

Development of a Real-time Facial Expression Recognition System

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Description:

Facial expression recognition has a wide range of applications, including human–computer interaction, advertising, and entertainment. This project focuses on **detecting and analyzing human emotions through facial expressions**. Various **facial features and deep learning models** will be studied to enhance recognition accuracy. To further improve performance, **attention mechanisms** will be applied to facial images and videos. Additionally, **lightweight models** will be developed to optimize efficiency while maintaining accuracy. By the end of the project, a system capable of real-time facial expression recognition will be implemented.

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- Human beings express emotions through facial expressions in daily communications
- Understanding these emotions and knowing how to react to people's expressions greatly enrich human-computer interaction



Happiness



Sadness



Fear



Surprise



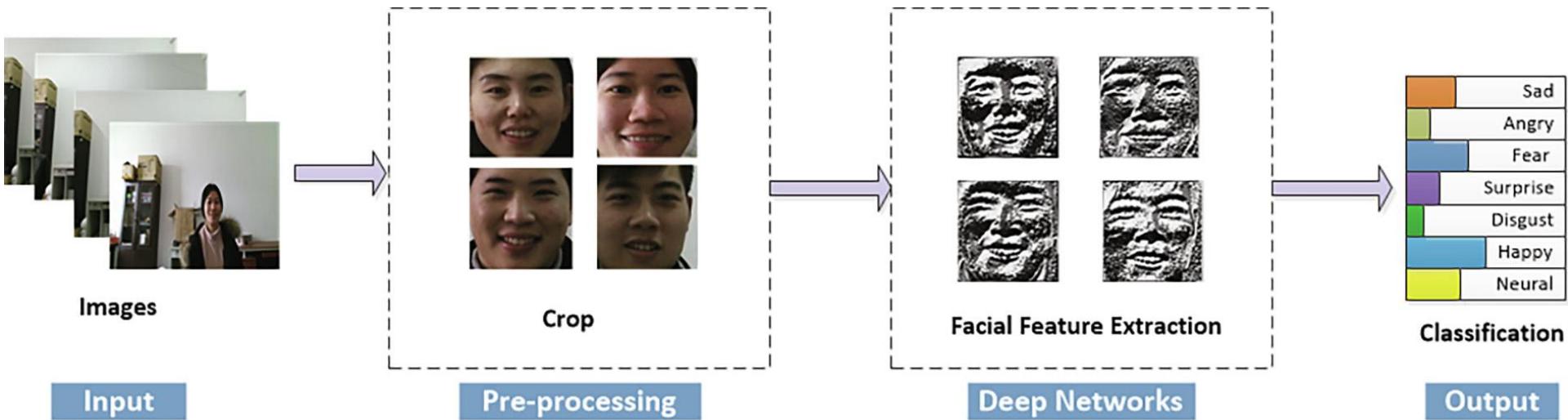
Disgust



Anger

Ekman's six basic expressions
(the neutral expression not included)

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- To perform facial expression recognition:
 1. Face detection
 2. Deep feature extraction (attention mechanisms, knowledge distillation to learn from a teacher network, advanced models)
 3. Classification

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1. Study deep learning-based facial expression recognition methods
2. Study different attention mechanisms/knowledge distillation methods to enhance facial expression recognition methods
3. Identify at least two datasets for your project
4. Investigate and evaluate at least three facial expression recognition methods
5. Explore techniques to enhance the performance of existing facial expression recognition methods (optional)
6. Present at least one paper on facial expression recognition in October 2025

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Papers:

1. Shan Li and Weihong Deng, "Reliable Crowdsourcing and Deep Locality Preserving Learning for Unconstrained Facial Expression Recognition," *IEEE Trans. on Image processing*, vol. 28, no. 1, pp. 356-370, 2019.
2. Jing Li, Kan Jin, Dalin Zhou, Naoyuki Kubota, and Zhaojie Ju, "Attention mechanism-based CNN for facial expression recognition," *Neurocomputing*, vol. 411, 21, pp. 340-350, October 2020.
3. Yan Chen, Kexuan Li, Feng Tian, Ganglin Wei, and Morteza Seberi, "Lightweight expression recognition combined attention fusion network with hybrid knowledge distillation for occluded e-learner facial images," *Neurocomputing*, vol. 411, Pages 340-350, 2020.
4. Fuyan Ma, Bin Sun, and Shutao Li, "Facial Expression Recognition With Visual Transformers and Attentional Selective Fusion," *IEEE Trans. on Affective Computing*, vol. 14, no. 2, pp. 1236-1248, 2023.
5. Rui Zhao, Tianshan Liu, Zixun Huang, Daniel P.K. Lun, and Kin-Man Lam, "Spatial-Temporal Graphs Plus Transformers for Geometry-guided Facial Expression Recognition," *IEEE Trans. on Affective Computing*, vol. 14, no. 4, pp. 2751-2767, October-December 2023.

Thank you