Jyothi Engineering College
NAAC Accredited College with NBA Accredited Programmes*
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A CENTRE OF EXCELLENCE IN SCIENCE & TECHNOLOGY BY THE CATHOLIC ARCHDIOCESE OF TRICHUR
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NBA accredited B.Tech Programmes in Computer Science & Engineering, Electronics & Communication Engineering, Electrical & Electronics Engineering and Mechanical Engineering valid for the academic years 2016-2022. NBA accredited B.Tech Programme in Civil Engineering valid for the academic years 2019-2022.

Bhavas Classification Using Deep Learning

Department of CSE

Jyothi Engineering College

Thrissur

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Group No: 24

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Vision of the Department

- Creating eminent and ethical leaders in the domain of Computational Sciences through quality professional education with a focus on holistic learning and excellence.

Mission of the Department

- To create technically competent and ethically conscious graduates in the field of Computer Science and Engineering by encouraging holistic learning and excellence.
- To prepare students for careers in Industry, Academia and the Government.
- To instill Entrepreneurial Orientation and research motivation among the students of the department.
- To emerge as a leader in education in the region by encouraging teaching, learning, industry and societal connect.

Contents

Abstract

1. Bhavas classification using deep learning is used to classify ‘navarasams’ of classical dance such as ‘Sringara’(Love), ‘Hasya’(Comic), ‘Karuna’(Compassion), ‘Raudra’(Anger), ‘Veera’(Valor), ‘Bhayankara’(Fear), ‘BhiBhatsa’(Disgust), ‘Adbhuta’(Wonder), ‘Shanta’(Tranquility)
2. Technology of deep learning to classify bhavas
3. Steps:
   i. Identify the dataset
   ii. Data pre-processing
   iii. Feature extraction
   iv. Identification and classification
   v. Trained and tested
   vi. Accuracy calculation

Objective

1. To classify facial expressions into 9 Bhavas using CNN such as Sringara'(Love), 'Hasya'(Comic), 'Karuna'(Compassion), 'Raudra'(Anger), 'Veera'(Valor), 'Bhayankara'(Fear), 'BhiBhatsa'(Disgust), 'Adbhuta'(Wonder), 'Shanta'(Tranquility)

Existing system

1. Convolutional Neural Network(CNN) is used to identify 6 elementary emotions
    i. Happy
    ii. Sad
    iii. Fear
    iv. Anger
    v. Surprise
    vi. Disgust

2. Classification is done through simple image processing
3. Different types of layers are present
    i. Input layer
    ii. Convolution layer
    iii. Activation layer

iv) Pooling layer

a. Mean pooling
b. Max pooling

v) Fully connected layer
vi) Softmax layer

4. Accuracy of 91.6 % has been achieved by the test result

Advantages & Disadvantages

1. Advantages

   i. High accuracy
   ii. Automatic extraction of features

2. Disadvantages

   i. Classifies input images to atmost 7 facial expressions
   ii. Less accuracy for disgust and surprise expressions

Literature Survey

Sl.No	Objective	Dataset	Methodology	Conclusion	Contribution to our project	Disadvantage
1	• Convolutional Neural Network (CNN) • Identify 6 basic emotions implemented in MATLAB	JAFFE (Japanese Female Facial Expression)	1. Take the input image 2. Image is pass through CNN 3. Feature extraction and Classification is performed 4. Accuracy	1. Complete view of facial emotion recognition system. 2. Accuracy of 91.6 %	1. Gives a complete view of facial emotion recognition system 2. CNN algorithm can be used for the project	Classifies input images to atmost 6 facial expressions

Sl.No	Objective	Dataset	Methodology	Conclusion	Contribution to our project	Disadvantage
2.	• Detect people's emotions in natural conditions • outperform traditional approaches • Human-level performance • Convolutional Neural Network (CNN)	FER-2013	1. Take the input image 2. Image is passed through i) Baseline model ii) Five layer model iii) ResNet50 model iv) ED NET 3. Feature extraction and Classification is performed 4. Accuracy calculation	1. Accuracies of some of the models achieved on the FER2013 test data i. Human_level - 65±5% ii. Baseline -61% iii. Five-layer model -66.2% iv. ResNet50 - 73% v. ED NET - 73.9% vi. State_of_the_art - 76.8%	CNN algorithm can be used for the project	1. Only 7 facial expression 2. More time is required

Sl.No	Objective	Dataset	Methodology	Conclusion	Contribution to our project	Disadvantage
3.	• To improve the accuracy in classifying emotions • To classify the facial expressions to angry, happy, fear, neutral, sad and surprise using CNN architecture	Combination of CK+, RaFD, MUG,KDEF	1. Take the input image 2. Fine tuning CNN architecture by VGG 3. Fine tuning CNN architecture by first model 4. Accuracy calculation	1. Accuracies obtained on different datasets: i) CK+ - 96.93% ii) MUG – 87.65% iii) RaFD – 93.33% 2. Highest accuracy is obtained for CK+	CNN algorithm can be used for the project	Considered images which has face in one position only

Sl.No	Objective	Dataset	Methodology	Conclusion	Contribution to our project	Disadvantage
4.	• To avoid the explicit feature extraction process • To Classify facial expressions to worried, angry, disgust, surprise, anxious, happy, sad, neutral emotions	CLDC	1. Image is normalized 2. Features are extracted and dimension is reduced using convolution layers and max pooling 3. RPN is used for region proposal 4. Softmax and regressor for classification and predicting bounding box coordinates	1. Mean Average Precision obtained on different networks: i) VGG_CNN _M _1024 – 0.8200 ii) ZF – 0.8203 iii) VGG16 – 0.8312 2. Not very good identification for surprise and neutral	Normalization technique can be used for preprocessing	Recognition rate for surprise and neutral is less

Sl.No	Objective	Dataset	Methodology	Conclusion	Contribution to our project	Disadvantage
5.	• To Classify facial expressions into 6 emotions. • Classifications with and without pre-processing of images. • Angry, sad, happy, disgust, surprise, fear and neutral.	FER-2013	1. Image pre-processing 2. Feature extraction and Classification using CNN. 3. 6 Convolutional layers used. 4. Training set 5. Accuracy	Obtained a test accuracy of 61.7%.	CNN algorithm can be used in our project	Misclassified images came from the emotions of fear and sad with 43.95% and 49.77% accuracy.

Sl.No	Objective	Dataset	Methodology	Conclusion	Contribution to our project	Disadvantage
6.	• Classify facial images into 6 emotions using CNN architecture. • Using dataset FER2013 for training.	FER-2013	1. Face detection and pre-processing 2. Feature extraction using trainable convolution kernels. 3. Max pooling by pooling layer 4. Classification by softmax layer into the 6 basic classification	1. An accuracy of 65.1 %. 2. CNN architecture and CNN parameter training explained.	CNN architecture can be used in our project	Distortion of image is high

Proposed system

1. Application to identify the bhavas from the given input facial image

2. Using CNN architecture and appropriate dataset we can train the system to classify them to bhavas

3. This application allows the normal users (Other than dancers) to easily understand the bhavas.

Features of the proposed system

1. The first 3 CNNs are used to segment eyes, lips and the cheeks regions from facial images because of the importance of these regions to recognize the bhavas
2. Using the first 3 CNN outputs, the proposed system forms a face-iconized image that is used by the fourth CNN as input
3. Every image block is classified as eyes, lips and the cheeks versus background
4. Then the training masks are generated by detecting and localizing facial landmarks on a face image
5. Training masks are used for determining majority and mixed classes in the facial component segmentation step
6. Softmax layer is used for classification and images are classified into bhavas

Modules of proposed system

1. **Data Pre-processing -**

- ➔ firstly normalizing data per image and then normalizing data per pixel
- ➔ Normalizing data per image:
  - Subtract from each image the mean value over that image
  - Set appropriate value for the standard deviation of the image
- ➔ Normalizing data per pixel:
  - Compute the mean image over the training set
  - For each training image, subtract from each pixel its mean value
  - Set the standard deviation of each pixel over all training images

2. Feature Extraction -

- ➔ The extraction of facial features requires translating the input data into a set of features
- ➔ Features included in this project are - eyes, lips and cheeks
- ➔ First three CNNs are trained to segment eye, lip and cheek regions from facial image
- ➔ Every image block is classified as eye, lips and the cheeks versus background
- ➔ The training masks are generated by detecting and localizing facial landmarks on a face image
- ➔ Training masks are used for determining majority and mixed classes in the facial component segmentation step

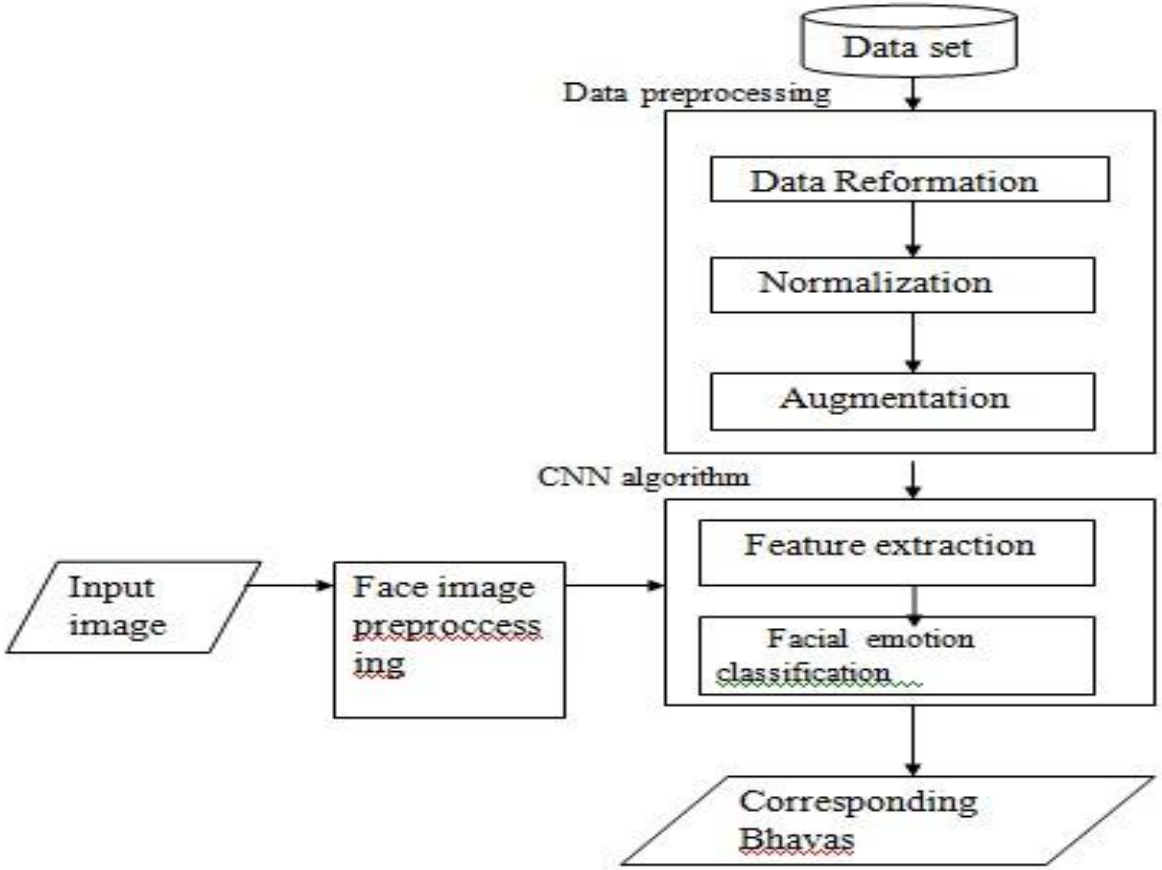
3. Identification and Classification -

- ➔ Softmax layer is used for classification
- ➔ Classify image to bhavas

SRS

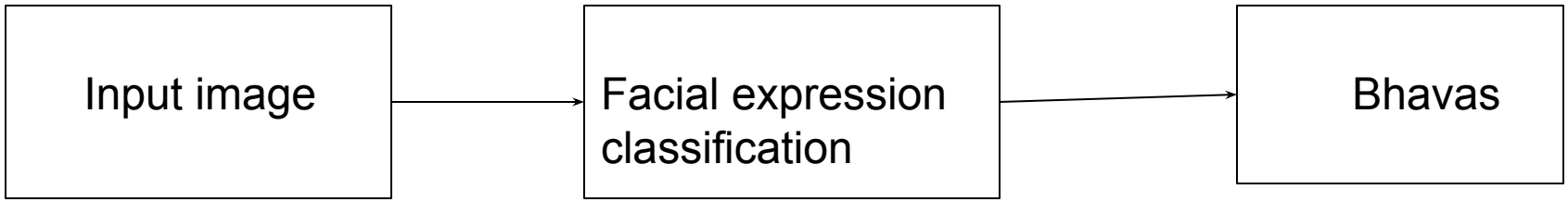
Functional Requirement	Non Functional Requirement
The system should classify an image into one of 9 emotions	The system should be implemented in jupyter notebook
The system should include an automatic face detection algorithm	

Architecture

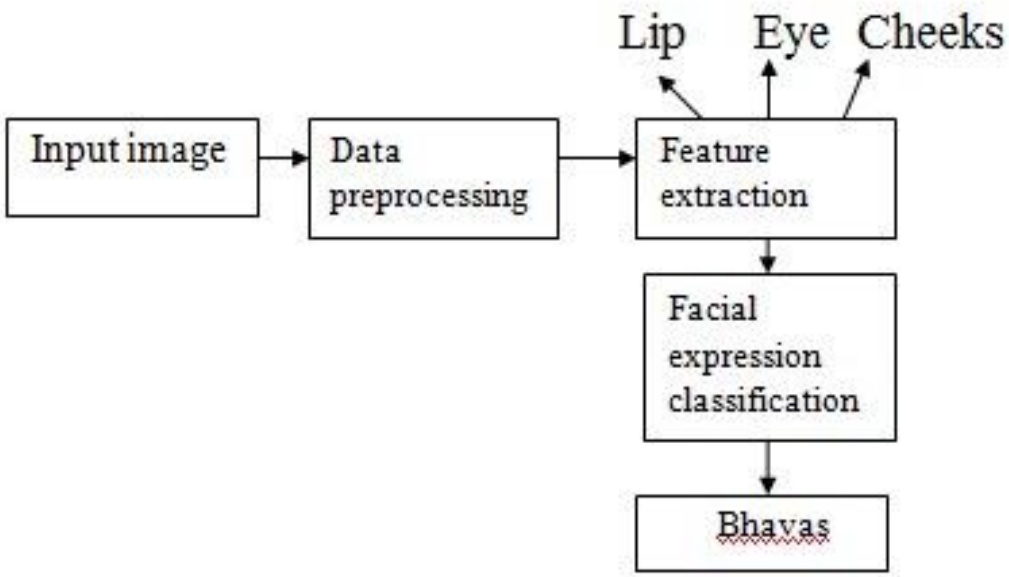


DFD

Level -0



Level -1


Lip
Eye
Cheeks
Input image
Data preprocessing
Feature extraction
Facial expression classification
Bhavas

Application of the proposed system

1. Dance beginners can easily understand each bhavas
2. It can be used to detect mental health disorder like depression
3. It is helpful for measuring customer satisfaction
4. It can be used for understanding mood of humans

Course Outcomes

1. C410.1 The students will be able to analyse a current topic of professional interest and present it before an audience
2. C410.2 Students will be able to identify an engineering problem, analyse it and propose a work plan to solve it
3. C410.3 Students will have gained thorough knowledge in design, implementations and execution of Computer science related projects
4. C410.4 Students will have attained the practical knowledge of what they learned in theory subjects
5. C410.5 Students will become familiar with usage of modern tools
6. C410.6 Students will have ability to plan and work in a team

Mapping of Course Outcome to PO

	Course Outcome						
Programme Outcomes		C410.1	C410.2	C410.3	C410.4	C410.5	C410.6
	1	3	3	3	3	3	3
	2	3	2	3	3	3	2
	3	2	3	2	3	3	3
	4	3	3	3	3	3	3
	5	3	3	3	2	3	3
	6	3	3	3	2	3	2
	7	3	3	3	2	3	3
	8	3	3	3	3	3	2
	9	3	3	3	3	3	2
	10	2	3	3	3	3	3
	11	3	3	3	2	3	3
	12	2	1	2	3	2	3

Pending works

1. Implementation
2. Coding
3. Testing

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Conclusion

1. CNN algorithm is used for facial feature extraction and emotion classification
2. Automatically extracts features rather than manual extraction
3. Identifies and classifies the facial expression into corresponding ‘bhava’
4. Helps non trained dancers easily to identify each of the bhavas

References

1. S. Harshitha, N. Sangeetha, A. P. Shirly and C. D. Abraham, "Human facial expression recognition using deep learning technique," 2019 2nd International Conference on Signal Processing and Communication (ICSPC), Coimbatore, India, 2019, pp. 339-342, doi: 10.1109/ICSPC46172.2019.8976876.
2. [1]Vamshi. N, R. and Raja S, B., “Facial Expression Recognition using Deep Learning”, arXiv e-prints, 2020.
3. Y. Lv, Z. Feng and C. Xu, "Facial expression recognition via deep learning," 2014 International Conference on Smart Computing, Hong Kong, 2014, pp. 303-308, doi: 10.1109/SMARTCOMP.2014.7043872.
4. Jiaxing Li, Dexiang Zhang, Jingjing Zhang, Jun Zhang, Teng Li, Yi Xia, Qing Yan, Lina Xun,Facial Expression Recognition with Faster R-CNN,Procedia Computer Science,https://doi.org/10.1016/j.procs.2017.03.069.

5. S. Singh and F. Nasoz, "Facial Expression Recognition with Convolutional Neural Networks," 2020 10th Annual Computing and Communication Workshop and Conference (CCWC), Las Vegas, NV, USA, 2020, pp. 0324-0328, doi: 10.1109/CCWC47524.2020.9031283.

6. L. Xu, M. Fei, W. Zhou and A. Yang, "Face Expression Recognition Based on Convolutional Neural Network*," 2018 Australian & New Zealand Control Conference (ANZCC), Melbourne, VIC, 2018, pp. 115-118, doi: 10.1109/ANZCC.2018.8606597.

Thank You