Animal Classification with ANN, CNN and VGG16

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ABSTRACT

With the rapid development in deep learning and neural networks, more powerful tools are introduced to deal with image problem. During this project, we use several methods to do animal classification. Our work begins with a brief introduction of object classification and related work. Then we introduce our dataset and how we preprocess and transform it. Next, we use three different methods to train our data and build model. Finally, performance of each model is provided and compared, which we can use for further analysis and conclusion.

PROBLEM STATEMENT

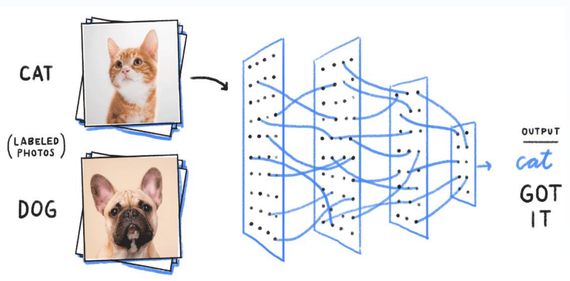
Our project solves an image classification problem by applying some deep learning approaches. Image classification can be very useful in the following areas:

- *Classify the land usage type*
- *Photo organization*
- *Visual search*

Our problem focuses on identifying and classifying animal species, which is a

- **Supervised Classification Problem**
  - **Input:** Labelled animal image
  - **Output:** Animal type
  - **Evaluation:** Categorical cross entropy

Our overall architecture is like the below graph:



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- Use neural networks to o classify huge amount of images in the ImageNet.

A Gentle Introduction to the ImageNet Challenge (ILSVRC)

by **Jason Brownlee** on May 1, 2019 in **Deep Learning for Computer Vision**

- In 2014, Karen Simonyan and Andrew Zisserman from the Oxford Vision Geometry Group (VGG) achieved top results for image classification and localization with their VGG model.

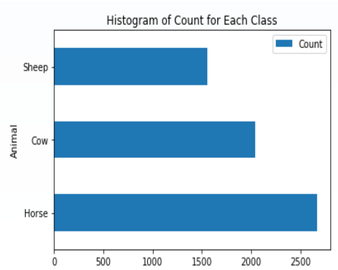
DATA

Animal-10 Dataset from Kaggle:

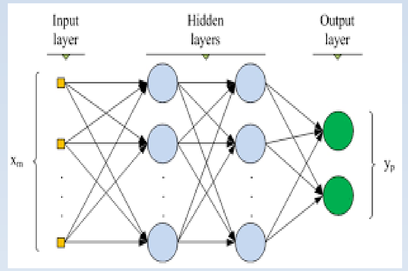
- *3 classes: Horse, Cow, Sheep*
- *100 * 100 RGB median quality images*
  - *4000 train images*
  - *1016 validation images*
  - *1254 test images*

Challenge:

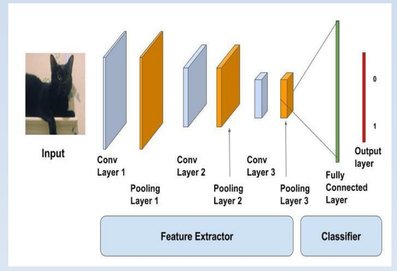
- Cow and Sheep are very similar to each other
- Most animals have a close background (i.e. grass)
- Imbalanced data



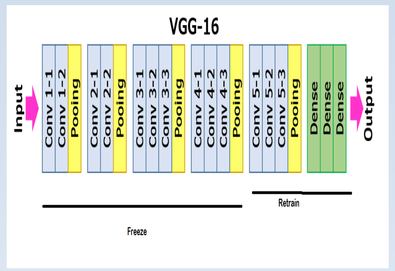
MODELS



a) ANN Architecture



b) CNN Architecture



c) VGG16 Architecture

QUANTITATIVE RESULTS

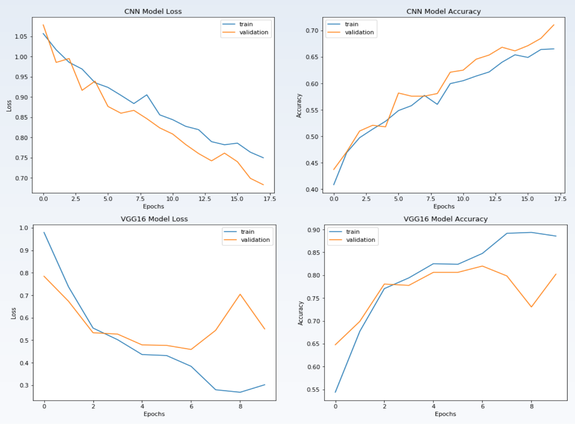
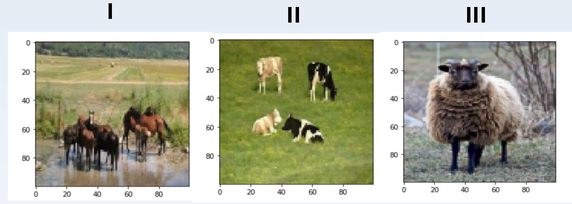


Table 1: The Result Table

Model	Test Loss	Test Accuracy(%)
ANN(2 layers)	-	44.41
ANN(3 layers)	-	45.13
CNN	0.67	71.53
VGG16	0.54	80.94

- The accuracy for ANN is not very high and increasing the number of layers does not improve the model performance much.
- For the CNN model, we tried 3 different training epochs. The best model has test accuracy 71% with18 epochs.
- For VGG16, which performs best and agrees with our expectation. We tried 2 different training epochs. The best model has test accuracy 81% with 10 epochs

QUALITATIVE RESULTS



	Actual Label	Predicted Label
I	Horse	Cow
II	Cow	Cow
III	Sheep	Sheep

We found that this model would misclassify sheep as horse or horse as cow, because some of them have the same color and the images also have similar background (i.e., grass). It may perform better on other animals. Overall, our model is good.

REFERENCES

[1] Jason Brownlee. Animal classification with vgg16 cnn, 2019.
[2] Jason Brownlee. A gentle introduction to the imagenet challenge (ilsvrc), 2019.
[3] Arthur Ouaknine. Review of deep learning algorithms for image classification, 2018.
[4] Zhong-Qiu Zhao, Peng Zheng, Shou-tao Xu, and Xindong Wu. Object detection with
deep learning: A review, 2018. cite arxiv:1807.055