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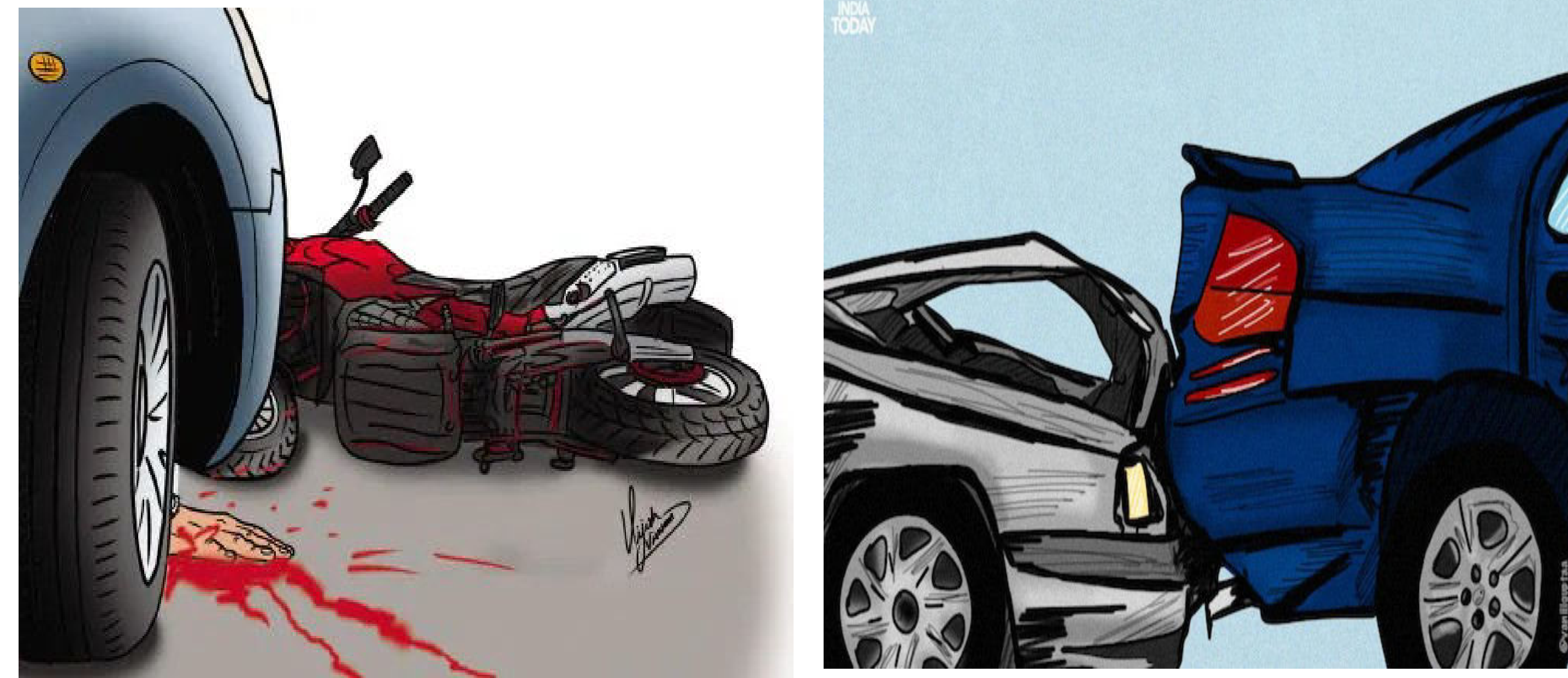
# Driver's Facial Expression Recognition: Enhancing Road Safety through Advanced Technology

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

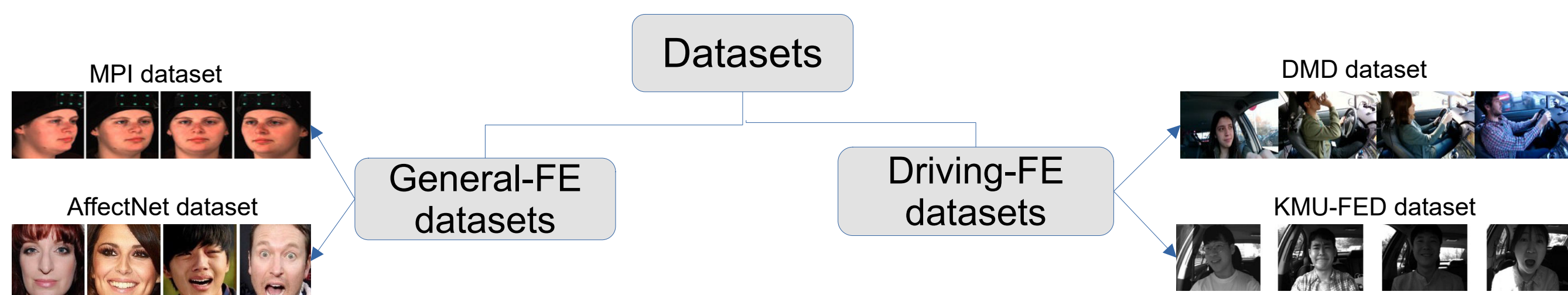


Fig.1 The datasets used in the literature.

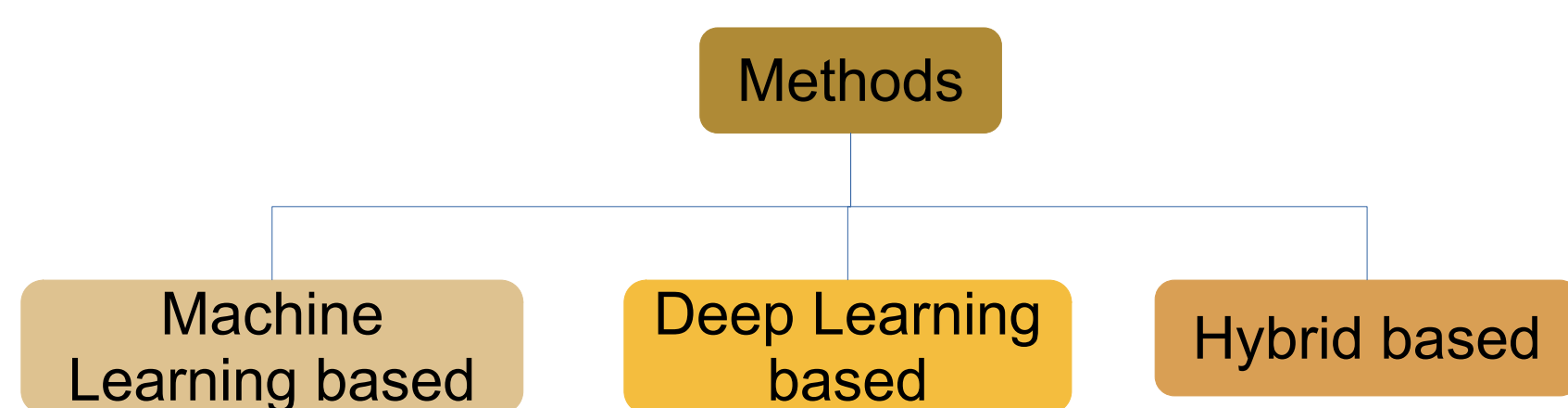


Fig.2 The different methods used in DFER system.

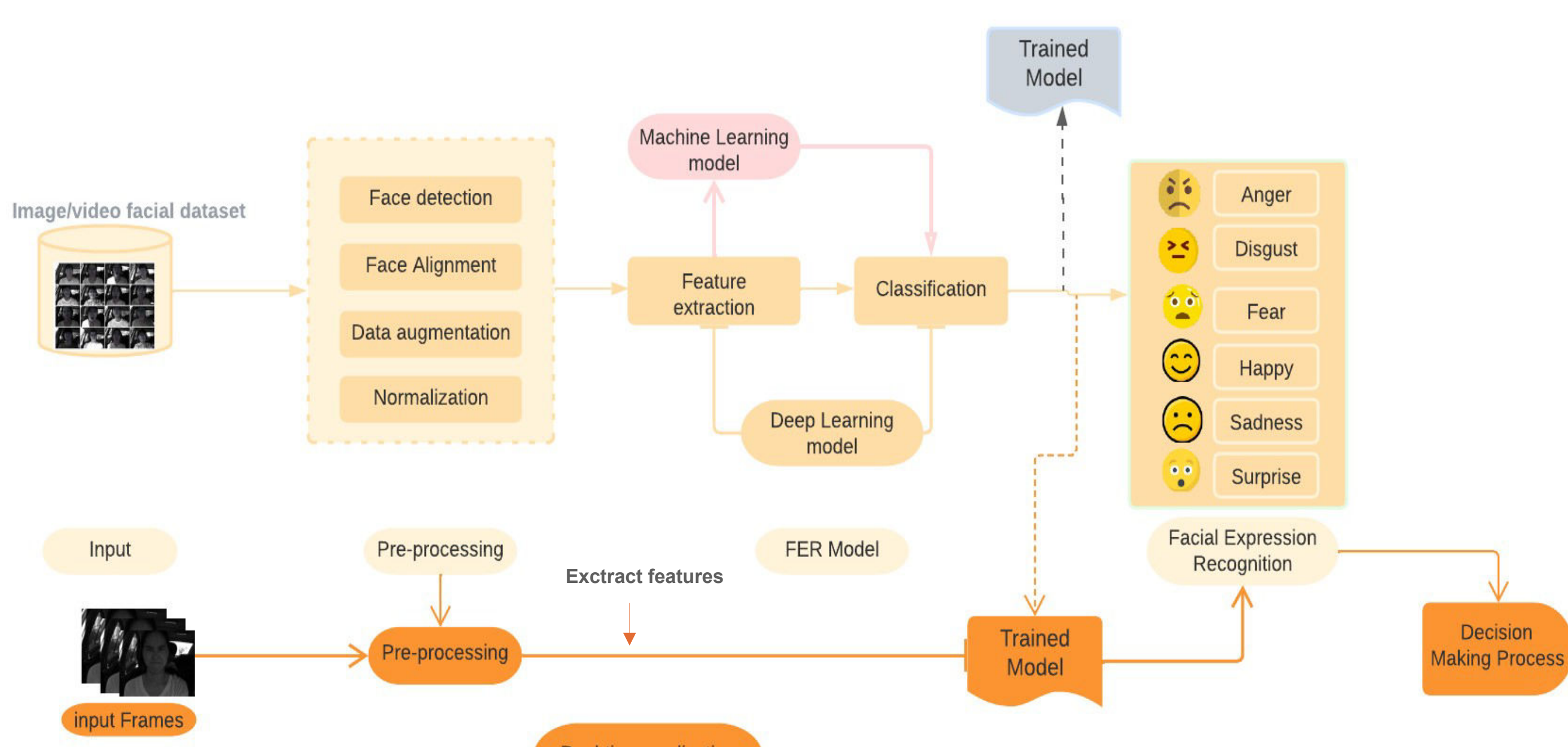


Fig.3 The pipeline for build DFER system

## 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

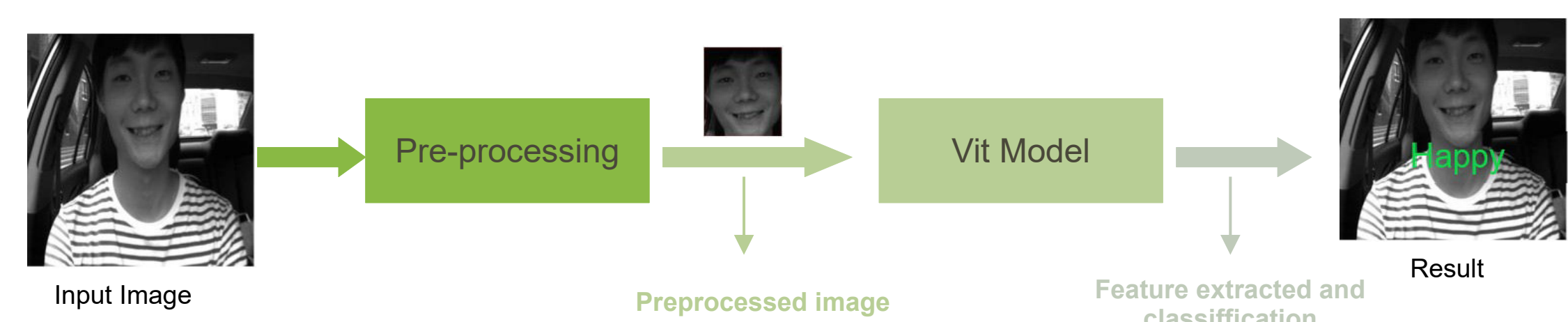
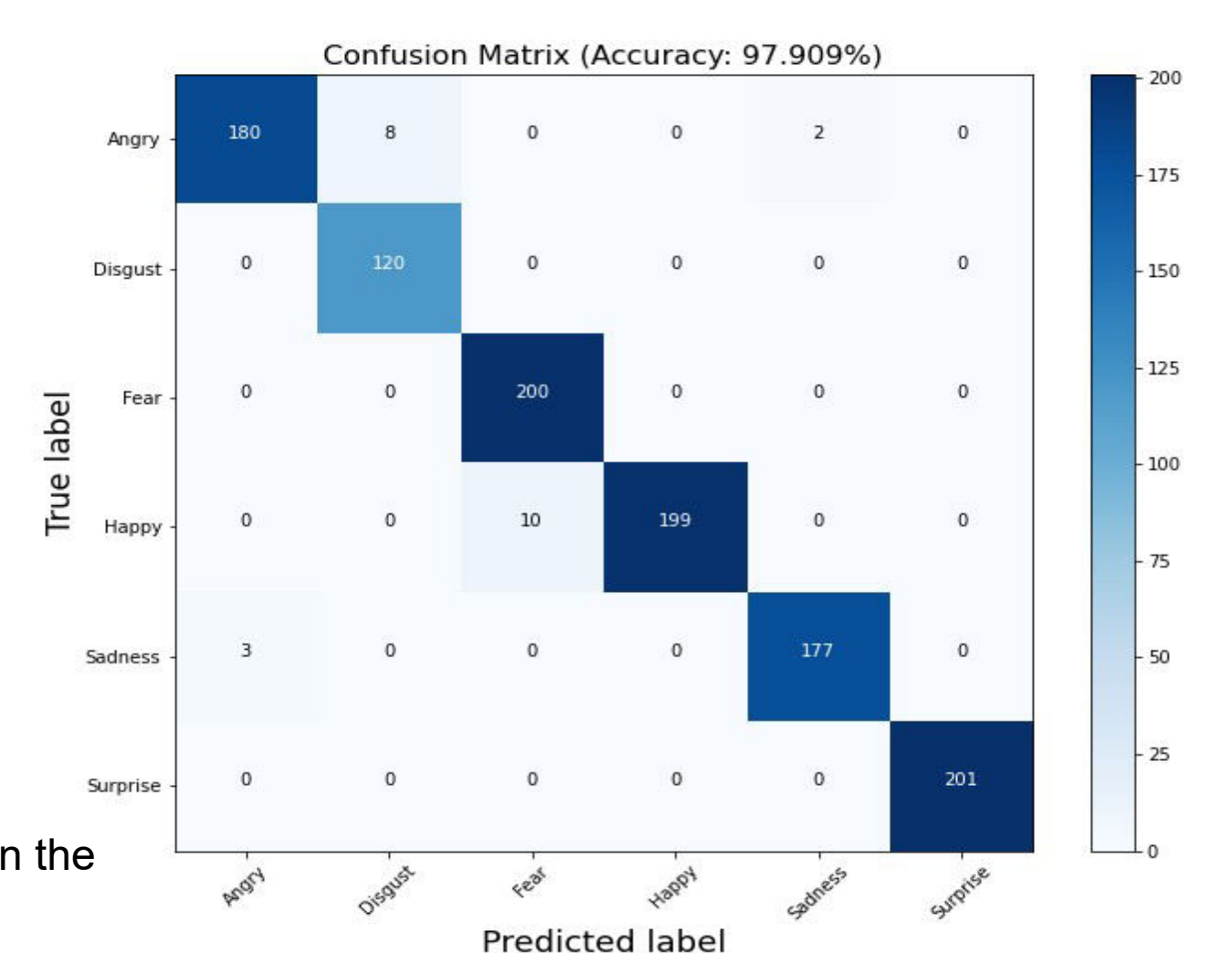


Fig.4 General Workflow of the proposed system

## 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.
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- [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