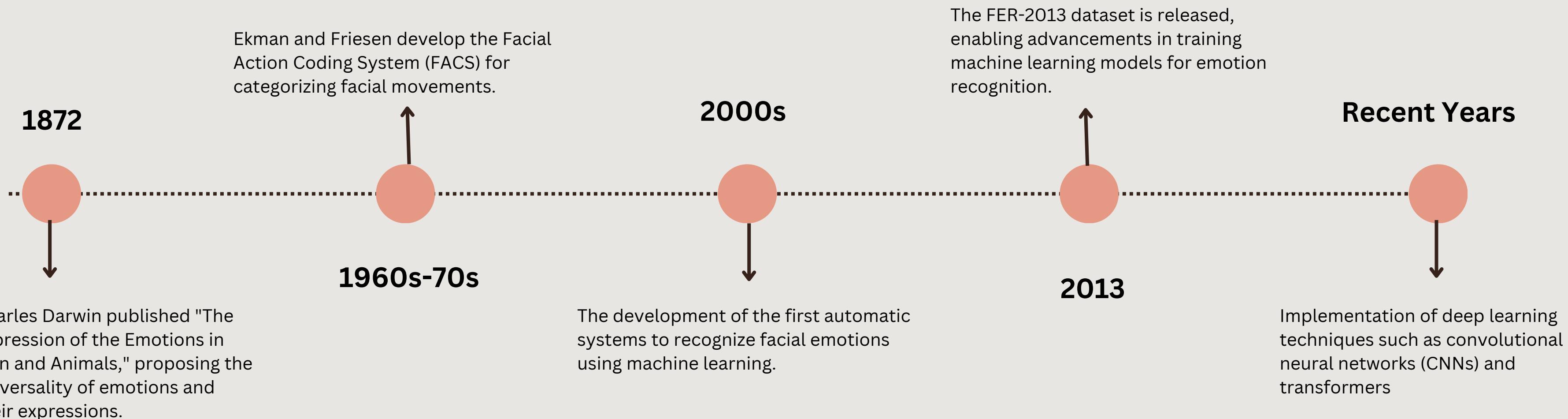
## **Probability-based AU**

Each basic AU as an individual dimension and uses continuous coordinates on an AU axis to represent the probability of this AU occurring on a face.

## Micro-Expressions

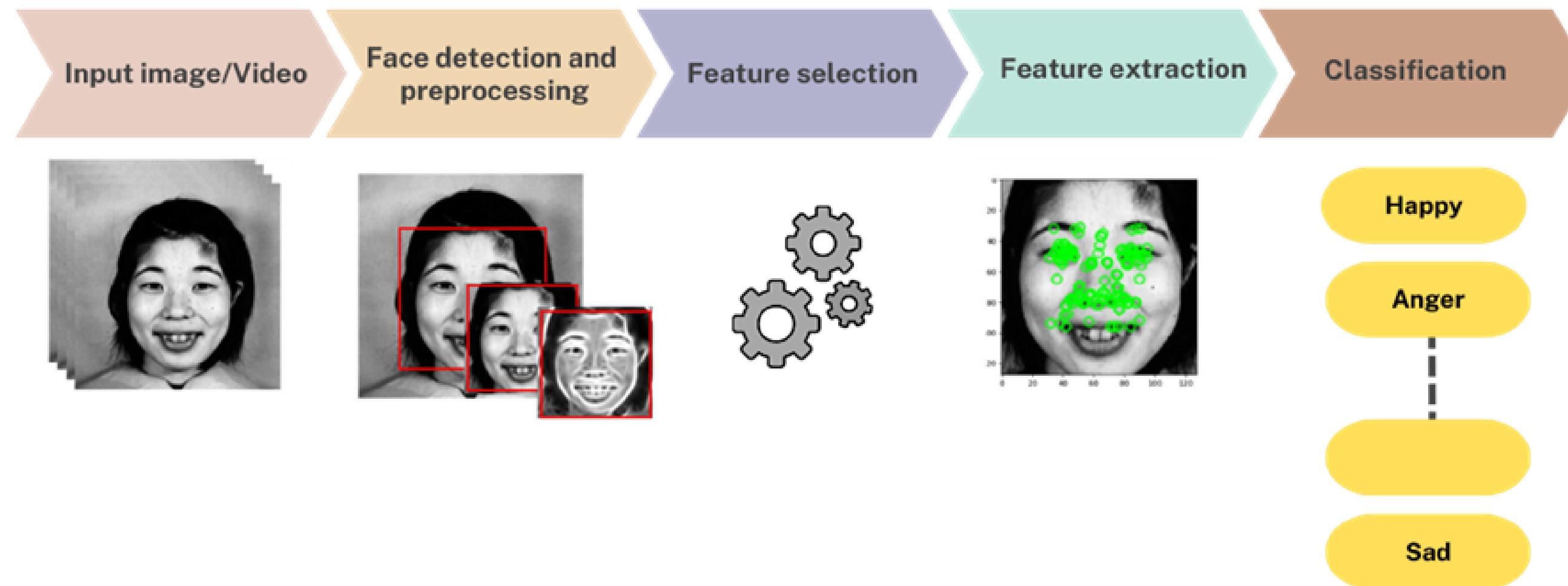
MEs are brief, involuntary facial expressions that reveal hidden emotions and are important for understanding humans' deceitful behaviors. Unlike general facial expressions, MEs are very short (i.e., 1/25 to 1/3 second), involve subtle muscle movements and are difficult to control through one's willpower.

# History of Emotion Recognition



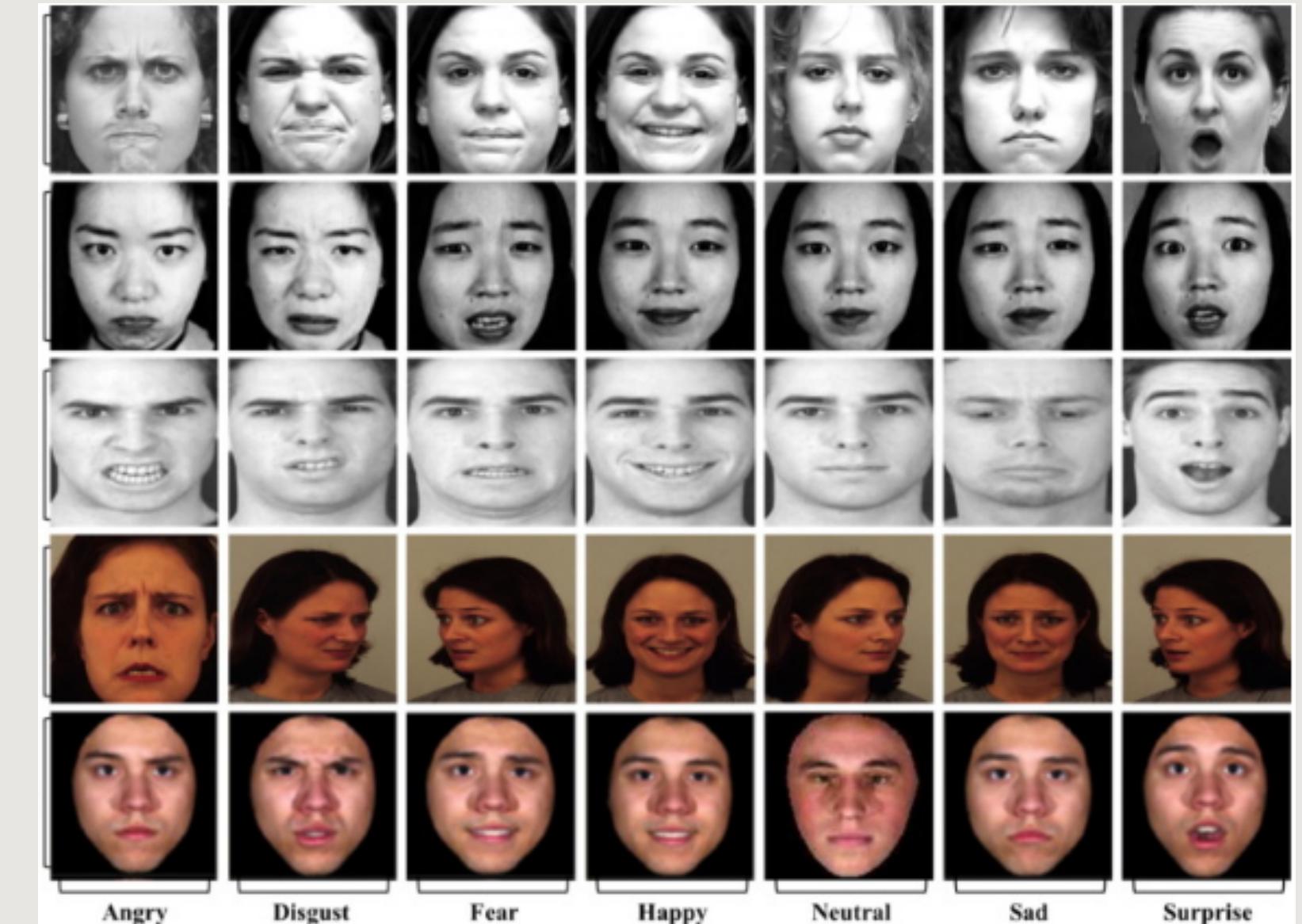
# FER systems

A FER system mainly consists of three stages, namely **face detection**, **feature extraction**, and **expression recognition**.

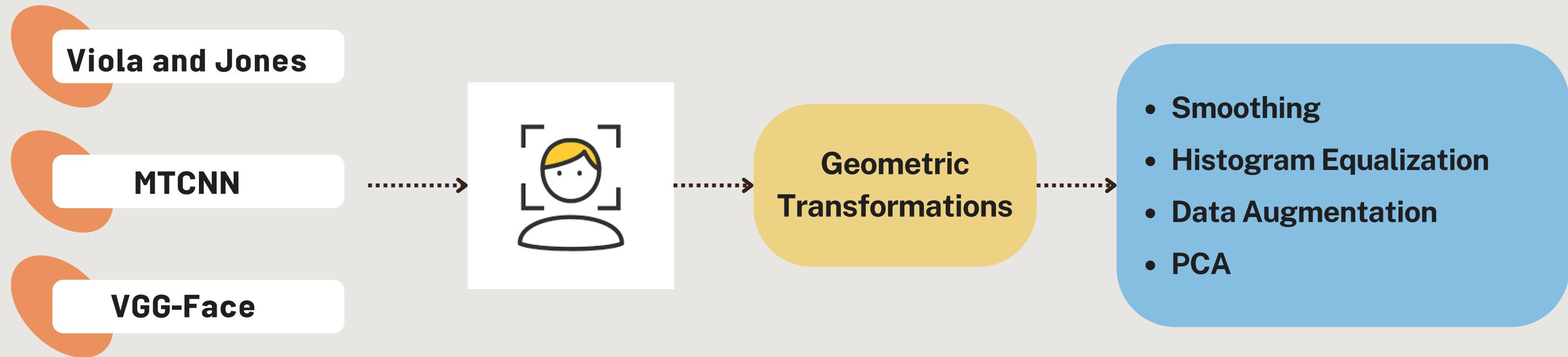


# Datasets

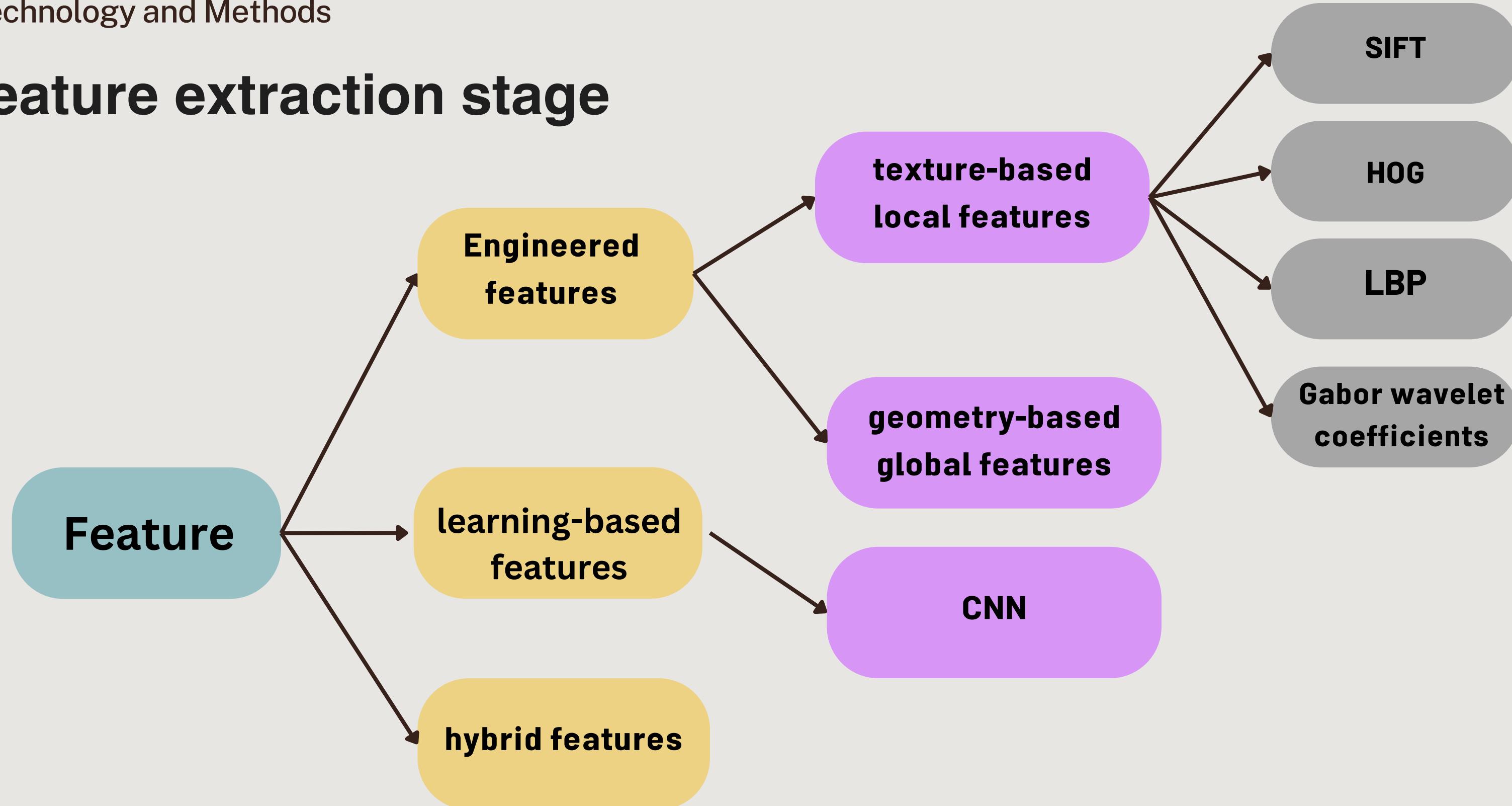
- JApnese Female Facial Expression (JAFFE)
- Cohn-Kanade (CK)
- Caltech Occluded Faces in the Wild (COFW)
- Acted Facial Expressions in the Wild (AFEW)
- FER-2013
- AffectNet
- RAF-DB
- DFEW
- ...



# Face detection - Preprocessing stage

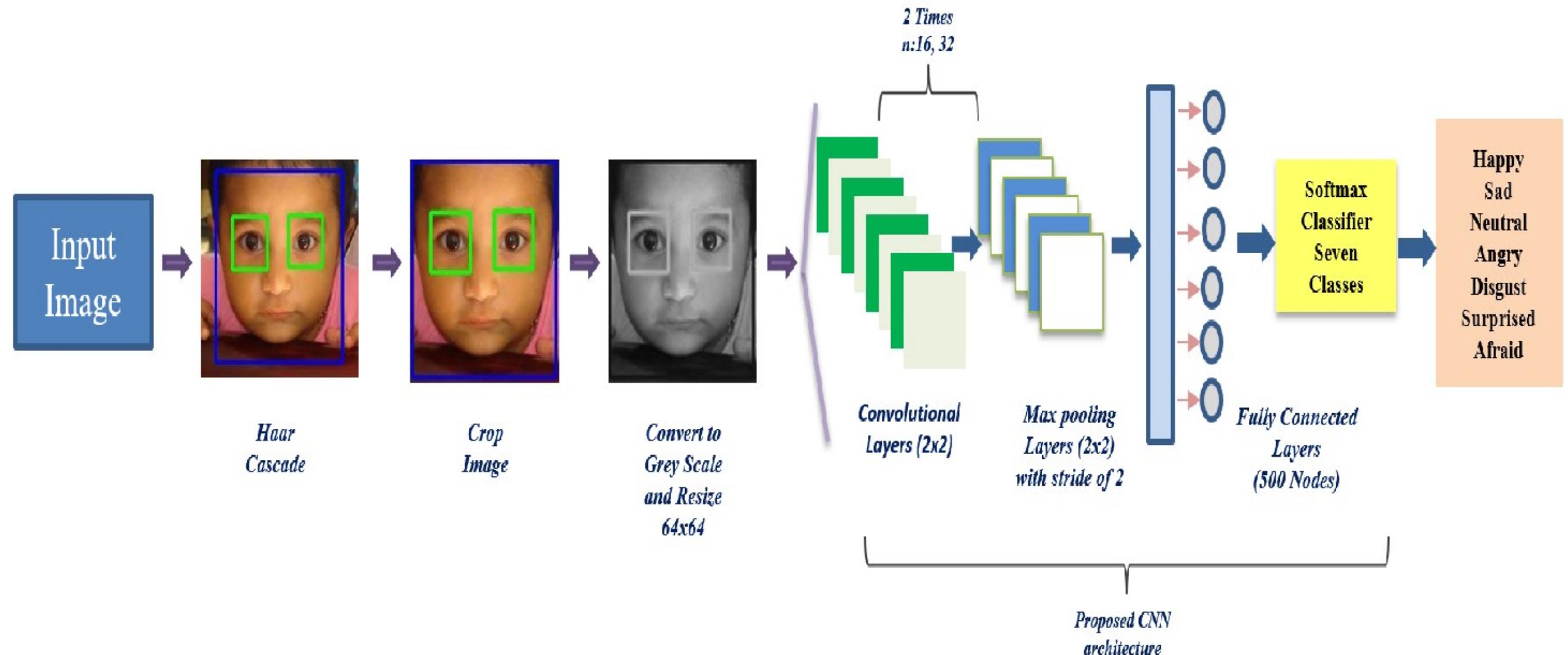


# Feature extraction stage

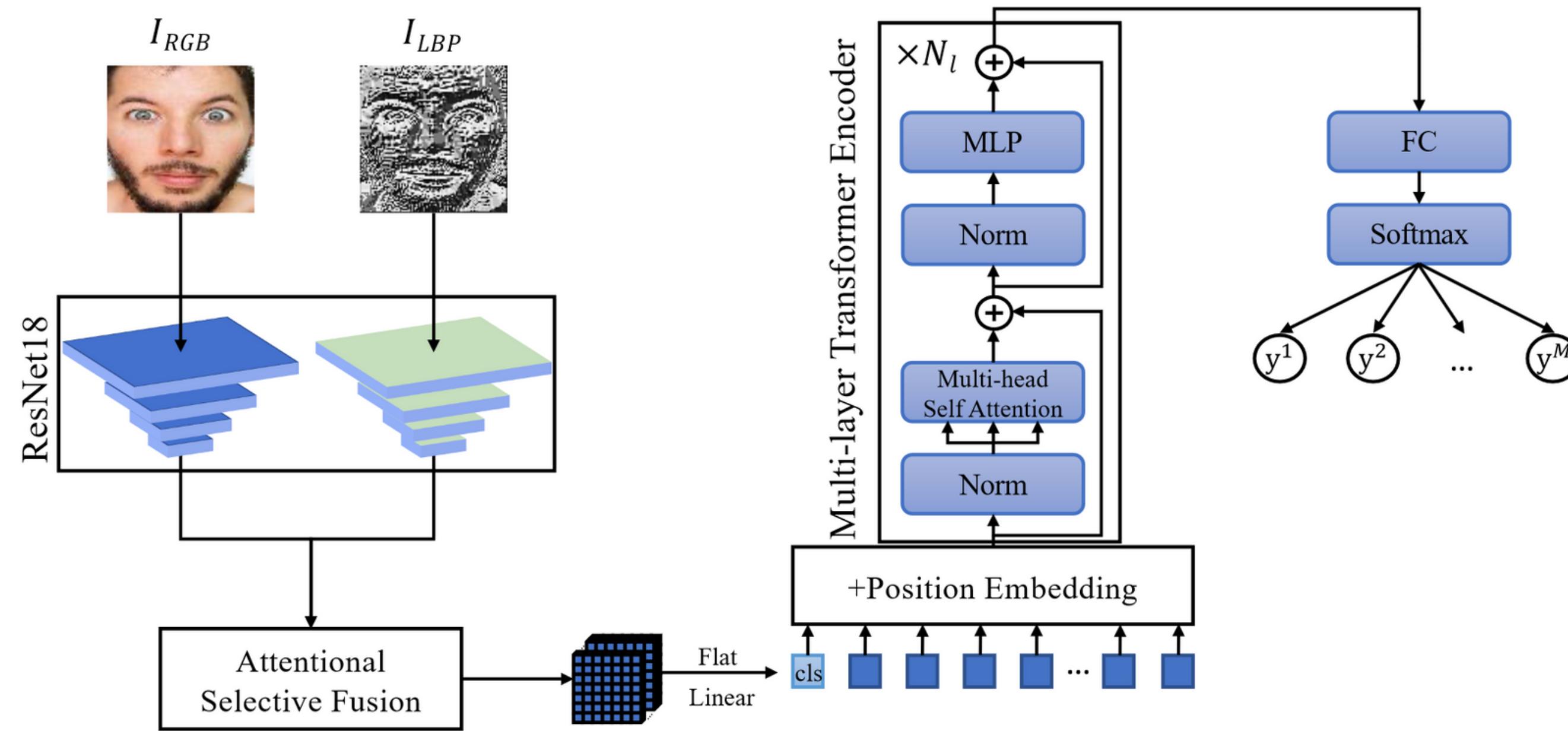


# Expression recognition

- SVM
- KNN
- NB
- ANN
- CNN
- RNN
- Transformers



# Expression recognition Model



## Where we can use FER system?

- Human-Computer Interaction (HCI)
- Automotive Industry
- Marketing and Retail
- Healthcare
- Security and Surveillance
- Education and Training
- Social Robotics
- ....

# Open issues and research challenges:

- Datasets
- Illumination
- Face pose
- Occlusion
- Ageing
- Low resolution



# Thank you!

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