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# Facial Emotion Filters Based on Deep learning and Computer Vision

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**ABSTRACT:**

In the contemporary digital world, the importance of facial filters has grown. With the help of these tools, users can experiment with various visual styles, showcase their creativity, and make amusing changes to their pictures and movies. Face filters use image processing and computer vision models to alter a video feed in real-time. The project involves pre-processing techniques such as normalization, cropping, and resizing of the images to ensure consistency and reduce noise in the dataset, selection of an appropriate machine learning model to classify facial emotions, such as Convolutional Neural Networks (CNNs), Facial Landmark Detection models. The project should include training the selected model using the pre-processed dataset and optimizing its hyperparameters to achieve the desired performance.
**Keywords**: Computer Vision, CNN, Facial Landmark Detection models, Image processing models, normalization, hyperparameters.

## 1. INTRODUCTION

With facial filters, users may freely express themselves in the modern digital environment by experimenting with different aesthetics and expressing their mood, personality, or hobbies. Face filters can boost user engagement and platform usage since individuals are more willing to share changed photos and videos with their friends and followers on social media. Companies and brands may utilise these filters to create appealing and distinctive marketing campaigns and increase brand recognition. They are a cutting-edge use of technology that demonstrates the artistic possibilities of the digital sphere. Users may have fun and take part in exciting activities alone or with friends by using facial filters.

Human communication relies heavily on facial expressions, but many people struggle to communicate their feelings clearly. In both social and professional contexts, this may result in misunderstandings, miscommunications, and emotional disengagement. To solve this problem, we want to create an application that can recognise and understand facial expressions in real-time while also applying the proper filters to strengthen the emotional information being sent.

## 2. OBJECTIVE

Face filters are being used more often on social media sites, and there is rising worry about how they may affect people and society. Despite the fact that some face filters are intended for amusement or self-expression, others might encourage unattainable beauty standards, alter how people see themselves and others, and increase social comparison and anxiety.

Furthermore, it is yet unknown how long-term use of face filters would affect both body image and emotional wellbeing. So, the challenge is to comprehend the possible advantages and disadvantages of face filters and to create rules and regulations to encourage their responsible usage and lessen their detrimental effects on people and society. This issue statement calls for study that looks at how face filters affect how people perceive themselves, interact with others, and feel emotionally. It also calls for the creation of measures to encourage digital literacy and the responsible and moral usage of face filters online.
The most common capability of today's filter systems is the ability to choose from a selection of built-in filters. In order to identify the underlying emotions on a person's face and apply a matching filter based on those emotions and the user's mood, the project intends to build a comprehensive Filter application model. This will increase user engagement and offer a sense of relaxation. The objective of this project, that involves creating face filters based on emotions, would be to develop a set of augmented reality filters that can recognize and respond to different emotional states in real-time.

The overall goal of this project is to develop a distinctive and ground-breaking application that may provide users a fresh means of self-expression while displaying the potential of cutting-edge computer vision and augmented reality technology.

## 3. LITERATURE SURVEY

"The Perception and Impact of Face Filters on Self-Representation and Social Interaction" by Alharbi et al. (2021) - This study investigated how face filters affect how people display themselves and connect with others on social media sites. Face filters, according to the study's findings, may drastically affect one's sense of self and have an influence on social interaction in both good and negative ways.

"Face Filter Effects on Perceived Attractiveness, Trustworthiness, and Competence" by Baranowski and Hecht (2020) - This study looked at how perceived competence, trustworthiness, and beauty were affected by face filters. The effects of face filters on these three aspects of perception vary depending on the type of filter employed, the researchers discovered.

"Do You See What I See? The Effects of Filters on Self-Perception and Social Comparison" by Fardouly et al. (2020) - This study looked at how facial filters affect how people see themselves and how they compare to others. Face filters, according to the study's findings, can have a detrimental impact on one's self-esteem and body image as well as contribute to unrealistic beauty standards.

"The Effect of Social Media Filters on Emotional Contagion" by Kim and Kim (2021) - This study looked at how face filters affect the spread of emotional contagion on social media. The study's findings revealed that filters can influence emotional contagion by boosting happy feelings while dampening negative ones.

"Me, Myself, and My Avatar: The Influence of Avatar-Based Filters on Self-Presentation and Social Interaction" by Wang et al. (2021) - This study investigated how self-presentation and social interaction on social media platforms are impacted by avatar-based filters. Researchers discovered that avatar-based filters may have a major impact on how

one presents themselves and can have both beneficial and detrimental impacts on social interaction.

These research collectively demonstrate that face filters may significantly affect how one perceives oneself, interacts with others, and spreads emotions. The type of filter employed and the environment in which it is applied may have an impact on the results.

## 4. METHODOLOGY

The method section of this study consists of four major steps:

1) Data Set Collection
2) Data Pre-Processing
3) Transfer Learning (Tuning weights)
4) Applying Face Filters

### 4.1 Data Set Collection:

The dataset, FER-2013 from Kaggle, contains 48x48 pixel grayscale portraits of people. Each face is automatically registered to essentially occupy the same space and be in the same general area. Each face must be assigned to one of seven groups: 0 for anger, 1 for disgust, 2 for fear, 3 for happiness, 4 for sadness, 5 for surprise, 6 for neutral. 3,589 cases make up the public test set and 28,709 samples make up the training set.

### 4.2 Data Pre-Processing:

Label encoding involves converting labels into a numeric format so that machines can read them. Machine learning techniques can then be used to identify how these labels function. For the structured dataset, it is a key supervised learning pre-processing step. Emotion classes are labelled using label encoding. During data preparation, normalisation, a scaling method used in machine learning, modifies the values of numerical columns in the dataset to use a standard scale. The training data's numpy array's features 'x' are normalised by dividing them by 255.0. Since we are utilising transfer learning and every deep learning classifier needs this size, we resize the pictures from the dataset to 224x224.

### 4.3 Transfer Learning:

Transfer learning is a deep learning and machine learning strategy that uses a model that has already been trained, usually on a large and varied dataset, as a starting point for training a new model on a distinct but related task or dataset. According to the theory underpinning transfer learning, even if the new dataset is smaller or less varied than the pre-trained model's, the characteristics it learnt can still be helpful for the new job. Faster training, improved performance, and less data usage are the outcomes.

### 4.4 Applying Face Filters:

Face filters are applied by using mediapipe's Face mesh to identify face characteristics and then placing a png over the necessary ROI of the picture frame that was taken. The mediapipe canonical face model may be used to detect the characteristics. The required ROI is first identified, the targeted area is then masked to remove the raw features, and lastly a filter image that is the same size as the masked region is overlaid to create a new picture in which the ROI has been replaced by the filter image. The applied filter can then be captured by using hand gesture which has been implemented using hands class from mediapipe’s solutions.

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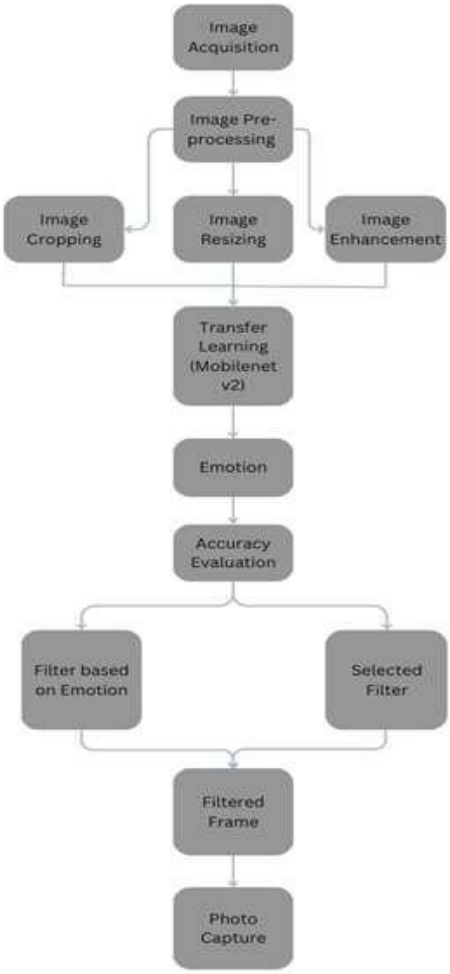
## 5. DATA FLOW DIAGRAM:




## 6. RESULTS:

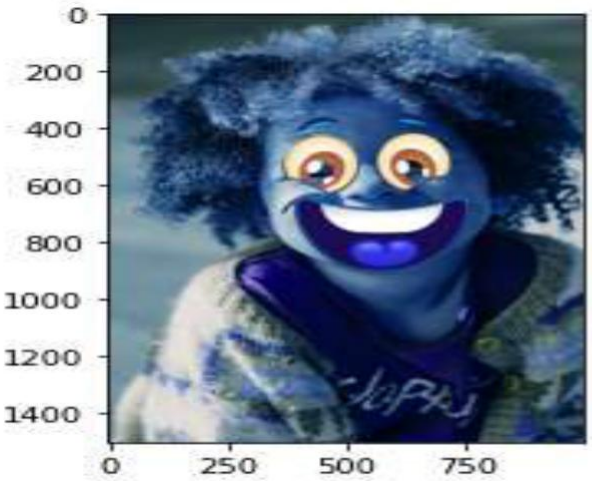



*Fig.6.1 Happy Filter*


*Fig.6.2 Angry Filter*

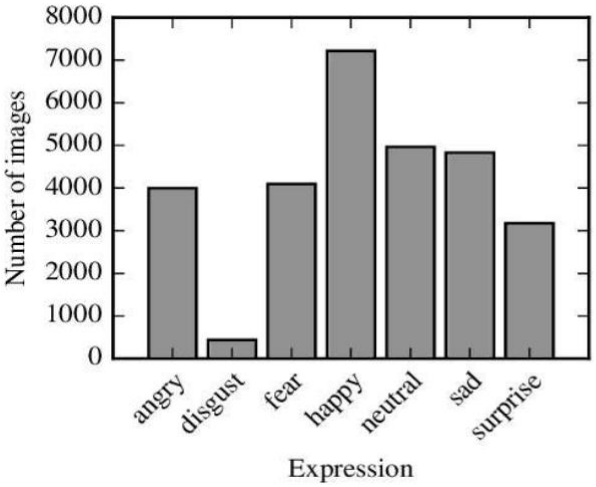



*Fig6.3 Training Data Distribution*

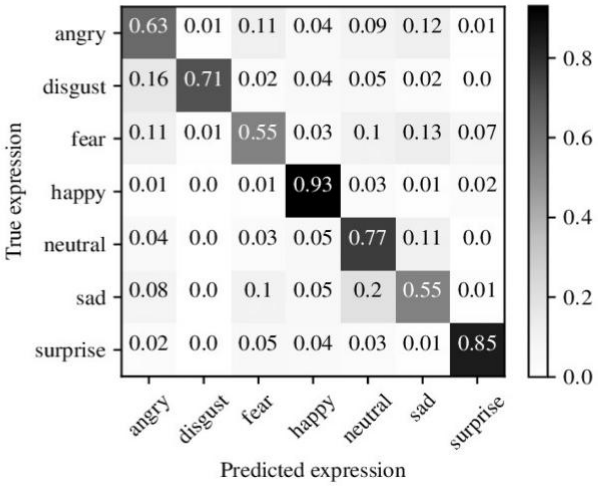



*Fig.6.4 Confusion Matrix*

## 7. DISCUSSIONS

The accuracy of the model can further be enhanced by:

- Transfer learning involves adapting the model that has already been trained to a new task. During fine-tuning, the pre-trained model's parameters are changed using the most recent task data.
- Accuracy can be improved by fine-tuning, particularly if the old task data and the new task data are similar.
- By adding random modifications to the original data, such as flipping or rotating photos, data augmentation includes producing additional training data. This can improve the model's ability to generalise to new data and boost accuracy.

**Changing the learning rate:** The learning rate controls how quickly the model responds to fresh input during training. If the learning rate is set too high, a model may overfit or converge too quickly, whereas a model may take too long to converge if the learning rate is set too low. Testing out different learning rates may help to increase accuracy.

**Increasing the training data:** The model's accuracy might be affected by the volume of training data. Increasing the training data can improve accuracy and model generalisation to new data. Using an appropriate pre-trained model by choosing an appropriate pre-trained model that is similar to the new work, the model's accuracy can be improved. You may increase the accuracy of your face emotion detection task, for instance, by employing a pre-trained model on face recognition tasks.

## 8. CONCLUSION:

Finally, social media platforms like Snapchat and Instagram have led the development of face filters in recent years. Face filters add virtual aspects to users' faces using computer vision and machine learning algorithms, making for a pleasant and interesting experience. Face filter applications can be created using a variety of current systems and libraries, including Open CV, Keras, and Mediapipe. These libraries include a variety of face detection, tracking, and recognition functions, making it simpl er to create original face filters.

In this situation, many modules, including face detection, landmark detection, and virtual object rende ring, can be used to create face filters. These modules can be put together to provide a pipeline that takes a picture of the user's face, finds facial landmarks, and instantly adds virtual objects. Face filters can also be applied for self-expression. Face emotion filters are a fun and creative way for people to express their feelings and moods. Users can apply filters, for instance, that make their faces move when they grin or show hearts when they are happy. Overall, the topic of face filters is fascinating, expanding quickly, and has a lot of potential for innovative and interesting applications. Face filters will likely get much more sophisticated and creative in the future as technology develops

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