Facial Emotion Detection

https://www.edps.europa.eu/system/files/2021-05/21-05-26\_techdispatch-facial-emotion-recognition\_ref\_en.pdf

Motivation

FER is a technology used for analysing sentiments across different sources primarily image and videos. It is primarily used in the fields of psychology and human-computer interaction with a multitude of various applications ranging from **personalised services**, **customer behaviour analysis**, **healthcare**, **employment**, **education**, **public** **safety**, **crime detection**.

* **Personalised Services** – Analyse emotions to display personalised messages, provide music recommendations etc.
* **Customer Behaviour Analysis** – Showing specific adverts based on emotion analysis.
* **Healthcare** – Detecting neurodegenerative diseases, predict psychotic disorders, suicide prevention and patient observation.
* **Employment** – Monitor employee attention and mood.
* **Education** – Design effective tutoring systems, detect engagement in online learning.
* **Public Safety** – Predictive screening of public spaces to identify emotions triggering potential terrorist threats
* **Crime Detection** – Spot shoplifters

These implementations come with a variety of issues such as Privacy Risks, Accuracy and Bias and Emotional Misinterpretation:

* **Privacy Risks**: FER involves analysing sensitive biometric data, raising concerns about individuals' privacy and the potential for unauthorised data use.
* **Accuracy and Bias**: FER algorithms may suffer from inaccuracies and biases, particularly against certain ethnic groups or skin colours, leading to unfair profiling and discrimination.
* **Emotional Misinterpretation**: The technology may misinterpret emotions due to contextual factors, resulting in erroneous conclusions that can affect individuals' lives negatively.

Your Research Topic

How does it work?

**FER** works following a 3-step process, face detection -> facial expression detection -> emotion classification. The face detection component can be omitted in certain cases based on how the visual data is provided.

* **Detection:** Locating the face in a scene.
* **Feature Extraction:** Mapping key facial landmarks (e.g., eyes, mouth, eyebrows) using deep learning techniques like Convolutional Neural Networks (CNNs).
* **Classification:** Assigning emotional labels based on models such as Ekman’s six (or more) basic emotions.

A person with facial expression

AI-generated content may be incorrect.

Possible applications?

Solving Real-World Problems (Reference Things Mentioned in Section 1):

* Enhancing human-computer interaction by making systems that adapt to our emotional states.
* Supporting mental health interventions, improving learning environments, and even boosting public safety by analysing group sentiments.

Potential Benefits:

* More personalised digital experiences and smarter automated systems.
* Applications in fields as varied as healthcare, education, marketing, and law enforcement.

How can it make the world a better place?

Prior to making the world a better place **FER** needs to tackle a variety of crucial challenges relating to privacy protection, reducing algorithmic bias, and refining emotion interpretation. Furthermore, rule and regulations ought to be put in place to limit the applicability of this technology. Given that these hurdles are overcome **FER** can be an empowering technology allowing us to better understand human emotion resulting in improved communication, safety, and personalised service, while ensuring fairness and privacy.

Your Aim and Objectives

**My Motivation**

I was motivated to investigate this FER topic and its various implementations as emotional because human emotional expressions are full of subtle nuances and micro expressions that can entirely change the meaning of an interaction. Although this is something that we as human learn to pick up on throughout our lives, I wanted to understand what techniques are present in this field and if any deal with emotional expression to this level of scrutiny.

**Explore**

Although my thesis isn’t directly tied to this field of study it would prove interesting to dive deeper into field not only in terms of improving or building up on existing techniques but also exploring how FER has been or can be integrated with other techniques such as pose estimation, voice processing and the like to extract a greater degree of emotional data with greater accuracies.

~~Even though my thesis is not directly focused on FER, I’m eager to explore how existing techniques can be refined and how FER can be integrated with other modalities—such as pose estimation and voice processing—to extract richer and more accurate emotional data.~~

**Curiosities**  
I am particularly curious about how FER technology might eventually be integrated into robotics, enabling the development of lifelike humanoid robots capable of understanding and responding to human emotions

**My Expected Outcomes**  
For this project, my goal is to identify the best state-of-the-art model that delivers the highest accuracy across diverse applications. I also aim to contribute insights into how multimodal integration can further enhance emotion recognition performance.

**My Motivation**  
I was inspired to investigate facial emotion recognition because human emotional expressions are full of subtle nuances and micro expressions that can entirely change the meaning of an interaction. Although we naturally learn to interpret these cues throughout our lives, I wanted to delve into the techniques used in this field to see if any capture this level of subtlety.

**What I Want to Explore**  
Even though my thesis is not directly focused on FER, I’m eager to explore how existing techniques can be refined and how FER can be integrated with other modalities—such as pose estimation and voice processing—to extract richer and more accurate emotional data.

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