Tutorial

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Facial Micro-Expression Analysis – A Computer Vision Challenge

I. Introduction & Overview

JOHN SEE Multimedia University, Malaysia

ANH CAT LE NGO TrustingSocial

SZE-TENG LIONG Feng Chia University, Taiwan

MMU
MULTIMEDIA UNIVERSITY

viprlab

Outline of Tutorial

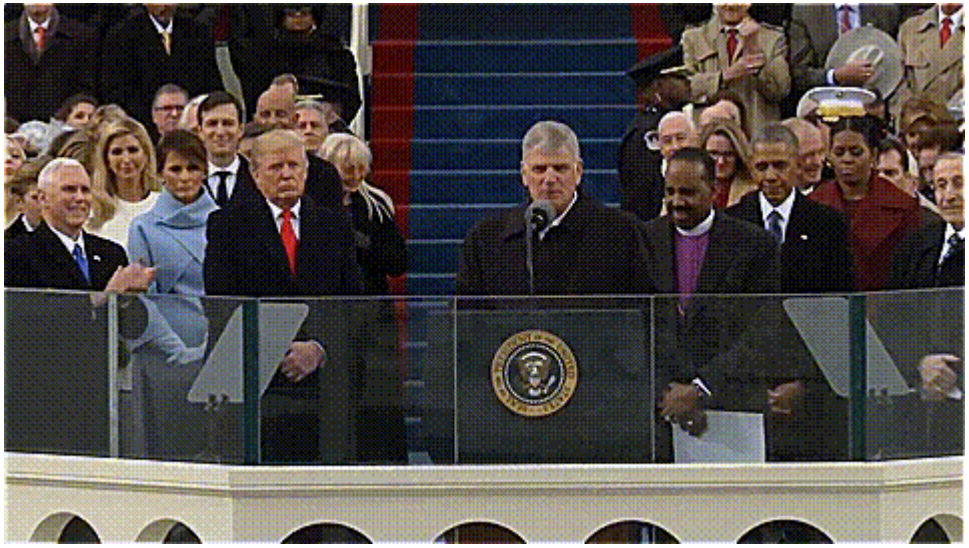
- **Part 1:** Introduction & Overview to Facial Micro-expression (ME) Analysis
- **Part 2:** ME Datasets
- **Part 3:** ME Spotting Task
- **Part 4:** ME Recognition Task
- **Part 5:** Challenges and Future Directions

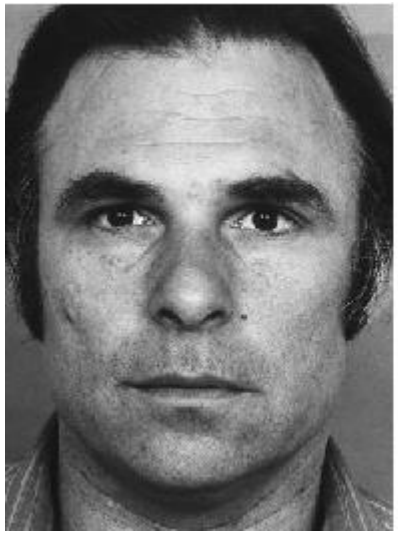
The Economist

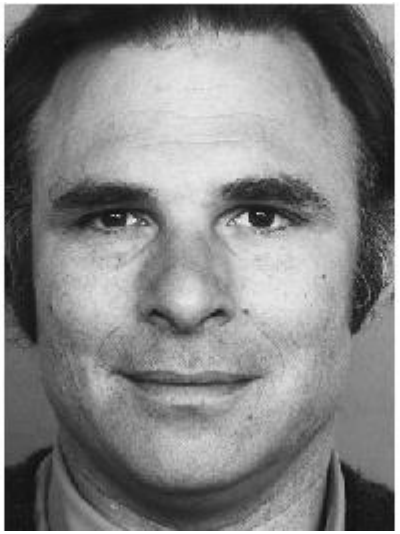
Clinton v Trump 1st debate

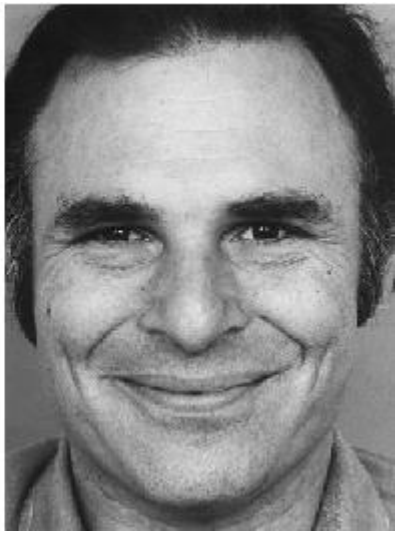
anger contempt sadness surprise

CREDIT : RBC NETWORK BROADCASTING









Neutral Non-Duchenne Smile Duchenne Smile

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.

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

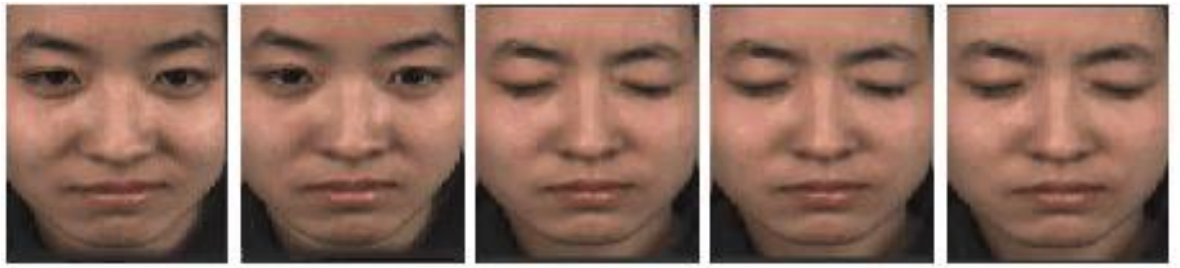
Porter, S., & ten Brinke, L. (2008). **Reading between the lies: Identifying concealed and falsified emotions in universal facial expressions.** Psychological Science.

Micro-Expressions

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

- The amygdala (the emotion center of the brain) responds appropriately to the stimuli that the individual experiences and the individual wishes to conceal this specific emotion.
- Results in the individual very briefly displaying their true emotions followed by a false emotional reaction (a return back to previous state)

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

Macro vs. Micro

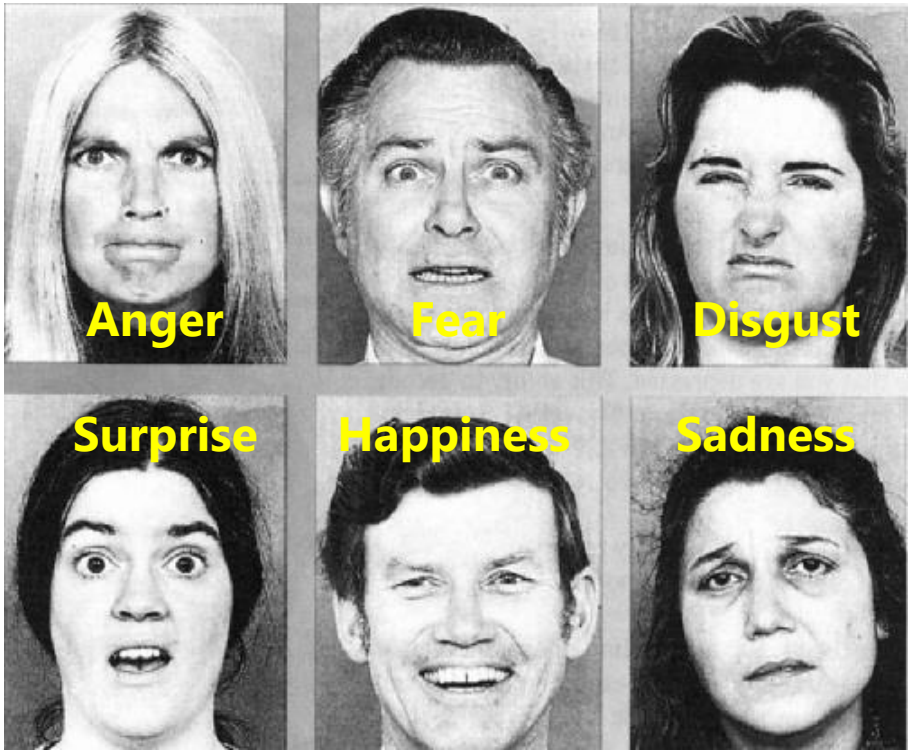
Macro-Expressions

- 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

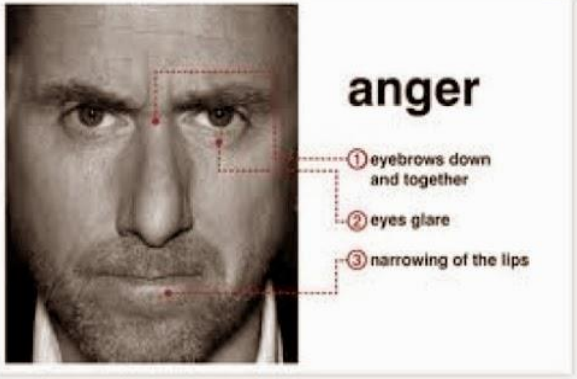
Universal Expressions of Emotion… as according to Ekman



Normal expressions

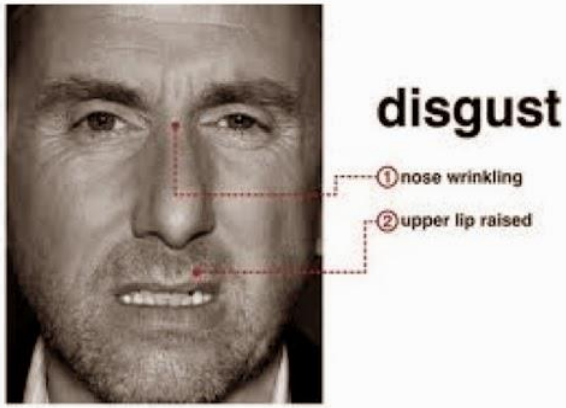
Micro-expressions

Microexpressions



anger

1. eyebrows down and together
2. eyes glare
3. narrowing of the lips

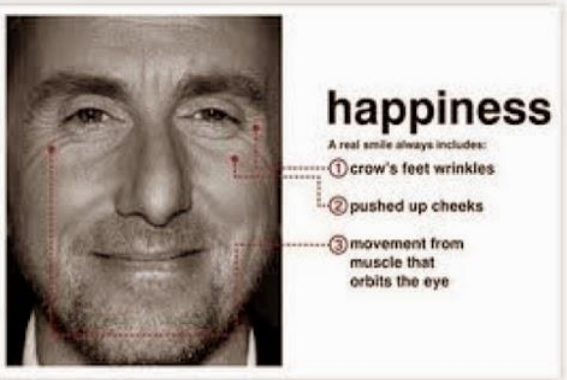


disgust

1. nose wrinkling
2. upper lip raised

fear

1. eyebrows raised and pulled together
2. raised upper eyelids
3. tensed lower eyelids
4. lips slightly stretched horizontally back to ears



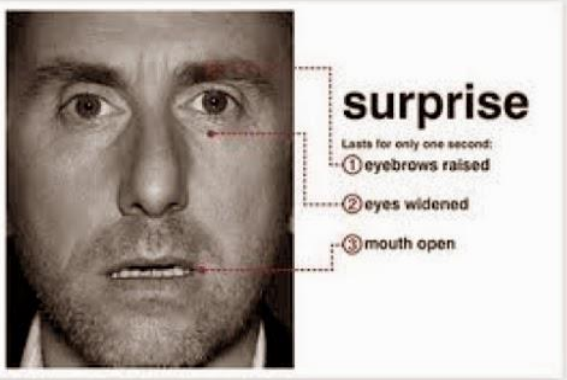
happiness

A real smile always includes:

1. crow's feet wrinkles
2. pushed up cheeks
3. movement from muscle that orbits the eye

sadness

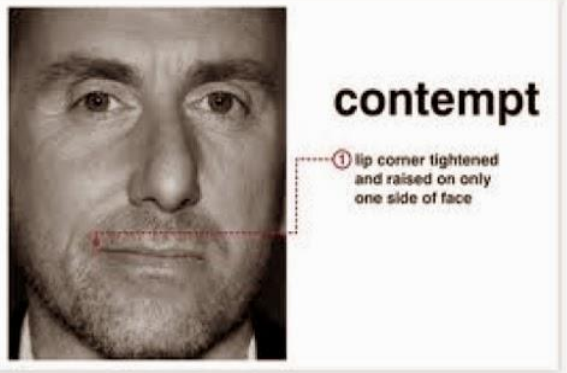
1. drooping upper eyelids
2. losing focus in eyes
3. slight pulling down of lip corners



surprise

Lasts for only one second:

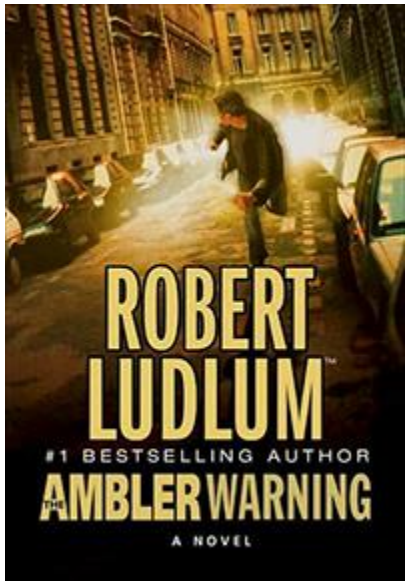
1. eyebrows raised
2. eyes widened
3. mouth open

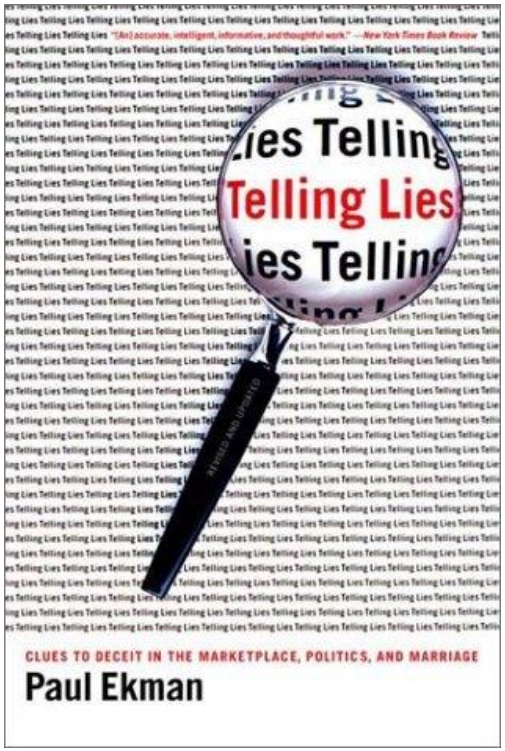


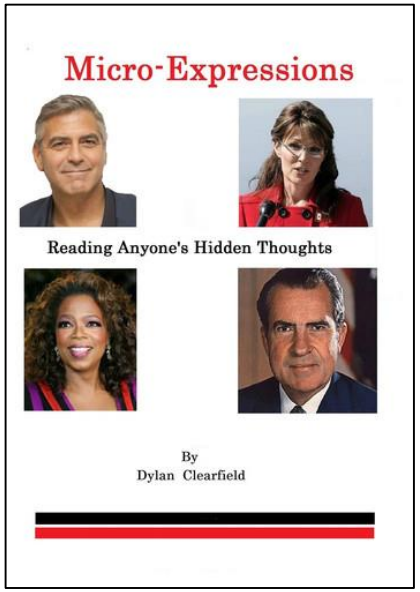
contempt

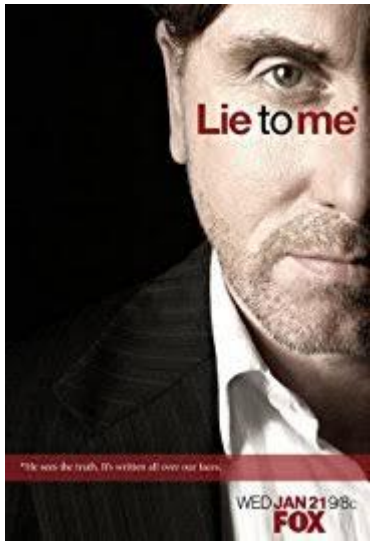
1. lip corner tightened and raised on only one side of face

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?

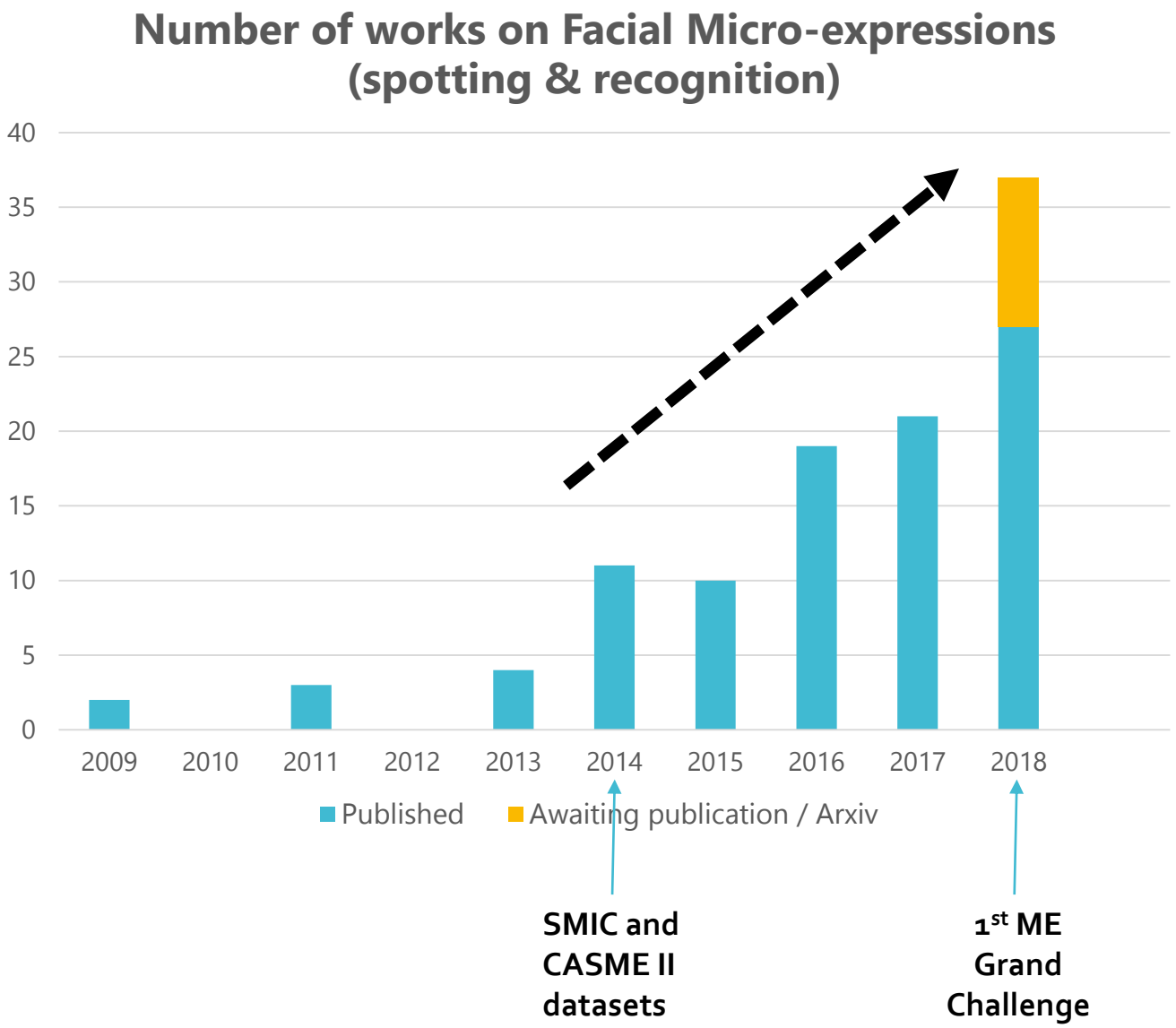
- Micro-expressions are typically captured by high speed cameras and observed through replaying them at slower speeds
- Frank et al. (2009)'s Experiment: Performance of detecting MEs by people who undergo METT reach at most 40%, unaided US Coast Guards performed not more than 50% at best.

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

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



End of Part 1

Questions?