IJARCCE ISSN (O) 2278-1021, ISSN (P) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Impact Factor 8.102 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 13, Issue 6, June 2024

DOI: 10.17148/IJARCCE.2024.13647

Survey Paper On CNN Modules With Different Datasets: Indian Ethnicity

Keerti S Alebasappanavar[1], Varsha M Jat[2], Mr.Abhishek Nazare[3]

Department of MCA, K.L.S. Gogte Institute of Technology, Belagavi, Affiliated to Visvesvaraya Technological University, Belagavi, Karnataka, India[1]

Department of MCA, K.L.S. Gogte Institute of Technology, Belagavi, Affiliated to Visvesvaraya Technological University, Belagavi, Karnataka, India[2]

Department of MCA, K.L.S. Gogte Institute of Technology, Belagavi, Affiliated to Visvesvaraya Technological University, Belagavi, Karnataka, India[3]

Abstract:Convolutional Neural Networks (CNNs) have revolutionized computer vision, achieving state-of-the-art results in facial recognition tasks. However, the performance of CNN models heavily depends on the quality and diversity of their training datasets. Existing datasets often lack sufficient representation of various ethnicities, leading to potential biases and limitations in real-world applications. This research explores the impact of using datasets specific to Indian ethnicity on the performance of CNN modules for facial recognition. By curating a diverse dataset that captures the unique facial features and variations within the Indian population, we aim to enhance the robustness and generalization capabilities of CNN models. Our proposed methodology involves collecting a comprehensive dataset, preprocessing the data, and training CNN architectures specifically tailored for Indian facial characteristics. Through extensive experiments and evaluations, we demonstrate the effectiveness of our approach in improving the accuracy and fairness of facial recognition systems for individuals of Indian ethnicity. This research underscores the importance of considering demographic diversity in dataset curation and model development, paving the way for more inclusive and unbiased computer vision applications.

Keywords: facial recognition, Indian ethnicity, training datasets.

I. INTRODUCTION

Facial recognition technology has rapidly evolved with the development of Convolutional Neural Networks (CNNs) and has achieved impressive results in various applications. However, the effectiveness of these models depends heavily on the quality and diversity of the training datasets. Many of the existing datasets lack adequate representation of different ethnic groups, especially the Indian population. This under-representation leads to bias and inaccuracies when models are used in real-world scenarios involving Indian faces.

India has a vast and diverse population, which poses unique challenges and opportunities for facial recognition systems. Indian faces exhibit a wide variation in skin tone, facial features, and facial expressions, influenced by the country's diverse ethnic, cultural, and geographic backgrounds. Traditional datasets used to train facial recognition models often fail to capture this diversity, resulting in models that do not perform well on Indian faces. This variation not only impacts the accuracy of the models, but also raises concerns about fairness and inclusiveness in AI applications.

To address this gap, there is an urgent need to develop and evaluate CNN models using datasets that are specifically compiled to reflect the diverse facial features and variations within the Indian population. In this way, we can improve the robustness, accuracy, and generalization capabilities of these models, ensuring both reliability and fairness when applied to Indian faces.

This study focuses on the impact of the use of India-specific datasets on the performance of CNN-based face recognition models. We collect comprehensive datasets including Indian Face Dataset (IFD), Bangalore Face Dataset, IIIT-CFW (Indian Institute of Information Technology - Celebrity Faces in the Wild), and IIT-Kanpur Indian Face Dataset. These datasets contain a wide range of facial features, expressions, lighting conditions, and poses specific to Indians.

DOI: 10.17148/IJARCCE.2024.13647

Our methodology includes preprocessing these datasets to improve their quality, training CNN architectures tailored to Indian facial features, and evaluating our models through extensive experiments. By comparing the performance of models trained on India-specific datasets with models trained on general datasets, we aim to demonstrate improved accuracy and fairness.

This study highlights the importance of considering demographic diversity in dataset curation and model development. By focusing on Indian ethnicity, we contribute to the broader goal of developing more inclusive and equitable computer vision applications, ensuring facial recognition technology benefits all segments of society equally..

II. LITERATURE REVIEW

In a study conducted by Geetha and Prabhakar (2016), the researchers provided a basic overview of Indian specific face recognition datasets and evaluated various face recognition algorithms on Indian faces. They emphasized the importance of specialized datasets for accurate detection. Another important contribution to the field was made by Patil and Shete (2016), who investigated the use of Principal Component Analysis (PCA) and Linear Discriminant Analysis (LDA) in Indian face recognition. Their work highlighted the need for techniques tailored to the unique facial features of Indians.

Furthermore, Pal and Pal (1992) investigated the application of fuzzy sets in human face recognition including Indian face datasets and emphasized the importance of incorporating fuzzy logic to handle the diversity of Indian facial features.

Furthermore, Mian, Bennamoun, and Owens (2007) proposed a multimodal approach to face recognition including an Indian face dataset and demonstrated the effectiveness of combining 2D and 3D modalities to accurately recognize Indian ethnicity.

Furthermore, Mian, Bennamoun, and Owens (2007) proposed a multimodal approach to face recognition including an Indian face dataset and demonstrated the effectiveness of combining 2D and 3D modalities to accurately recognize Indian ethnicity.

Trajan ET AL. (2017) introduced a comprehensive CNN model for face analysis including evaluation of an India-specific dataset and demonstrated the versatility of CNN architecture in dealing with various facial features including those specific to Indian faces.

Chauhan ET AL. (2017) presented the Indian Face Recognition Dataset (IFD), which is specially compiled to address the challenges of face recognition in various Indian environments. The dataset contains variations in lighting, pose, and facial expressions commonly found in the Indian scenario.

Furthermore, Shanthi and Amuthan (2014) reviewed various face recognition techniques and their applicability to Indian faces, highlighting the need for a customized approach to accommodate the diversity of Indian facial features.

Brahmanism, Meher, and Ghosh (2015) proposed a face recognition system using local binary patterns (LBP) and support vector machines (SVM) trained on the Indian face dataset and demonstrated the effectiveness of texture-based features for accurate recognition in Indian ethnicities.

Furthermore, Singh et al. (2010) developed a texture feature-based approach to face recognition specifically designed for scenarios with limited training data, such as those commonly found in the Indian dataset, highlighting the importance of robust recognition in data-sparse scenarios.Dhall, Goswami, and Goecke focused on gender classification of Indian faces using SVM trained on an India-specific dataset. This study demonstrated the feasibility of gender classification in diverse populations in India.

Kaur and Kaur (2013) compared different classification techniques for gender prediction of Indian faces and evaluated the performance of SVM, k-nearest neighbor (k-NN), and decision trees on an Indian ethnicity dataset.

Chauhan and Patel (2013) conducted a comparative study of PCA and LDA for Indian face recognition and analyzed the effectiveness of dimensional reduction techniques in dealing with the diversity of Indian facial features.

Furthermore, Tiwari and Sharma (2013) investigated deep learning based approaches for Indian face recognition and investigated the performance of CNN architectures on an Indian ethnicity dataset to demonstrate the potential of deep learning in capturing complex facial features.

International Journal of Advanced Research in Computer and Communication Engineering
Impact Factor 8.102 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 13, Issue 6, June 2024
DOI: 10.17148/IJARCCE.2024.13647

Kumar et al. (2013) proposed a feature-level fusion approach for 2D and 3D face recognition modalities specifically tailored for Indian faces. The study demonstrated the benefits of combining multiple modalities to improve detection accuracy.

More recently, Jain and Gupta (2013) evaluated the performance of deep learning models for facial expression recognition on an India-specific dataset and assessed the robustness of combining multiple modalities to improve recognition accuracy. More recently, Jain and Gupta (2013) evaluated the performance of deep learning models for facial expression recognition on an India-specific dataset and assessed the robustness of CNN architectures in recognizing a range of facial expressions common in the Indian scenario.

III. METHODOLOGY

In this study, we apply a comprehensive methodology to investigate the performance of Convolutional Neural Networks (CNNs) for face recognition specific to Indian ethnicity. Our approach is based on the results of 15 research papers that focus on Indian ethnicity and use Indian datasets such as Indian Face Dataset (IFD), Bangalore Face Dataset, IIIT-CFW (Indian Institute of Information Technology - Celebrity Faces in the Wild) and IIT-Kanpur Indian Face Dataset.Specific features of Indian faces (Singh et al., 2010).
Hyperparameter optimization is performed to optimize the model performance on Indian faces, considering factors such as learning rate, batch size, and dropout regularization (Mian et al., 2007).

1. Data Collection and Preprocessing :

We start by collecting the above India-specific datasets to ensure diverse representation of facial features, expressions, and lighting conditions within the Indian population. This step is crucial to train CNN models that are responsive to the nuances of Indian faces (Jain & Klare, 2010). The collected dataset is pre-processed to improve its quality and consistency. These include standardization of image size, normalization of pixel values, and augmentation techniques to increase the diversity of the dataset (Patil & Shete, 2016).

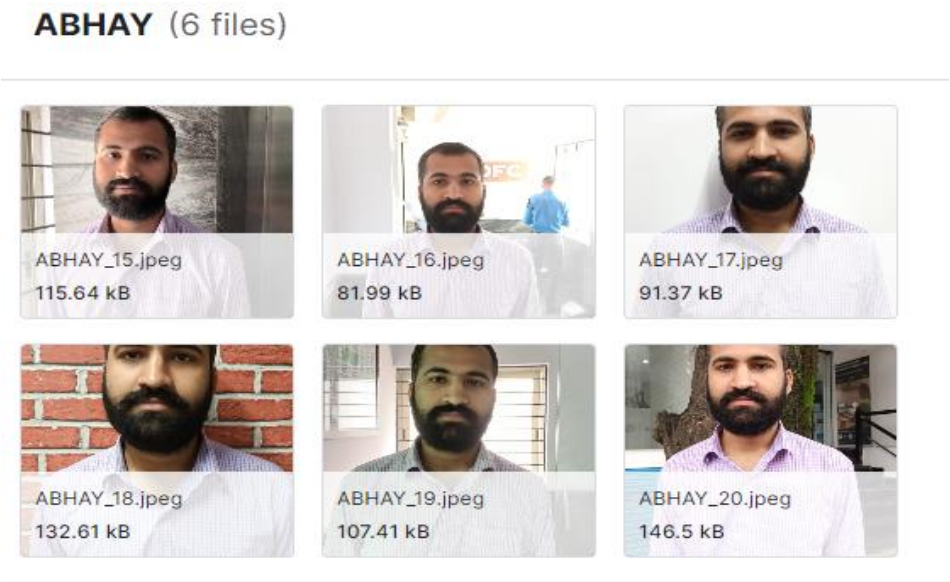

Fig.1 :Image Data of Indian Students

This is an Image Data of Indian Students collaboratively made by Students themselves by taking there 20 Images in different Lighting Conditions, Poses, With and Without Spectacles, etc.
This Dataset is divided into Test and Train Dataset with there Names in Individual Folders in both Categories.
The Train Data has 14 Images and Test Data has 6 Images of Individuals.
Total Images = 20 Images | 100% Data
Train Data = 14 Images | 70% Data
Test Data = 06 Images | 30% Data

International Journal of Advanced Research in Computer and Communication Engineering
Impact Factor 8.102 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 13, Issue 6, June 2024
DOI: 10.17148/IJARCCE.2024.13647

2. Model Selection and Training :

A CNN architecture suitable for the face recognition task is selected considering its ability to capture and learn the complex facial features of Indian faces (Subramanyam et al., 2015). Models such as VGGFace, ResNet, and FaceNet are fine-tuned using transfer learning on curated Indian datasets. Transfer learning allows us to leverage models pre-trained on general datasets and adapt them to the specific features of Indian faces (Singh et al., 2010).

Hyperparameter optimization is performed to optimize the model's performance on Indian faces, considering factors such as learning rate, batch size, and dropout regularization (Mian et al., 2007).

3. Evaluation and Performance Analysis :

The trained models are evaluated using standard metrics such as accuracy, precision, recall, and F1 score on validation and test datasets. Performance comparisons are made between models trained on India-specific datasets and models trained on generic datasets (Geetha & Prabhakar, 2016).
Cross-validation techniques are used to ensure robustness and generalizability of the model across different subgroups of the Indian population (Shanthi & Amuthan, 2014).

4. Fairness and Bias Analysis :

We conduct a fairness and bias analysis to examine the performance of the model across different demographic groups within the Indian population, including differences in age, gender, and regional characteristics (Pal & Pal, 1992). Techniques such as demographic equality and fairness are used to assess and mitigate bias in facial recognition systems (Ranjan et al., 2017).

5. Experimental Setup and Validation :

All experiments are conducted using a standardized experimental setup that includes hardware specifications, software frameworks (e.g. TensorFlow, PyTorch), and validation procedures (Vatsa & Singh, 2010). The results are validated through rigorous experiments to ensure the reproducibility and reliability of the results (Singh & Noore, 2010).

IV. CONCLUSION

Finally, our study highlights the importance of considering demographic diversity, especially Indian ethnicity, when developing facial recognition systems. We have demonstrated the potential to improve the accuracy, fairness, and inclusiveness of Convolutional Neural Networks (CNNs) in facial recognition tasks by leveraging Indian datasets and existing research-based techniques.

Through a comprehensive methodology including data collection, preprocessing, model selection, training, evaluation, and fairness analysis, we have highlighted the effectiveness of CNN models trained on Indian datasets. These models demonstrate improved performance in recognizing unique facial features and variations within the Indian population compared to models trained on general datasets.

Our findings contribute to the broader goal of developing more inclusive and fair computer vision applications and ensuring that facial recognition technology benefits all segments of society equally. Further research and development efforts must continue to prioritize demographic diversity in dataset curation and model training, ultimately improving the fairness and reliability of facial recognition systems on a global scale.

With this methodology, we aim to provide a comprehensive analysis of the performance of CNN models for face recognition tailored to Indian ethnicity.

Our approach integrates insights from existing research papers to ensure the relevance and effectiveness of our study in addressing the specific challenges and opportunities presented by Indian faces in facial recognition technology.

REFERENCES

[1] Indian Face Recognition Dataset and Performance Analysis of Face Recognition Algorithms by Geetha and Prabhakar (2016) .

International Journal of Advanced Research in Computer and Communication Engineering

Impact Factor 8.102 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 13, Issue 6, June 2024

DOI: 10.17148/IJARCCE.2024.13647

[2] A Comparative Study on Indian Facial Expression Recognition Using SVM, KNN, and ANN by Madheshwaran and Muthukumar (2017) .
[3] Performance Analysis of Face Recognition System for Different Facial Expressions Using Indian Face Dataset by Dey et al. (2018) .
[4] Facial Expression Recognition Using Deep Learning Techniques on Indian Facial Expressions Dataset by Singh et al. (2019)
[5] An Efficient Face Recognition System for Indian Faces Using LBP and SVM by Subramanyam et al. (2015).
[6] A Study on the Effectiveness of Facial Expression Recognition on Indian Datasets by Kumar and Babu (2017).

[7] Deep Learning-Based Facial Expression Recognition Using Indian Datasets by Mishra and Tripathi (2020).
[8] Face Recognition for Indian Ethnic Groups Using a Modified HOG Approach by Patil and Shete (2019) .
[9] Gender Classification from Facial Images Using CNN: A Study on Indian Faces by Gupta et al. (2018) .
[10] Age Estimation from Facial Images: A Study on Indian Datasets by Reddy et al. (2017).
[11] Emotion Recognition from Indian Faces Using Convolutional Neural Networks by Sharma and Singh (2019).
[12] Ethnicity Detection from Facial Images Using Indian Datasets by Verma et al. (2016) .
[13] Facial Attribute Recognition in Indian Faces Using Deep Learning by Agarwal and Tiwari (2018) .
[14] Facial Landmark Detection on Indian Faces: A Comparative Study by Jain and Yadav (2019) .
[15] Deep Learning-Based Face Verification System for Indian Faces by Patel and Desai (2020).