



**HAL**  
open science

# Driver's Facial Expression Recognition: Enhancing Road Safety through Advanced Technology

Ibtissam Saadi, Douglas W. Cunningham, Yassin El Hillali, Abdelmalik Taleb-Ahmed, Abdenour Hadid

► **To cite this version:**

Ibtissam Saadi, Douglas W. Cunningham, Yassin El Hillali, Abdelmalik Taleb-Ahmed, Abdenour Hadid. Driver's Facial Expression Recognition: Enhancing Road Safety through Advanced Technology. Mardi des chercheurs 2023, Jun 2023, Valenciennes, France. hal-04303817

**HAL Id: hal-04303817**

**<https://hal.science/hal-04303817v1>**

Submitted on 23 Nov 2023

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



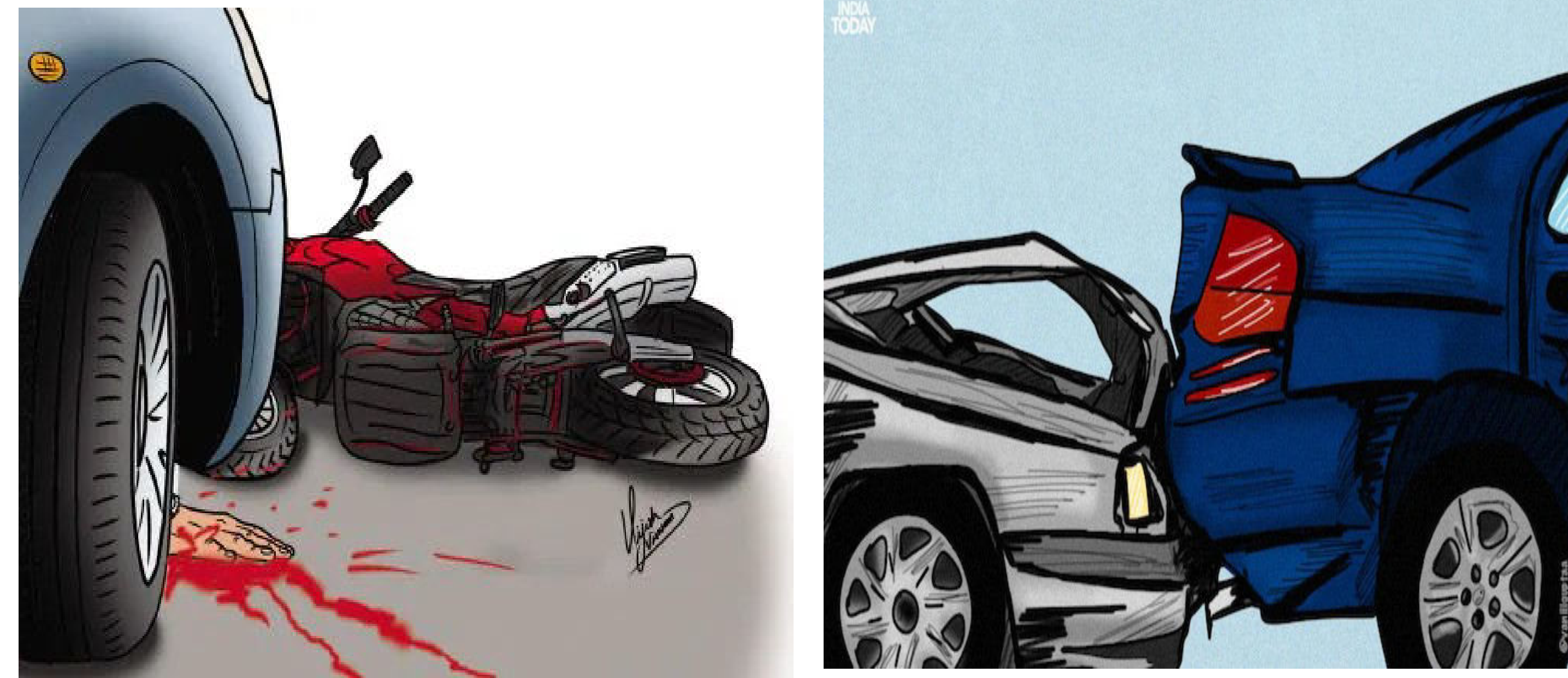
# Driver's Facial Expression Recognition: Enhancing Road Safety through Advanced Technology

Ibtissam saadi<sup>1,2</sup>, Douglas Cunningham<sup>1</sup>, Yassin El Hillali<sup>2</sup>, Abdenour Hadid<sup>3</sup>, Abdelmalik Taleb-Ahmed<sup>2</sup>.

Brandenburg University of Technology Germany<sup>1</sup>, Laboratory of IEMN, CNRS Univ of polytechnique-Hauts-de-France <sup>2</sup>, Sorbonne University Abu Dhabi<sup>3</sup>.

## Abstract

- Road safety worldwide is a major concern due to human factors like driver errors and inattentiveness.
- Driver facial expression recognition (DFER) technology offers a promising solution to enhance road safety.
- DFER provides valuable information about the driver's cognitive and emotional state, including anger, disgust, fear, happy, sad, surprise, and neutral.
- DFER enables proactive vehicle responses and assists advanced monitoring systems like Advanced Driver Assistance System (ADAS).
- Implementation of DFER systems is crucial for preventing risks and promoting safer road environments for all users.



## 1. Objectives

- Develop an accurate and efficient driver facial expression recognition system.
- Improve road safety by mitigating the potential risks caused by human errors.

## 2. Methodology Overview

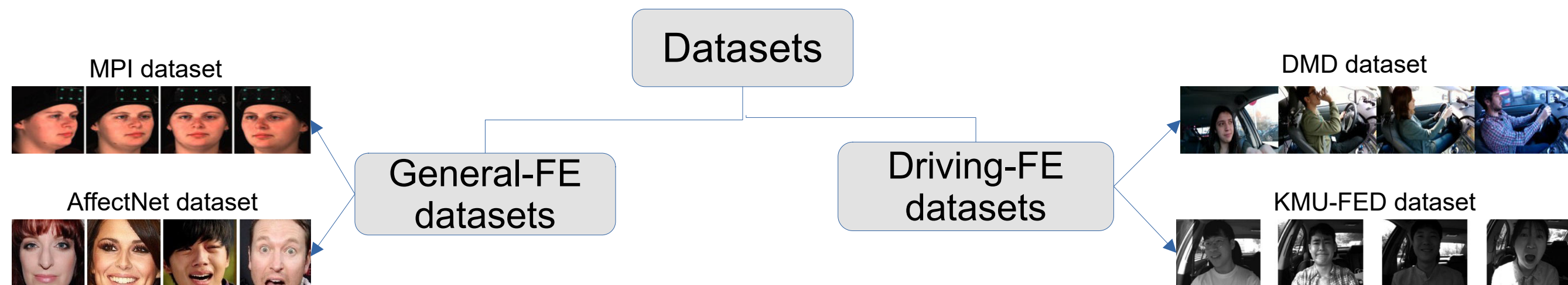


Fig.1 The datasets used in the literature.

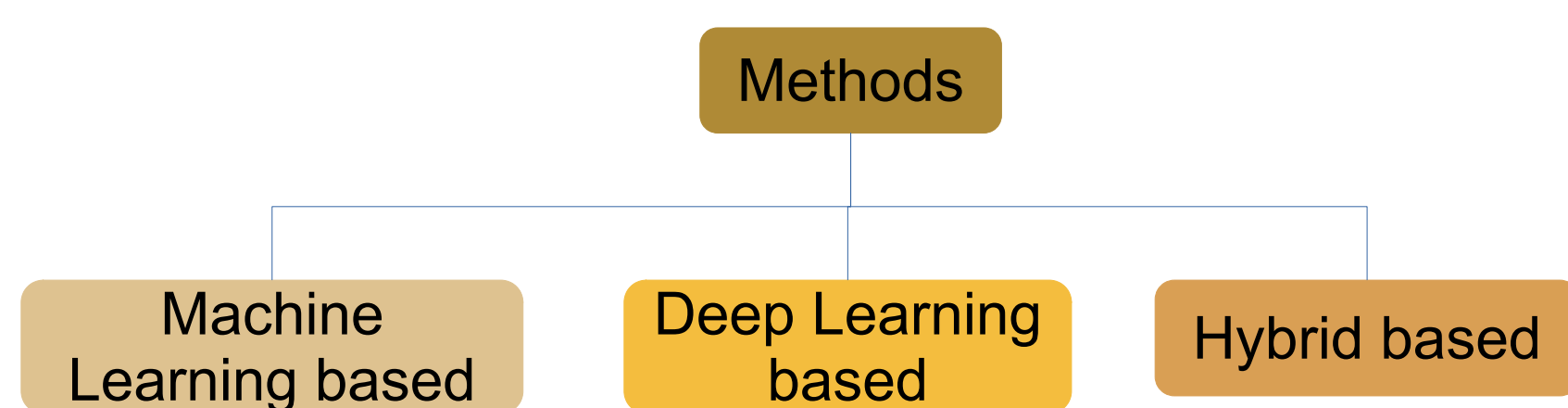


Fig.2 The different methods used in DFER system.

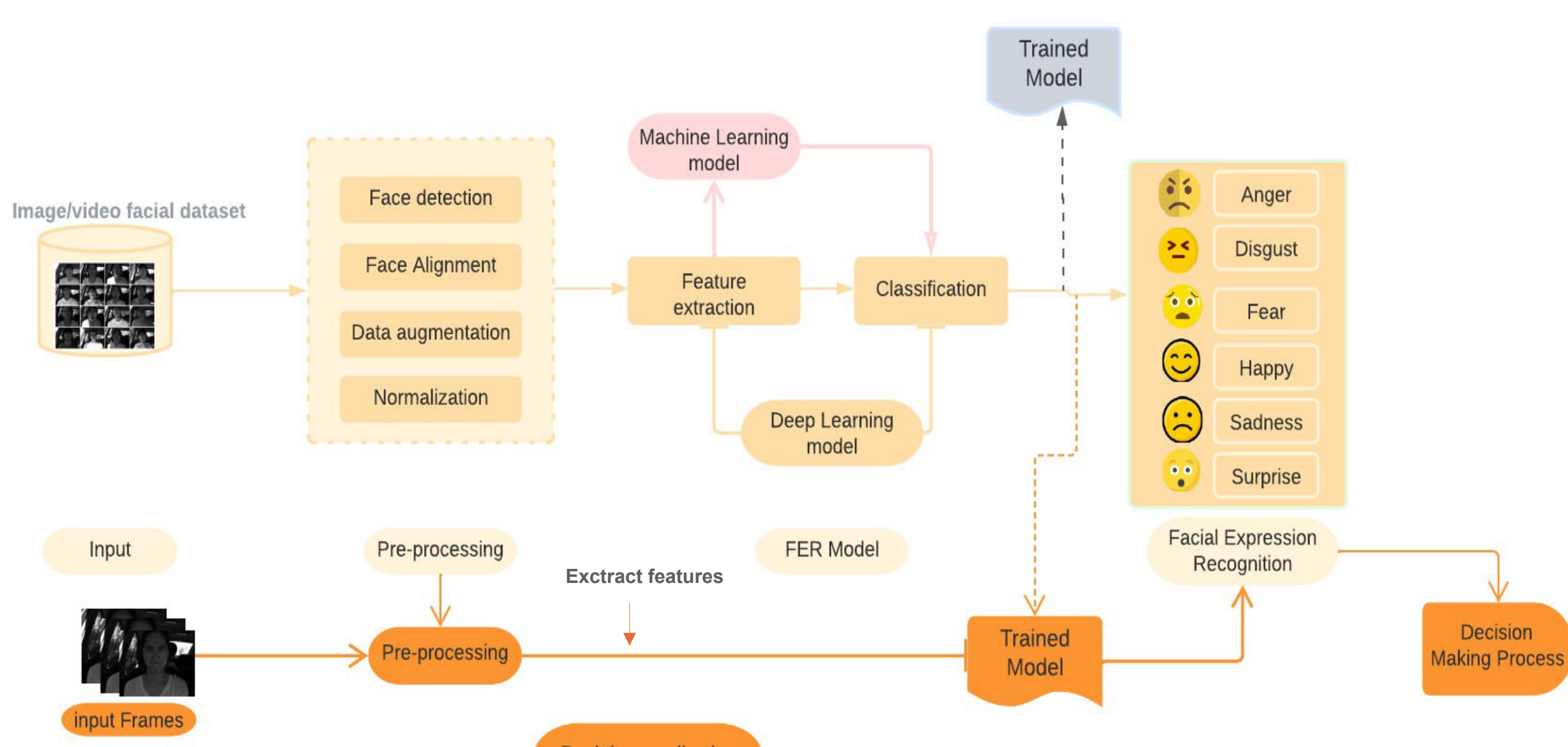


Fig.3 The pipeline for build DFER system

## 3. Experiments

### 1. Dataset

- We used KMU-FED dataset.
- Contains a total of 1106 facial expressions.
- Six basic expressions: anger, disgust, fear, happy, sadness, and surprise.



Samples from KMU-FED dataset.

## 2. proposed system

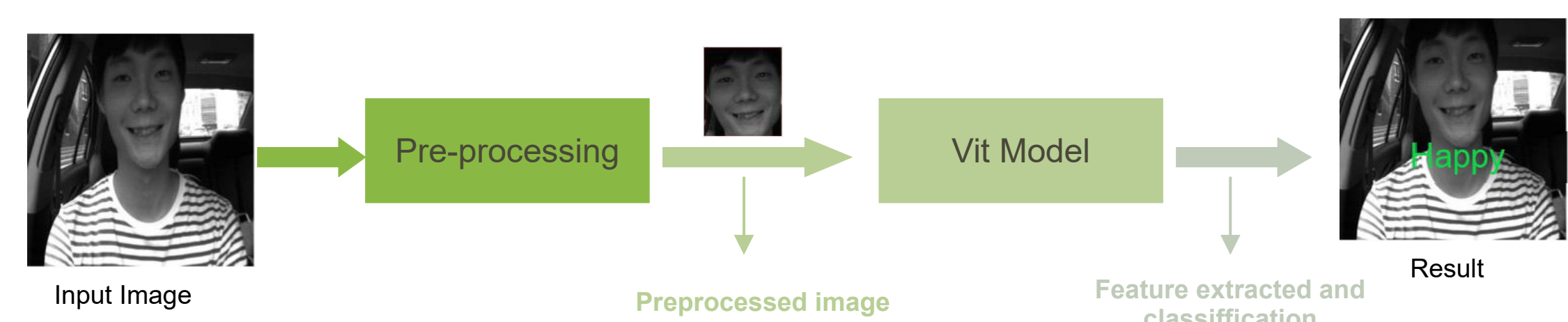
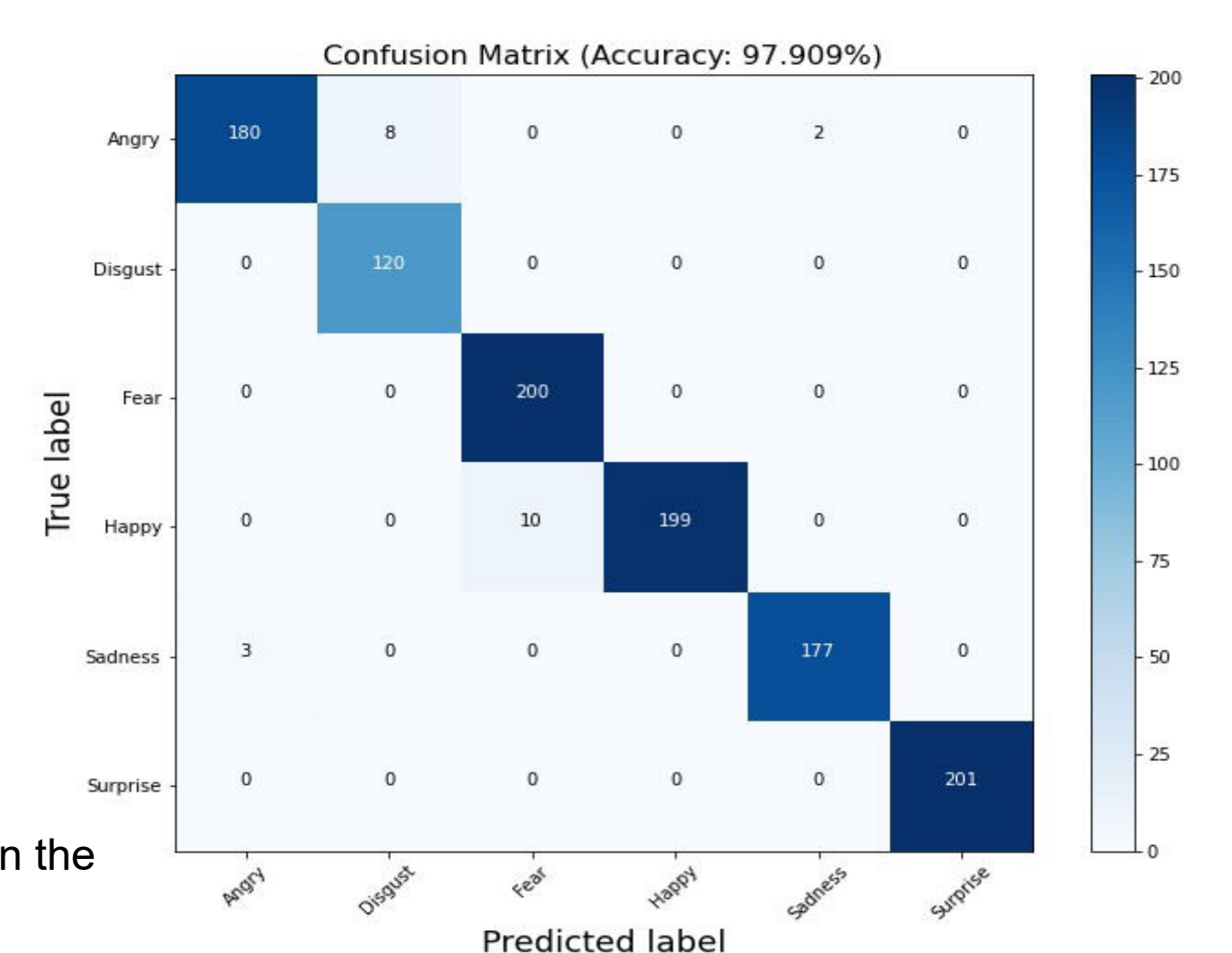


Fig.4 General Workflow of the proposed system

## 3. Results and discussion

Methods	Accuracy
LMRF [1]	95.1%
Hierarchical WRF [2]	94.7%
Modified SqueezeNet 1.1 [3]	83.43%
Our Method	<b>97.9 %</b>

Table.1 Comparison of the proposed method with state-of-the-art methods on the KMU-FED dataset.



- The proposed method outperforming the SOTA methods.
- The proposed method performs well on real driving environment.
- Fear and surprised expressions are predicted with zero error rate.



## 4. Conclusion

- Driver facial expression recognition technology offers promising potential to improve road safety.
- Accurately detecting and recognizing facial expressions provides valuable insights into the driver's cognitive and emotional state.
- Various methods and datasets have been employed to develop effective driver facial expression recognition systems.

### Future work

- Implement the system in real time on embedded systems.
- Investigate the fusion of facial expression recognition with other modalities such as voice analysis, and physiological signals.
- development of larger, diverse, and well-annotated datasets.

## References

- [1] Jeong, M., Nam, J., & Ko, B. C. (2020). Lightweight multilayer random forests for monitoring driver emotional status. *Ieee Access*, 8, 60344-60354.
- [2] Jeong, M., & Ko, B. C. (2018). Driver's facial expression recognition in real-time for safe driving. *Sensors*, 18(12), 4270.
- [3] Sahoo, G. K., Das, S. K., & Singh, P. (2022, May). Deep Learning-Based Facial Emotion Recognition for Driver Healthcare. In *2022 National Conference on Communications (NCC)* (pp. 154-159). IEEE