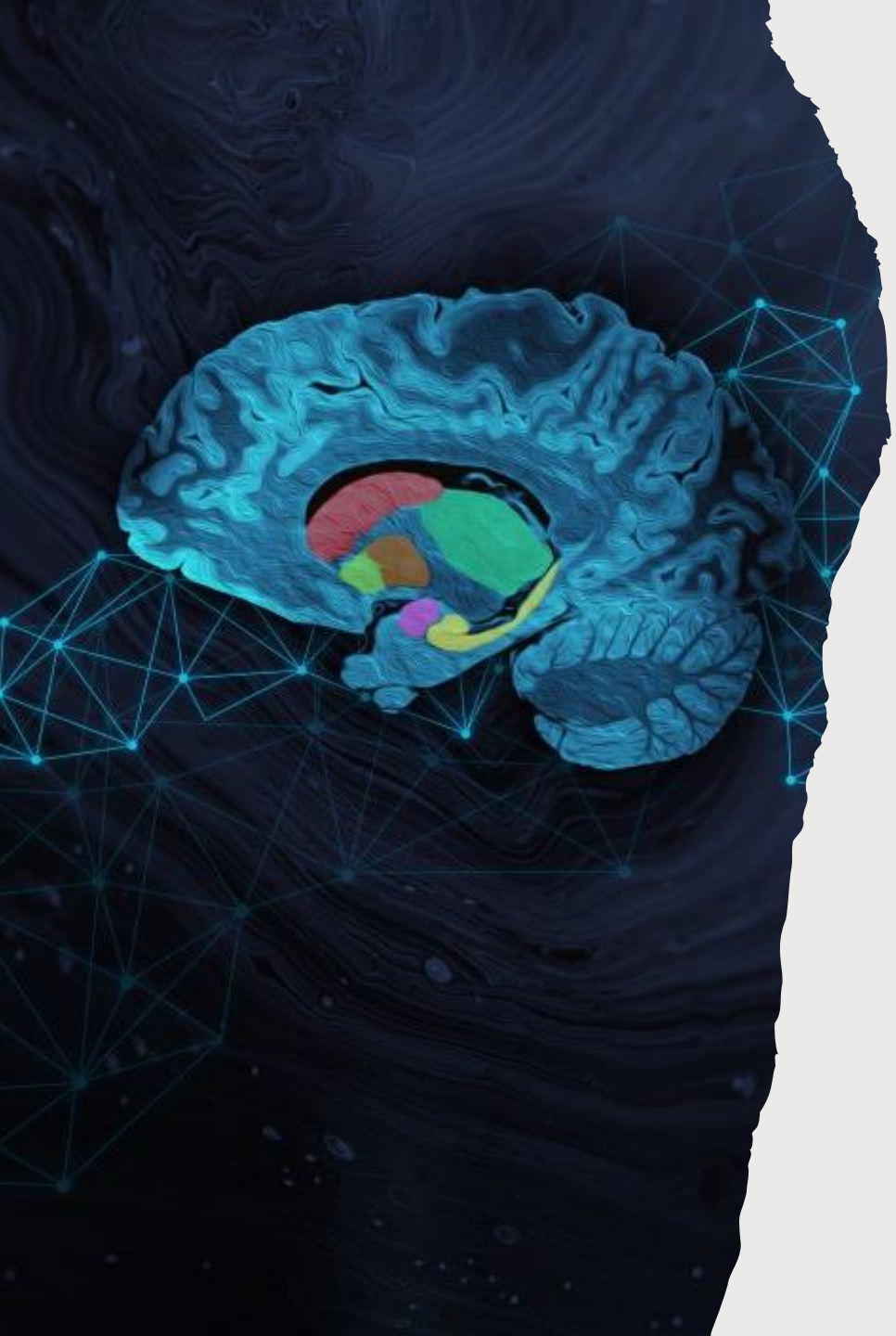


OUTLINE

- **Breed** signifies a stock of animals or plants within a species having a distinctive appearance and typically having been developed by deliberate selection. It's important to identify & record these natural variations among animal populations for scientific research & biological advancements.

- **Breed Identification** has been an evolving process, with technological advancements. We now have various techniques to perform this process in an **automated** manner, with tools like **Machine Learning** (*SVMs, Classification*), **Deep Learning**(*Convolutional neural networks- CNNs, Fully-connected NNs, Transfer Learning, etc.;*), **Cloud computing**(*Azure computer vision*).

LITERATURE SURVEY

LITERATURE REVIEW- 1

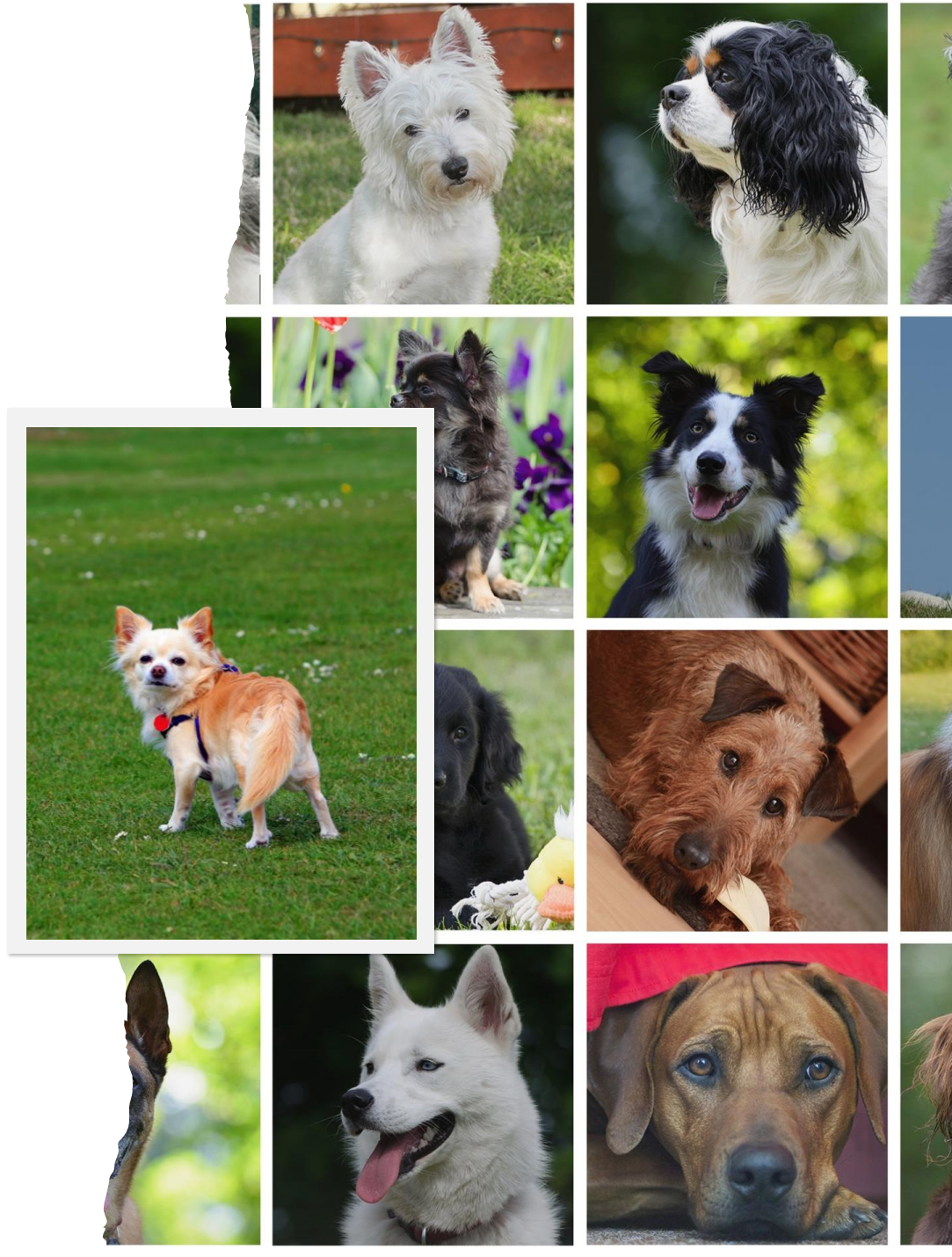
- **Title:**

Dog Breed Prediction using Convolutional Neural Network

- In this paper the main objective was to implement an Image Classification with Deep Learning and Convolutional Neural Networks(fully-connected from scratch) using Tensorflow.

- **Methods:**

- This model works on neural networks, CNN, Tensorflow, Node.js, AngularJS , MongoDB.

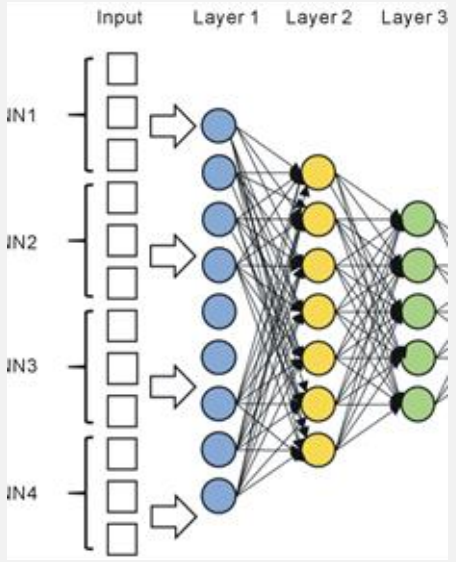


DRAWBACKS

This method involved more computation resources & lot of time on pre-processing the input images of the dogs. This is because the technique used was traditional CNN, where the whole model had to be built from scratch, & whole model was trained on the data given.

This is one of the earliest and most basic CNN architecture.
But this paper did not include the concept of transfer learning, where bulk of the model would be pre-trained & it's a more efficient way to build the CNN here.

Transfer learning would involve very little preprocessing & saves resources.



LITERATURE REVIEW- 2

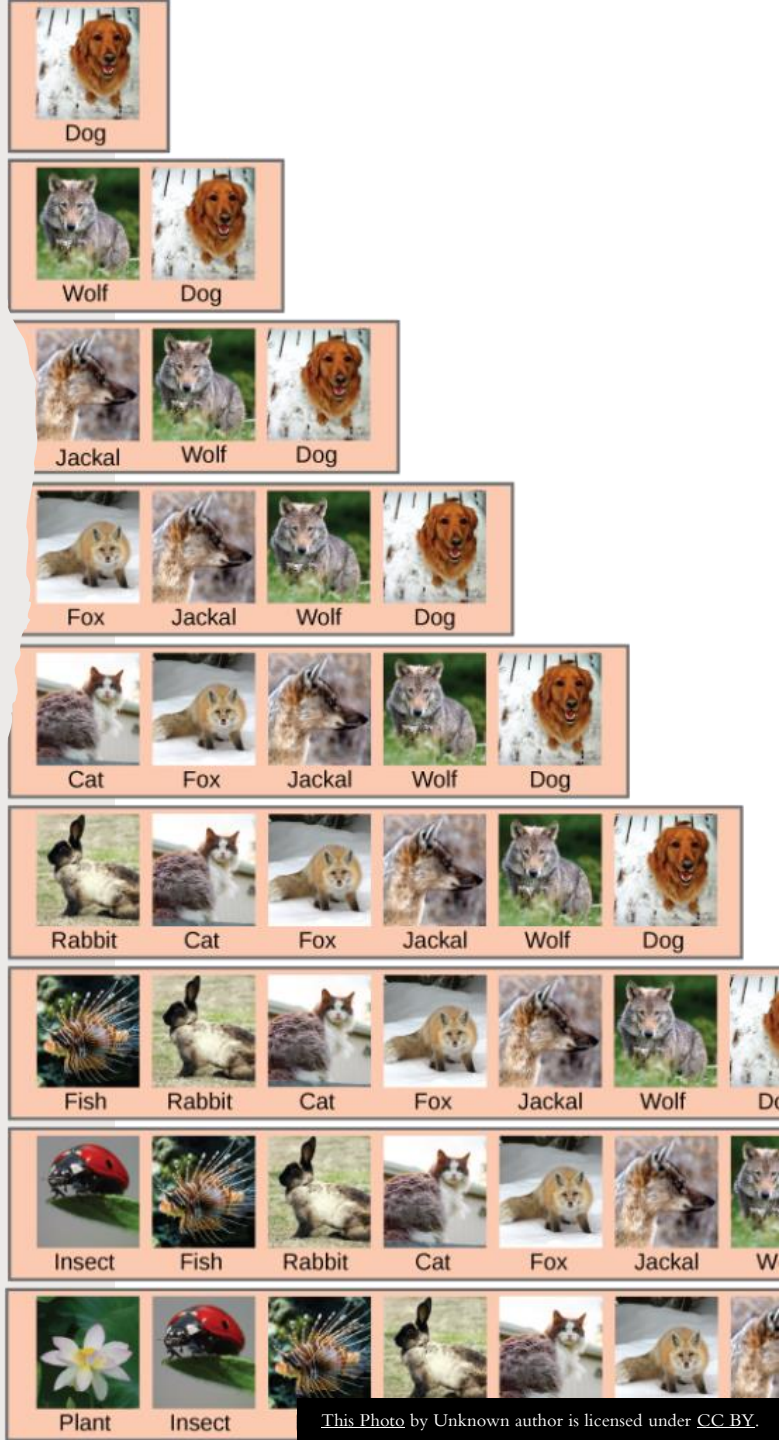
- Title:

Animal Classification using Deep Learning Inception-v3 Model on Tensorflow.

- In this paper, based on Inception-v3 model in TensorFlow platform, we use the transfer learning technology to retrain the animal category datasets, which can greatly improve the accuracy of animal classification.

- Methods:

- resources used were python 3.5, Tensorflow 1.2 and the hardware platform is Lenovo G50 laptop: processor 1.90GHz Intel i3, memory 4GB.
- The technique implemented was Inception-v3 model architecture in tensorflow.



DRAWBACKS

- Here, an old version of tensorflow was used (version 1.6).
- On the imagenet weights, the inception-v3 architecture was used here. Whereas, Xception architecture would have yielded better performance on the imagenet weights for this model.
- No activation functions were mentioned here.
- Early stopping methods were not used.

LITERATURE REVIEW- 3

- Title:

Dog Breed Classification Using Deep Learning

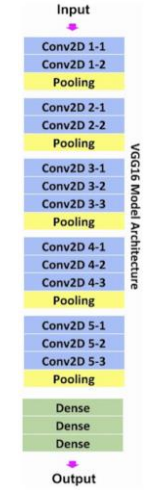
- In this paper, they have proposed two models to classify dogs according to their breeds, using the concept of transfer learning model architectures & comparing their performances.

- Methods:

- Techniques used were Deep Learning – Transfer Learning, with 2 architectures – Vgg16 & Inception v3.
- Preprocessing & Data augmentation were done, prior to using those 2 architectures & building the CNN; finally comparing the performances.

DRAWBACKS

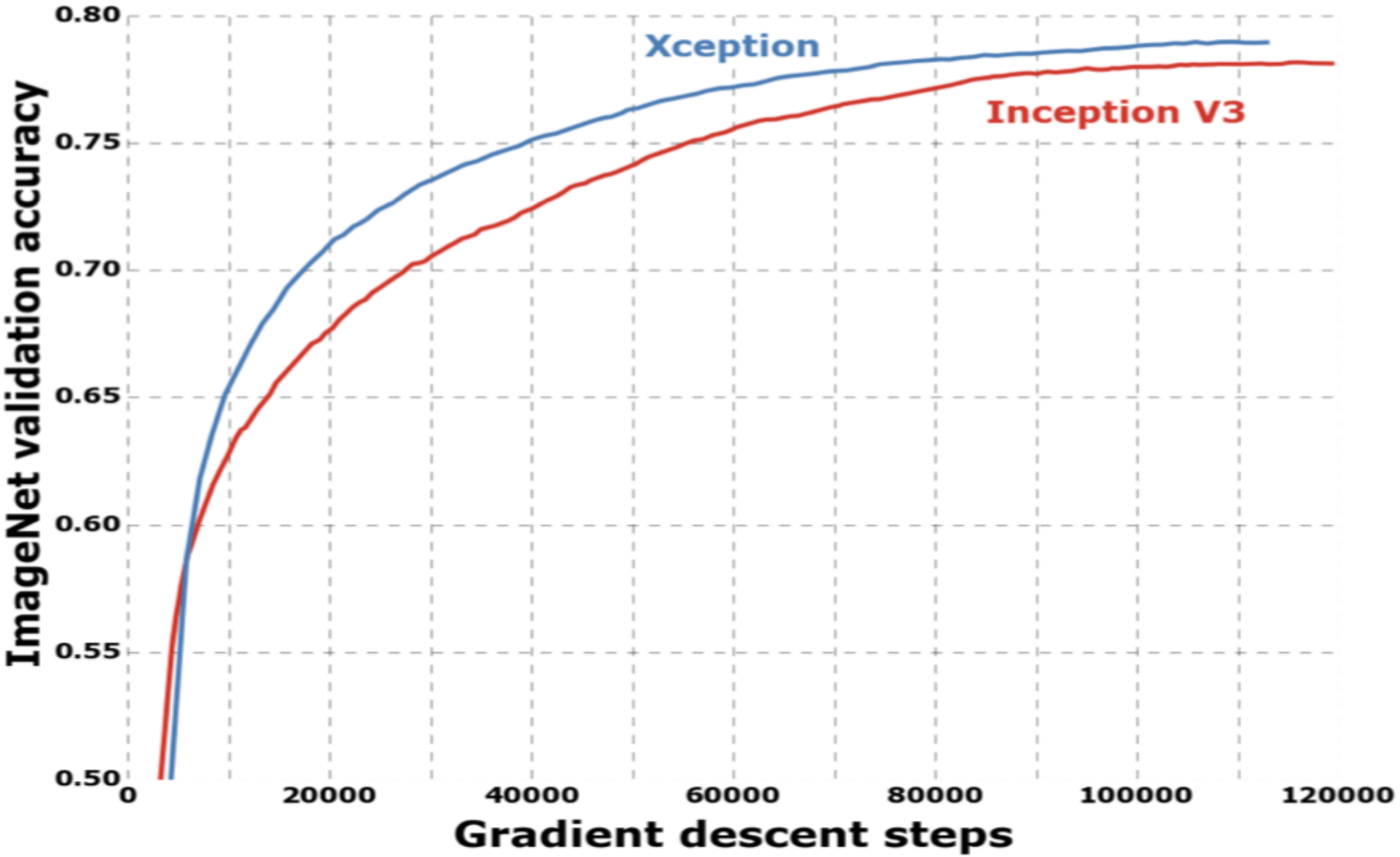
- Here, the results obtained showed that Inception v3 architecture was performing better than Vgg16 architecture, over the imagenet weights. But, on the imagenet weights, Xception architecture could have outperformed the Inception v3 as well.
- Xception architecture could have given greater computational efficiency, with the same no of parameters as of the Inception-v3 model.
- There is scope for enhancement in the accuracy & loss curves, With respect to the Inception-v3 as well.



PROPOSED METHODOLOGY

XCEPTION MODEL USING TENSORFLOW

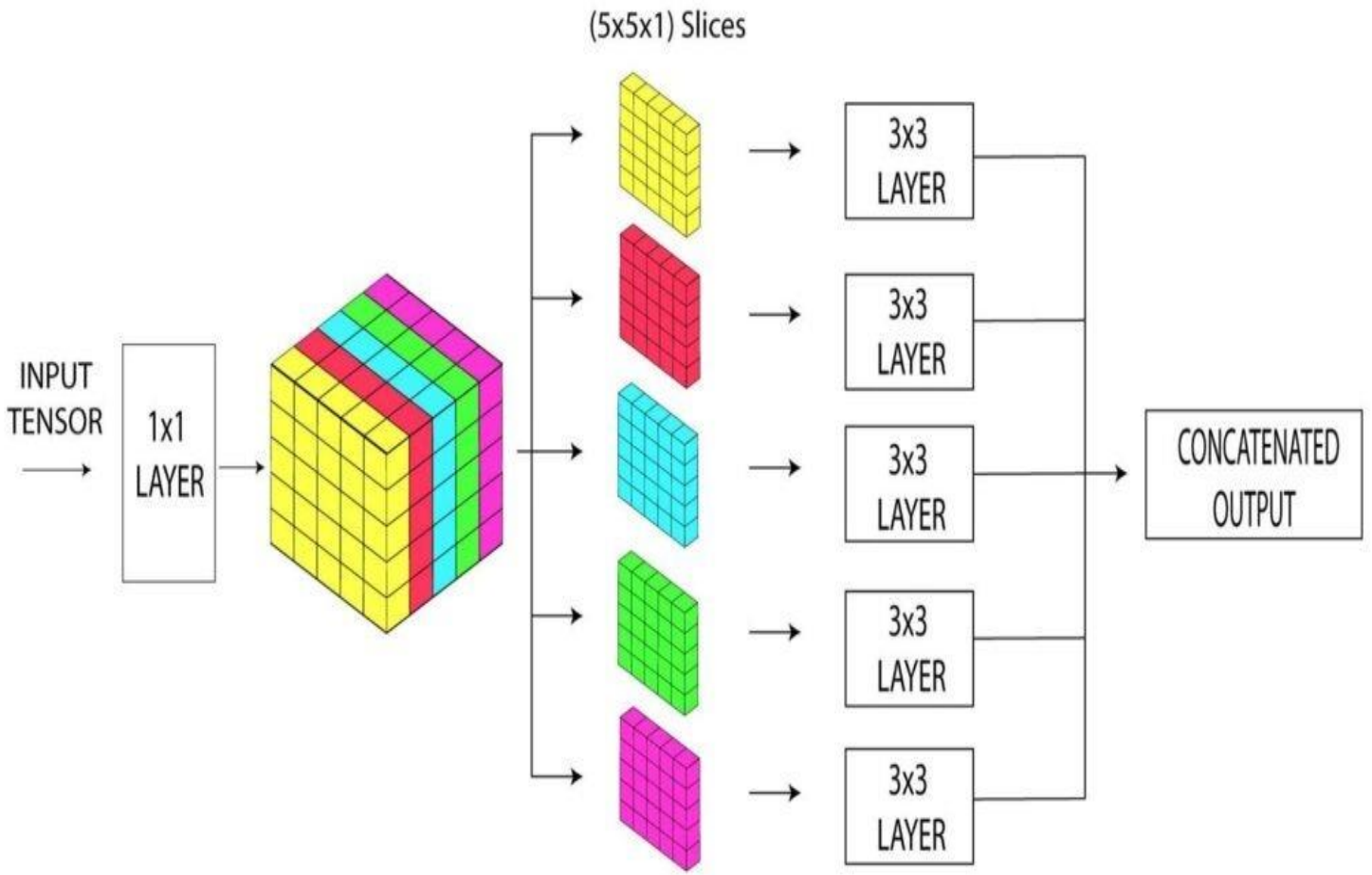
- After the literature survey, we have proposed a new methodology to overcome the previous drawbacks, & to achieve higher efficiency & accuracy, in breed identification, by using the concept of transfer learning.
- We will the transfer learning, using the Xception architecture, which is pre-trained over the imagenet weights, & shows outstanding performance for it, than other architectures.
- We'll take the input images, resize/rescale them accordingly, & use data augmentation for more training samples. Then we use the pre-trained Xception model (imagenet) as our base model, & use it's updated weights/biases, to build our custom head model (CNN) for our own breed images data.
- The head model CNN(multiple layers) built on top of Xception, completes the fully-connected network, trained over the data(images) we have at hand, & use the best hyperparameters & set the other parameters accordingly.
- This methodology leads to better computational efficiency, saves reesources & training time, performs better than other imagenet architectures, needs very less preprocessing of images comparitively.

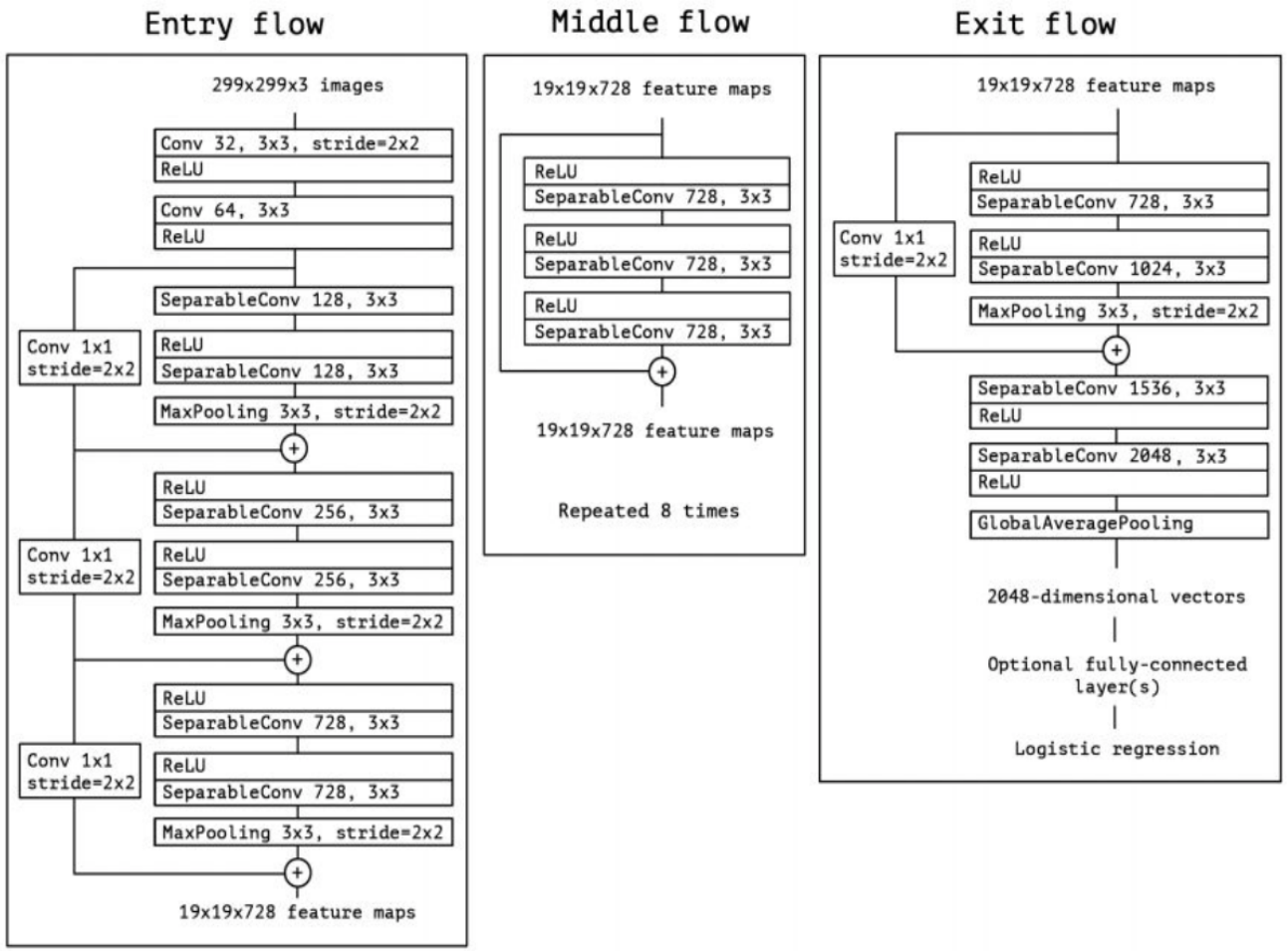

Xception
Inception V3
ImageNet validation accuracy
0.80
0.75
0.70
0.65
0.60
0.55
0.50
0
20000
40000
60000
80000
100000
120000
Gradient descent steps

THE XCEPTION ARCHITECTURE

- Xception stands for “extreme inception. ”It works a step more in-depth, than inception-v3 network, while processing the images. The author of Xception is also the author of Keras.

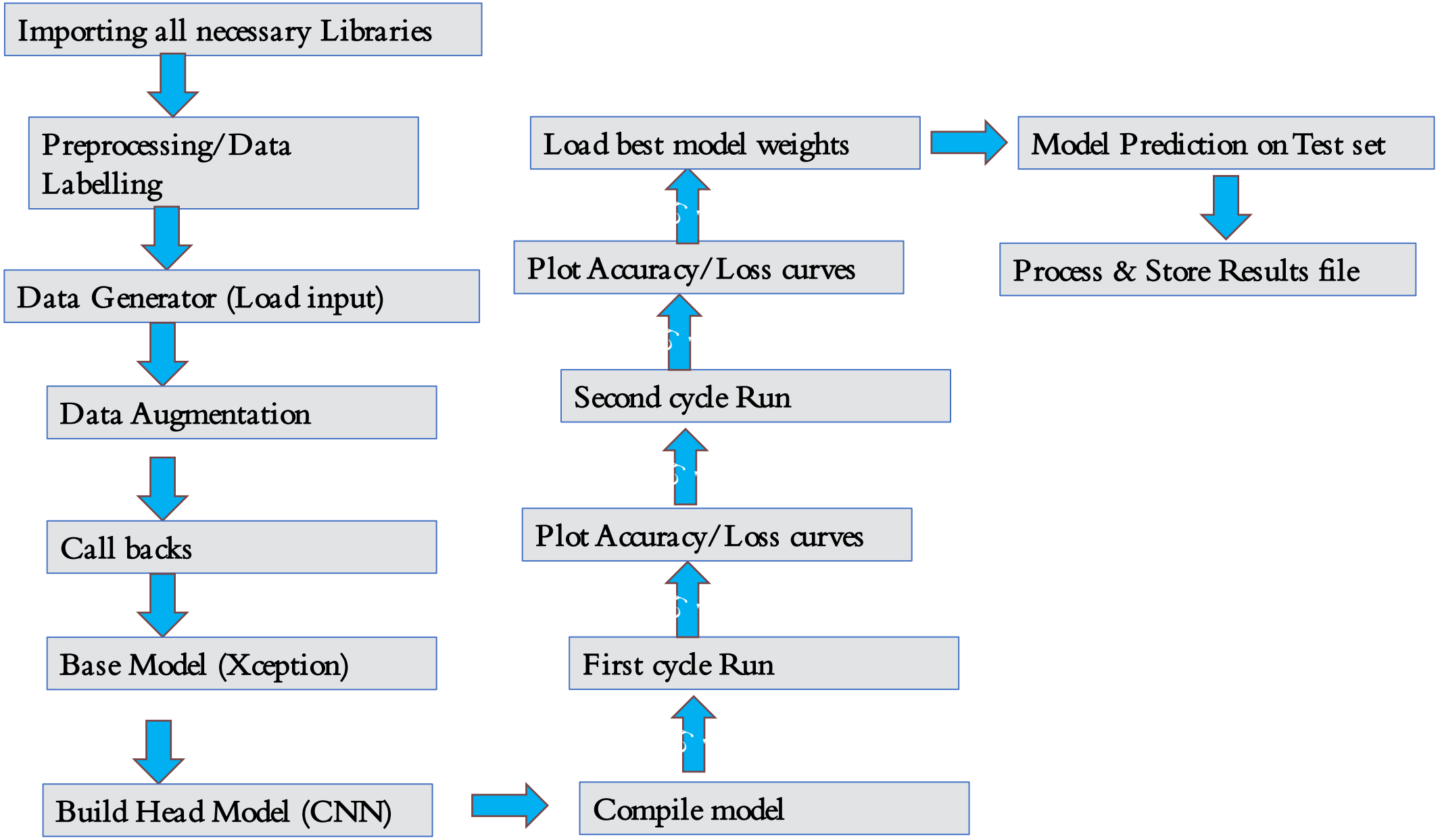
- Xception outperforms Inception v3 & others, on the ImageNet dataset.





WHAT DOES XCEPTION LOOK LIKE?

FLOWCHART


Importing all necessary Libraries
Preprocessing/Data Labelling
Data Generator (Load input)
Data Augmentation
Call backs
Base Model (Xception)
Build Head Model (CNN)
Compile model
First cycle Run
Plot Accuracy/Loss curves
Second cycle Run
Plot Accuracy/Loss curves
Load best model weights
Model Prediction on Test set
Process & Store Results file

CONCLUSION & SCOPE FOR FUTURE

- This proposed methodology ensures that all previous drawbacks have been overcome & a neural network system will be established on the principles of transfer learning, that assures an automated way of performing breed identification while achieving computational efficiency, high accuracy & saving time & resources.
- This framework can be implemented at scale, on real-time camera trap images, taken from animal habitats, to automatically identify the breeds of the species.
- The same concept can be extended to any type of species (breeds), for their images.
- This can be implemented to work as a real-time live feed identification system if it's enhanced even more & scaled up using technologies like Cloud computing & can be embedded with IoT resources, to advance the research furthermore.

REFERENCES

- [1] Kadari, S.I., Kulkarni, S.S., & Kulkarni, S.G. (2020). Dog Breed Prediction using Convolutional Neural Network.
- [2] Chetana Khandale1 , Mayank Ramdev2 (2019). Animal Classification using Deep Learning Inception-v3 Model on Tensorflow.

  10.1109/CONIT51480.2021.9498338
- [3] Varshney, Akash & Katiyar, Abhay & Singh, Aman & Chauhan, Surendra. (2021). Dog Breed Classification Using Deep Learning. 1-5. 10.1109/CONIT51480.2021.9498338.

- **Data Augmentation and Transfer Learning for Limited Dataset**

https://www.wseas.org/multimedia/journals/control/2018/b065103-788.pdf

- **Intuitive guide to DNN Architectures**

https://towardsdatascience.com/an-intuitive-guide-to-deep-network-architectures-65fdc477db41

- **Xception Vs Inception-v3**

https://towardsdatascience.com/review-xception-with-depthwise-separable-convolution-better-than-inception-v3-image-dc967dd42568


THANK YOU