

HorseDogCat Identifier

Convolutional Neural Network (CNN)

Description of the Work:

The dataset consists of images divided into three categories: cats, dogs and horses. The goal is to develop a Convolutional Neural Network (CNN) that can accurately classify an image into one of these three categories.

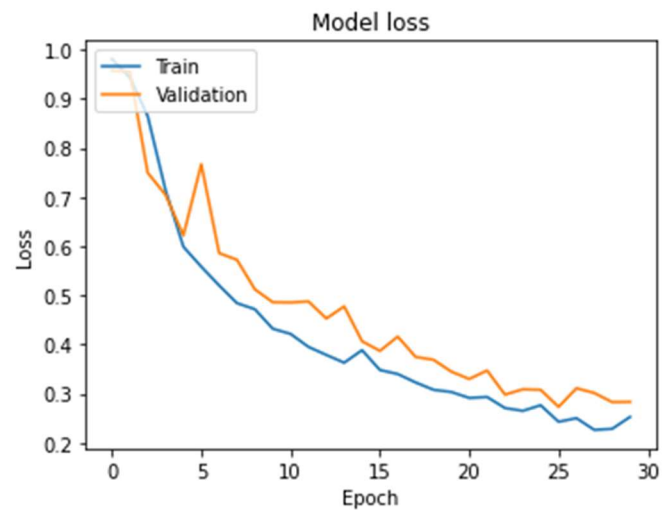
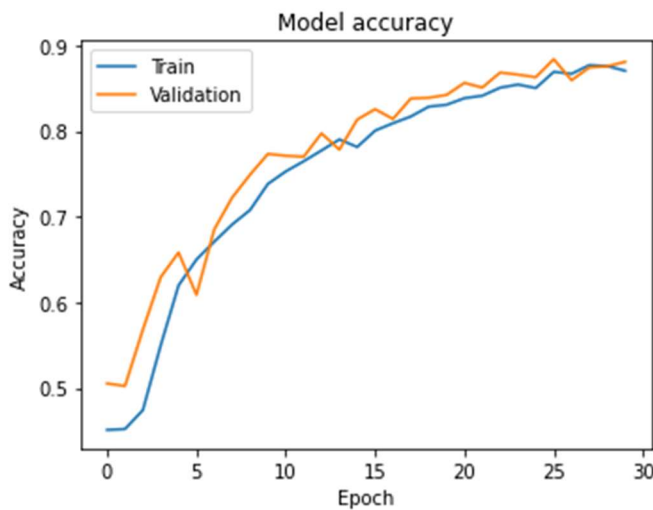
Data Preparation for the Training and the Structure of the CNN:

- Dataset Short Description:
 - The dataset includes 12500 images of cats, 12500 images of dogs and 4567 images of horses.
- Example images:



- CNN Structure Description:
 - Convolutional Blocks: The model consists of four convolutional blocks. Each block includes:
 - Convolutional layer with ReLU activation
 - Max-pooling layer
 - After the convolutional blocks:
 - A flattening layer
 - Dense layer with 512 neurons and ReLU activation
 - Dropout layer with a rate of 0.5
 - Output layer with 3 neurons, one for each class and uses softmax activation.
 - The training also includes preprocessing, which apply various transformations to the input images, such as rotating.

Neural networks Training



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Final Training Accuracy: 0.8704824447631836
Final Validation Accuracy: 0.8808771967887878
Final Training Loss: 0.252388060092926
Final Validation Loss: 0.28306812047958374

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Relevant Metrics for the Case

- Test accuracy
 - The model achieved a test accuracy of 74,96%.
- Confusion Matrix:
 - Cat:
 - The model predicted 1226 correctly, 392 were predicted as cats but were dogs, and 54 as cats but were horses.
 - Dog:
 - The model predicted 4006 correctly, 525 were predicted as dogs but were cats, and 336 as dogs but were horses.
 - Horse:
 - The model predicted 1726 correctly, 55 were predicted as horses but were cats, and 962 as horses but were dogs.
- Recall: (How much the model identifies of all actual instances)
 - Cat:
 - Recall for the cat class was 0.73 = 73%
 - Dog:
 - Recall for the dog class was 0.82 = 82%
 - Horse:
 - Recall for the horse class was 0.63 = 63%
- F1-Score:
 - Cat:
 - F1-Score is 0.71.
 - Dog:
 - F1-Score is 0.78.
 - Horse:
 - F1-Score is 0.71, which can be misleading, given the low number of correct predictions.
- Support: (How many instances of each class are in the test set)
 - 1672 cats, 4867 dogs, and 2743 horses

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Found 9282 images belonging to 3 classes.
9282/9282 [=====] - 105s 11ms/step - loss: 0.8280 - accuracy: 0.7496
Test Loss: 0.8280224800109863
Test Accuracy: 0.7496229410171509
9282/9282 [=====] - 100s 11ms/step
Confusion Matrix:
[[1226 392 54]
 [ 525 4006 336]
 [ 55 962 1726]]
Classification Report:

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	precision	recall	f1-score	support
cat	0.68	0.73	0.71	1672
dog	0.75	0.82	0.78	4867
horse	0.82	0.63	0.71	2743
accuracy			0.75	9282
macro avg	0.75	0.73	0.73	9282
weighted avg	0.76	0.75	0.75	9282

Conclusions of the results

Validation of the Model:

The model was validated using a test set consisting of unseen images of cats, dogs, and horses. The confusion matrix revealed that the model is most effective with dogs, but had difficulty distinguishing between horses and dogs, as seen in the metrics that a high number of horses was misclassified as dogs. The overall accuracy of the model is 75%, which might be usable for some applications.

Model performance:

The performance of the model is moderate. It performs well in dogs but not as well for cats and especially horses.

Applicability of the Model:

If one was to use this for an application, where the images are used as part of content filtering system that aims to categorize images of pets, 75% accuracy might be too low. If you put an image of your horse, it will identify it as a dog probably, and that would lead to poor user experience.

Improvements for a Better Model:

- Increase the diversity of the training set.
- Training set should be more balanced, so the model does not favor the more represented class.

Sources for data:

<https://www.kaggle.com/datasets/erkamk/cat-and-dog-images-dataset>

<https://www.kaggle.com/datasets/alessiocrrado99/animals10>