Tutorial

ACCV 2020

Recent Advances and Challenges in Facial Micro-Expression Analysis

Introduction & Overview

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Outline of Tutorial

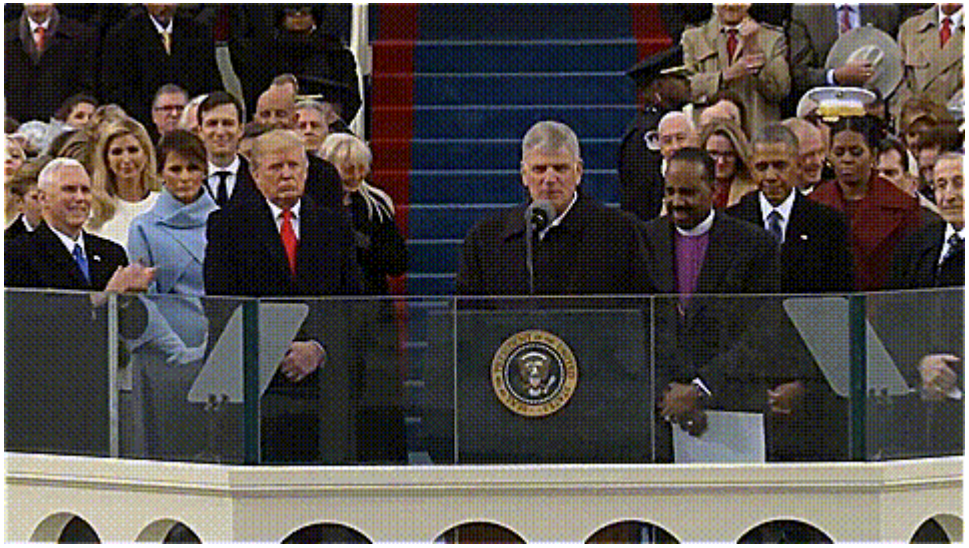
- **Part 1:** Introduction & Overview to Facial Micro-expression (ME) Analysis
- **Part 2:** ME Datasets
- **Part 3:** ME Spotting Task
- **Part 4:** ME Recognition Task
- **Part 5:** Challenges and Future Directions

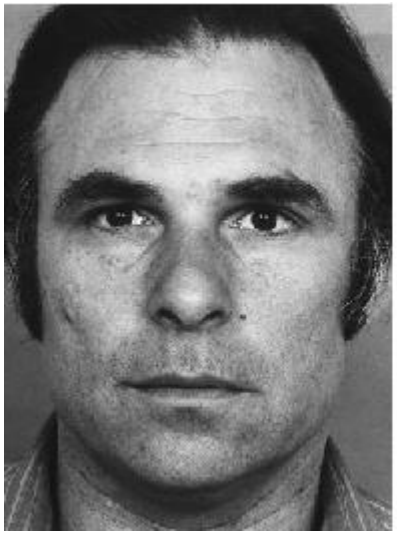
The Economist

Clinton v Trump 1st debate

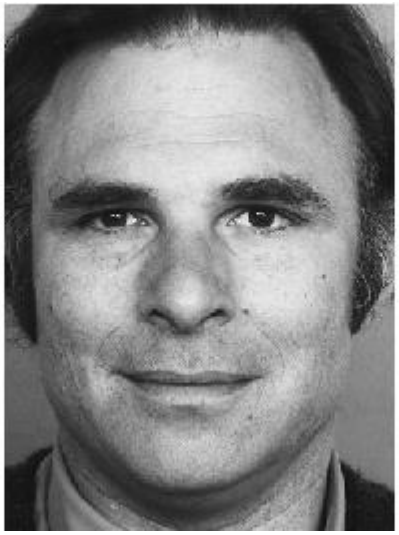
anger contempt sadness surprise

CREDIT : RBC NETWORK BROADCASTING

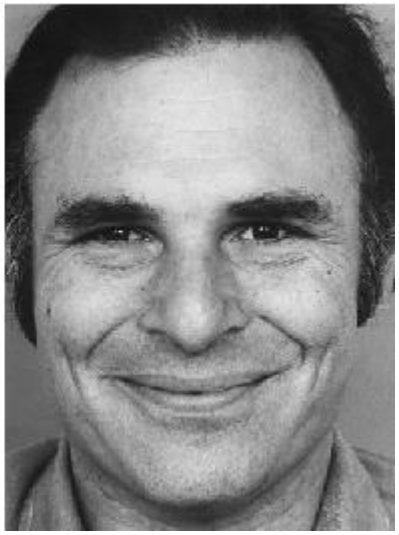




Neutral



Non-Duchenne Smile



Duchenne Smile

Duchenne Smile:
Occurs when the zygomaticus major muscle lifts the corners of your mouth at the same time the orbicularis oculi muscles lift your cheeks and crinkle your eyes at the corners.

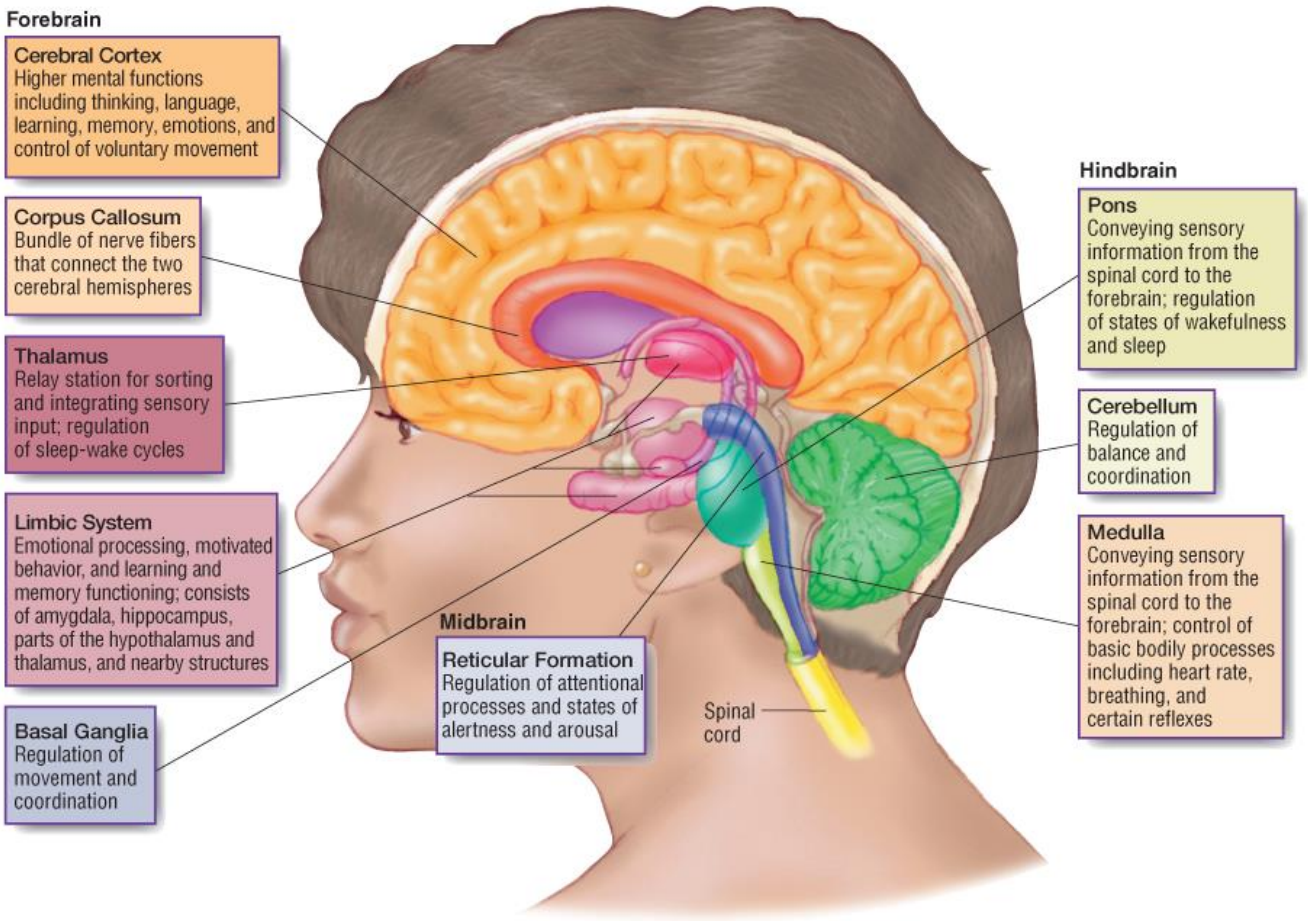
Vandeventer & Patterson (2012) **Differentiating Duchenne from non-Duchenne smiles using active appearance models.** BTAS.

Discovery

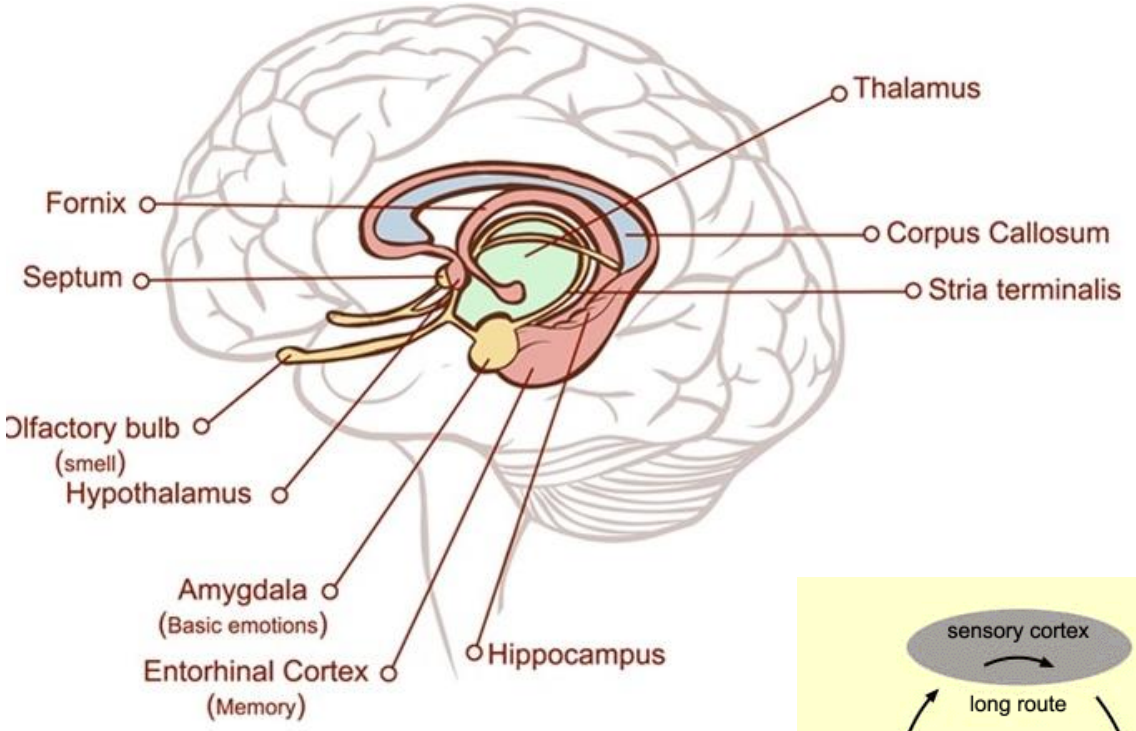
- **Haggard and Isaacs (1966)** – discovered micro-expressions while scanning through motion picture films of psychotherapy hours, looking for clues of non-verbal communication.

- **Ekman and Friesen (1969)** spotted a quick full-face emotional expression in a filmed interview – a strong negative feeling a psychiatric patient was trying to hide from her psychiatrist to convince that she is no longer suicidal.
  - **Slow motion** – shows a brief sad face lasting only 2 frames (1/12 seconds) followed by a longer duration false smile.

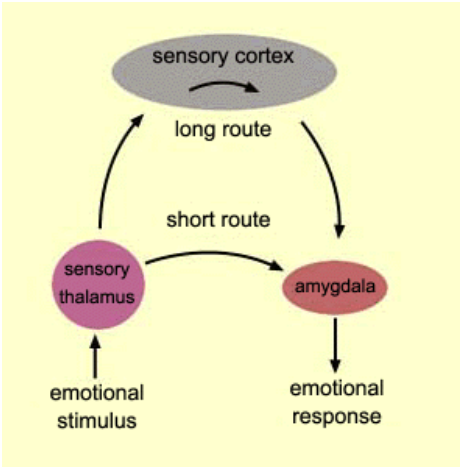
Major Structures of the Brain



Limbic System



"Amgydala hijack"
➔ Emotional response that is immediate, overwhelming and out of measure with actual stimulus



First baby steps forward

- **Porter and ten Brinke (2008)** – first report published validating the existence of micro-expressions
- **Matsumoto et al. (2000)** – first report published about tests designed for the ability to recognize micro-expressions
- **Ekman (2003)** – Micro-expression Training Tool (METT) was designed

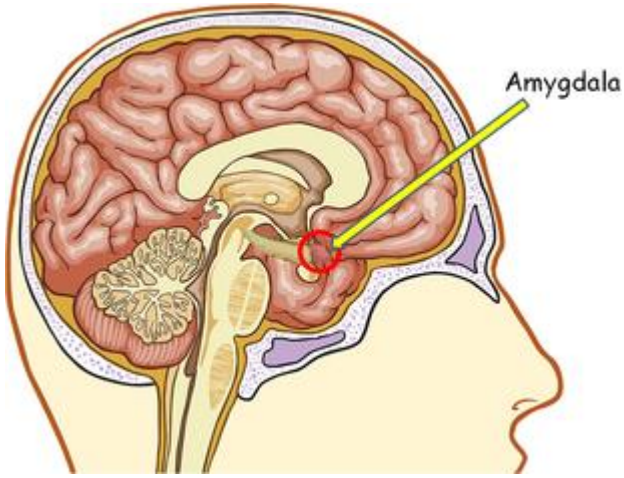
Matsumoto, D., LeRoux, J. A., Wilson-Cohn, C., Raroque, J., Kooken, K., Ekman, P., . . . Goh, A. (2000). **A new test to measure emotion recognition ability: Matsumoto and Ekman's Japanese and Caucasian Brief Affect Recognition Test (JACBART)**. Journal of Nonverbal Behavior

Porter, S., & ten Brinke, L. (2008). **Reading between the lies: Identifying concealed and falsified emotions in universal facial expressions.** Psychological Science.

Micro-Expressions

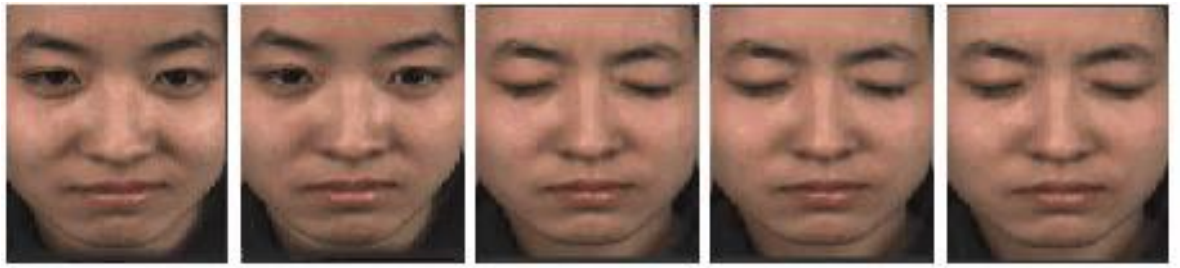
Micro-expressions ➔ Result of a **voluntary** and **involuntary** emotional response that conflicts with one another.

- The amygdala (the emotion centre of the brain) responds to the stimuli that the individual experiences and the individual wishes to conceal this specific emotion.
- Resulting effect ➔ the individual very briefly displays his/her true emotions followed by a "clipped" emotional reaction back to the previous state



Svetieva, E., & Frank, M. G. (2016). Empathy, emotion dysregulation, and enhanced microexpression recognition ability. *Motivation and Emotion*, *40*(2), 309-320.

Micro-Expressions

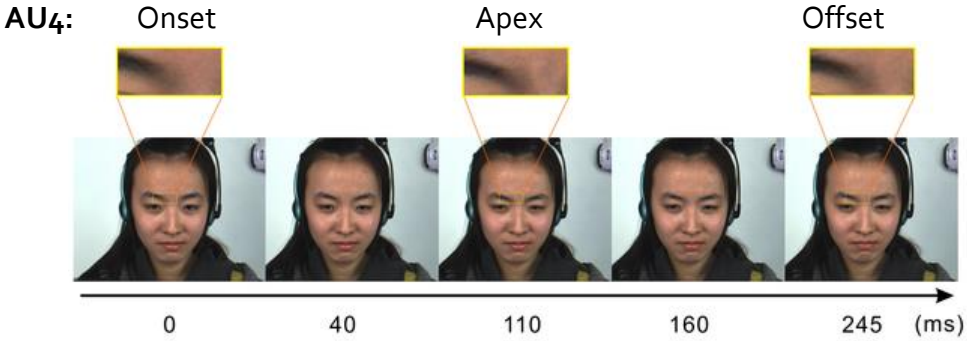


Happiness **Surprise** **Disgust** **Repression** **Others**

(Videos are 20x slower)

3 main characteristics:

- Rapid and short duration: 1/25 second – 1/5 second
- Subtle: Low intensity of expression
- Fragmented/partial facial action units



AU4 (right inner brow) lowers a little bit at 110ms = Disgust

Macro vs. Micro

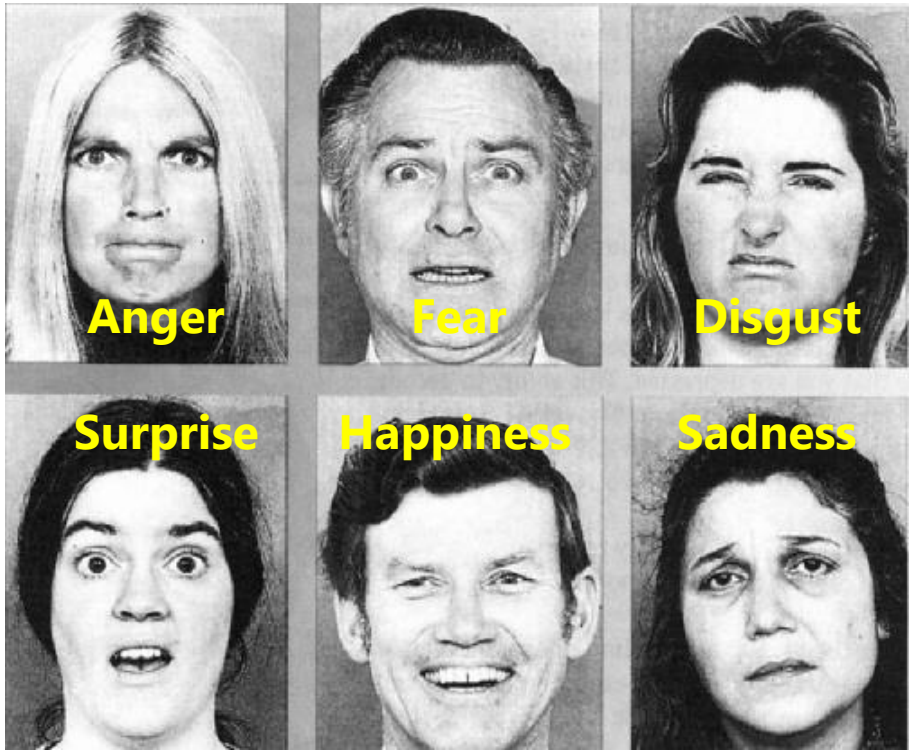
Macro-Expressions

- Typically ¾ – 2 seconds
- Occurs over a larger region of the face
- Voluntary response
- Typically a genuine feeling (though it can be faked)
- Easy interpretable by anybody

Micro-Expressions

- Last for 1/25 to 1/5 of a second
- Occurs at a small, concentrated area (often just one facial region)
- Involuntary action (not amounting to faking it)
- Concealment of a genuine feeling
- Not easily identifiable by an untrained layperson

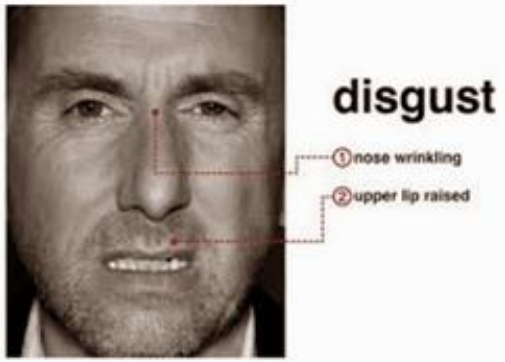
Universal Expressions of Emotion… as according to Ekman

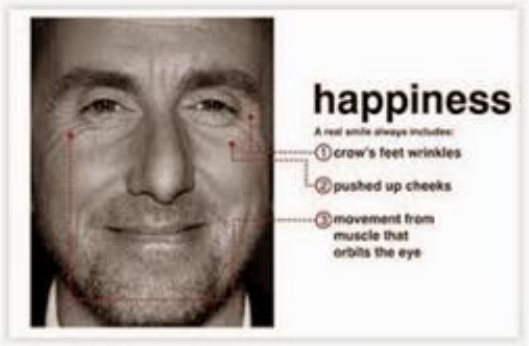


Normal expressions

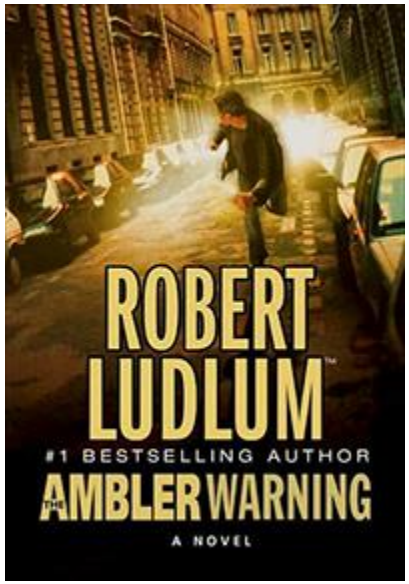
Micro-expressions

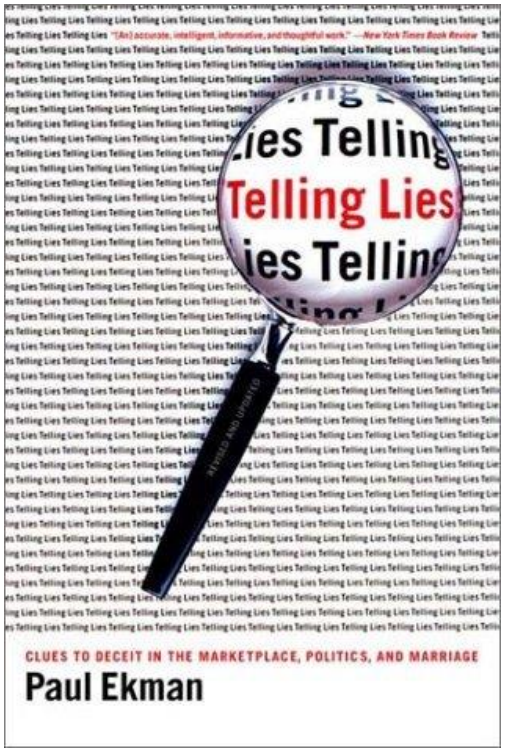
Deconstructing Micro-Expressions

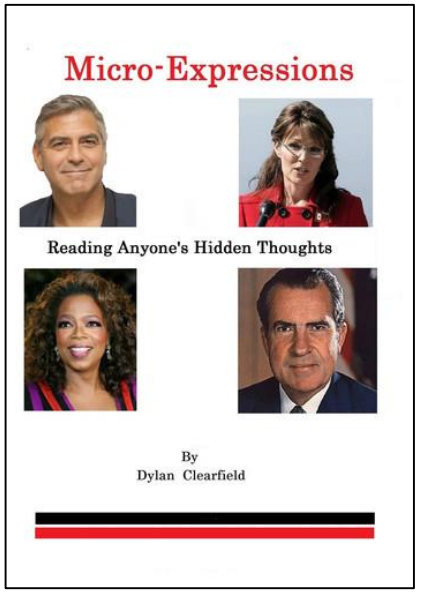


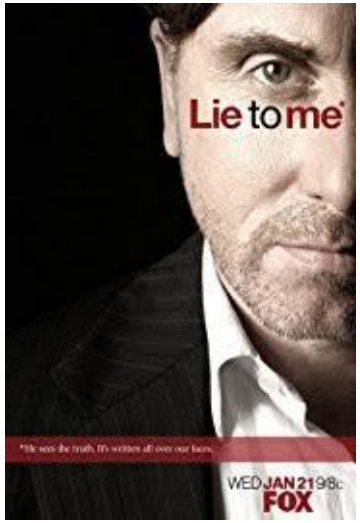


Books…
Movies…
Popular culture









Applications

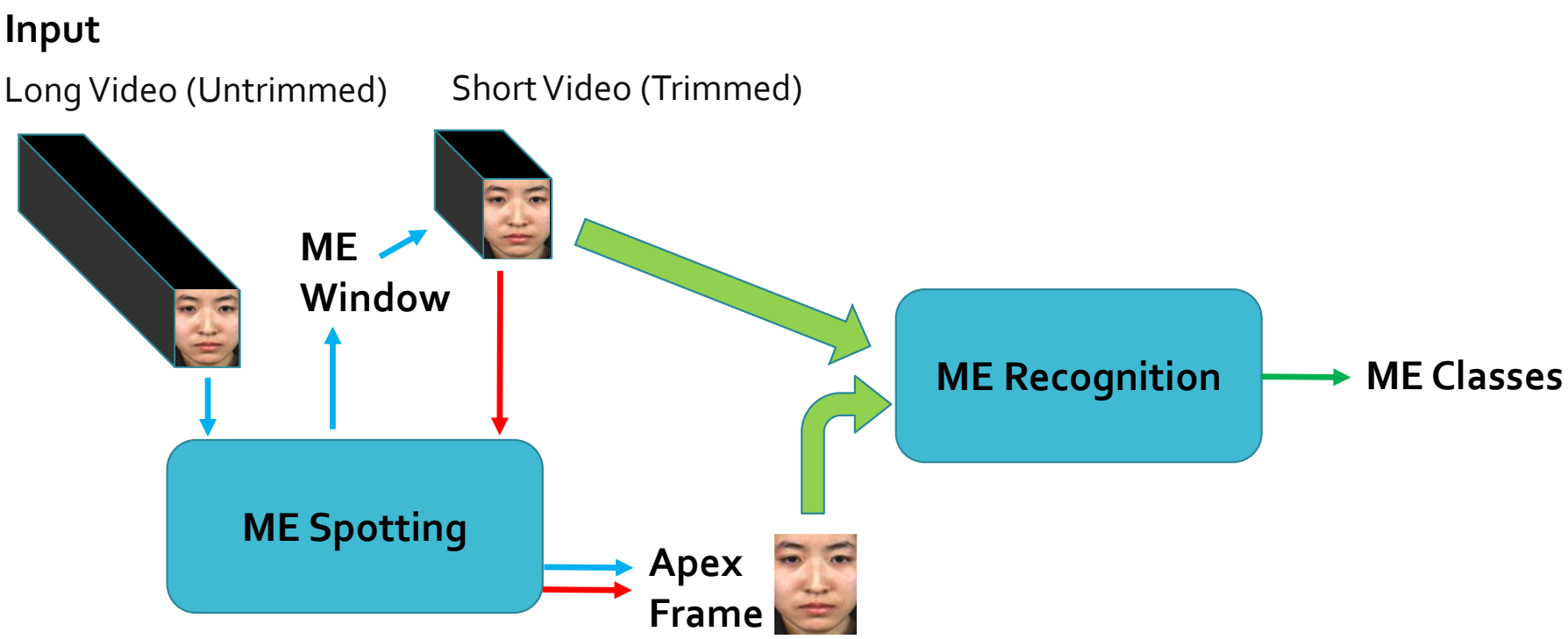
- Interviews
- Business Negotiations
- Criminal Interrogation
- Clinical Diagnosis
- Political Debates
- High-stakes Games (Poker, Game Shows etc.)

Can machines play a part?

- Micro-expressions are typically captured by high speed cameras and observed through replaying them at slower speeds
- Frank et al. (2009)'s Experiment: Performance of detecting MEs by people who undergo METT reach at most 40%, unaided US Coast Guards performed not more than 50% at best.

- **Can researchers in computer vision / video processing / machine learning help to automate the task?**

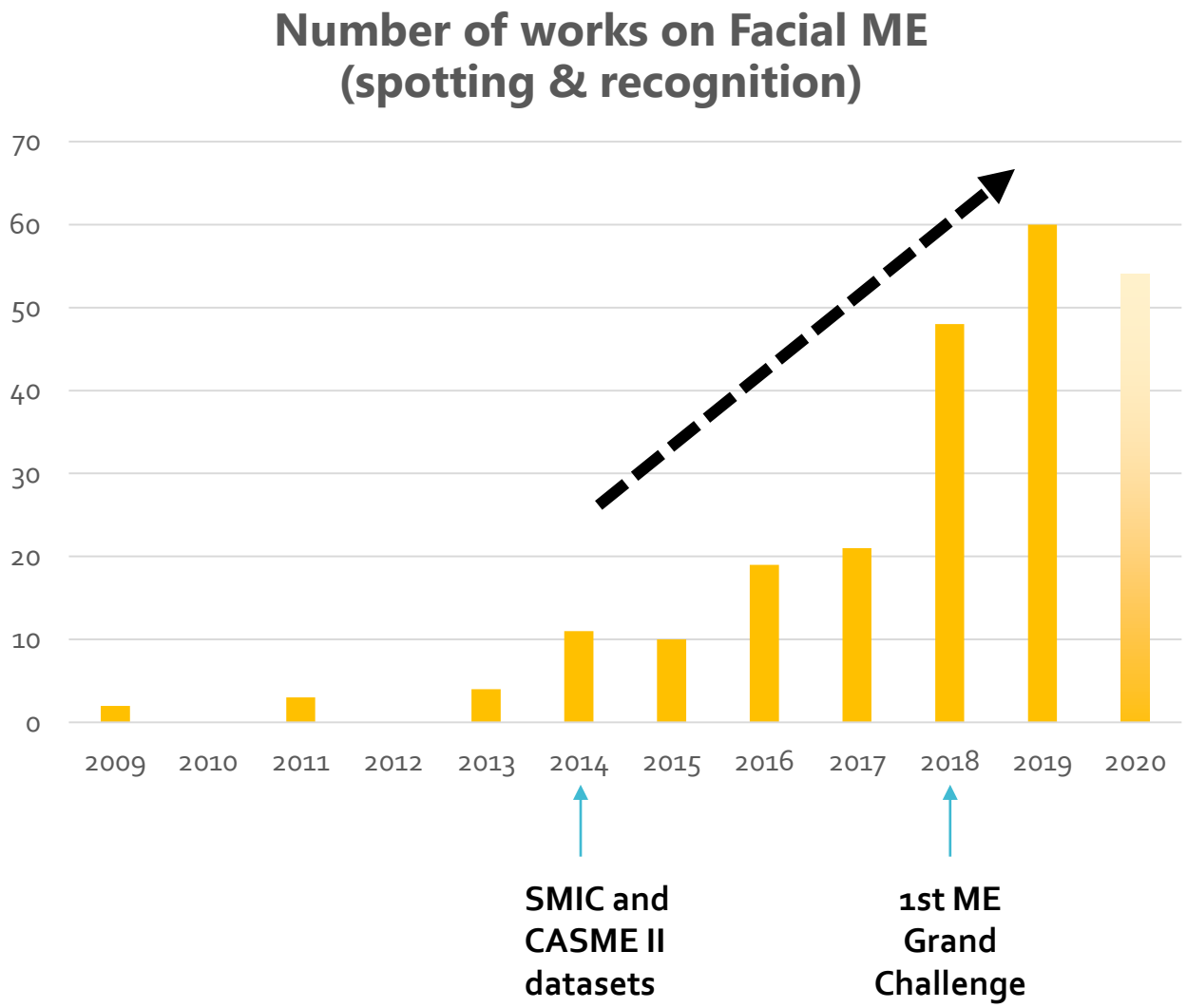
Micro-Expression Analysis Tasks



Facial Micro-Expression Analysis: Current State

- **A relatively "young" field**
  - Bloomed circa 2013-2014 with the establishment of spontaneous facial ME datasets from University of Oulu (SMIC) and the Chinese Academy of Sciences, China (CASME, CASME II)
- **Survey paper**:
  - "A Survey of Automatic Facial Micro-expression Analysis: Databases, Methods and Challenges", Oh et al., Frontiers in Psychology, 2018
- **Pipelines for ME spotting and recognition**
  - Known pipelines for these two tasks have been established
  - Merging them into a single seamless task is still challenging and a road less travelled (only 2 papers on this!)

Facial Micro-Expression Analysis: Current State of Interest



Survey Paper on Facial ME Analysis

frontiers in Psychology

REVIEW
published: 10 July 2018
doi: 10.3389/fpsyg.2018.01128

A Survey of Automatic Facial Micro-Expression Analysis: Databases, Methods, and Challenges

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Over the last few years, automatic facial micro-expression analysis has garnered increasing attention from experts across different disciplines because of its potential applications in various fields such as clinical diagnosis, forensic investigation and security systems. Advances in computer algorithms and video acquisition technology have

OPEN ACCESS

- Comprehensive review
- An updated survey expected in 2021
- **BOTH** spotting and recognition tasks covered
- Open Access!

End of Part 1

Questions?