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In the following report we tried to classified cats and dogs with the help of cifar-10 dataset from keras. we compared our scratch developed CNN model, with traditional machine learning models Support Vector Machine, Random Forest, and Logistic Regression.

1.processing the data

The dataset we used had a 50000+ images, which had various classes. We looked at the images of cats-class 3and dogs-class 5.

2.we labeled 0 for cats and 1 for dogs and then

Normalized the values by division with 255, which helps our CNN model

3.Preprocessing and Dataset

The 60,000 32x32 color images in the CIFAR-10 dataset are broken down into 10 classes, each with 6,000 images. A training set of 50,000 photos and a test set of 10,000 images make up the dataset. We concentrate on the pictures of dogs (class 5) and cats (class 3) for our binary classification challenge.

4.The following are the preprocessing steps:

removing the dataset's cat and dog photographs, leaving behind a smaller dataset that solely contains the relevant images.

Binary representation of the labels: 0 for cats and 1 for dogs.

By dividing the image's pixel values by 255, normalization is achieved, scaling the data to the [0, 1] range. The learning algorithms' performance and convergence are enhanced by this phase.

Model for Convolutional Neural Networks (CNN)

5.The architecture we use to create a CNN model is as follows:

A max-pooling layer comes after each of the three convolutional layers. 32, 64, and 128 filters are present in the convolutional layers, accordingly with a 3x3 kernel size and a ReLU activation function, respectively. The pool size for the max-pooling layers is 2x2.

6.To make the feature maps into a one-dimensional array, add a flatten layer. a layer with 256 nodes and a ReLU activation function that is fully linked. a dropout layer to lessen overfitting at a rate of 0.5.a single-node output layer with a sigmoid activation function that outputs a final binary classification.

7.The binary cross-entropy loss, accuracy, and Adam optimizer are used in the model's construction. A validation set (test set) is used to track the model's progress throughout training, which lasts for 20 epochs.

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CNN:
Accuracy:  0.758
F1 Score:  0.7727699530516432
Precision:  0.7283185840707964
Recall:  0.823
```

8.Models of conventional machine learning

For the same classification job, we further train and assess three classical machine learning models:

a linear kernel Support Vector Machine (SVM),RF with 100 decision trees, random forest and Maximum 500 iterations for Logistic Regression (LR).

9.We flatten the photos by making each 32x32x3 image into a one-dimensional array of length 3072 before supplying the data to these models. The training and test sets both go through this procedure.

10.Comparison and Evaluation of Models

Using the same measures as for the CNN, we assess how well traditional machine learning models perform. We used the same metrics—accuracy, F1 score, precision, and recall—to assess the performance of conventional machine learning models.

```
SVM:
Accuracy:  0.5835
F1 Score:  0.5841238142785821
Precision:  0.5832502492522432
Recall:  0.585

RF:
Accuracy:  0.6685
F1 Score:  0.6537859007832897
Precision:  0.6841530054644809
Recall:  0.626

LR:
Accuracy:  0.575
F1 Score:  0.5804540967423494
Precision:  0.5730994152046783
Recall:  0.588
```

11.By contrasting CNN's performance, We can determine the advantages and disadvantages of each strategy by contrasting the performance of the CNN model with that of the conventional machine learning models. The CNN model may perform better in the context of our binary image classification job because it can learn hierarchical features through its convolutional and pooling layers. Traditional machine learning algorithms, on the other hand, could have trouble recognizing the intricate patterns found in the photos, especially when dealing with flattened input data.

It is significant to note that the selection of feature extraction techniques and the fine-tuning of hyperparameters can have an impact on the performance of conventional machine learning models. A detailed investigation of these elements could result in enhancements to their functionality.

12.Conclusion

Using a portion of the CIFAR-10 dataset, this paper compared a deep learning model (CNN) with more conventional machine learning models (SVM, RF, and LR) for the task of binary image classification. The outcomes imply that the CNN model may outperform the conventional machine learning models in this situation, while more research into feature extraction strategies and hyperparameter tweaking may help the latter models perform better.

The current method has the drawback of concentrating just on the cat and dog classes in the CIFAR-10 dataset. Future research should study various picture classification problems or broaden the analysis to include additional classes. Further insights and performance enhancements might result from experimenting with different CNN model architectures, various feature extraction methods for conventional machine learning models, or the use of ensemble methods.