Breed Identification System

Prepared By : Group B
Subject Code : COMP 6721

Contents

High Level Overview

Curiosity

With scientific advancement, humans wants to learn more about species lives surrounding them

Unavailability

There are not enough image sources available of various breeds of one animal which makes quite tough

TSNE & Hyper-parameter

Use TSNE to visualize predicted data and Hyper-parameter to improve accuracy of predictions

Vet Clinics

To help animals for providing healthier life, humans should be aware about all kind of variants of one specie to give proper treatment to animals

CNN methods

3 different CNN architectures are used to identify breed of animals (dog, fish, cat)

Goals

- **To predict correct breed of 3 animals (dog, cat, fish)**
- **Generate balanced dataset for future research for others**
- **Understanding concepts of AI in deep length for future projects**
- **Getting familiar with real-time problems & solution methods**

Datasets

Animal	Number of Images	Image sizes	No. of breeds
Dog	20.6 k	{400 - 500} X {310 - 345}	120
Cat	127 k	{300 - 330} X {250 - 270}	67
Fish	9 k	590 X 445	9

Dog

Eliminate some breeds having very less number of images (around 75 images/breed) and new dataset has 50 breeds with total 9719 images with uniform distribution of images among breeds (130-200 images).

Cat

Pruned to 67k images consisting of 27 breeds with distribution of images per breed is around 500 to 1000 images.

Fish

No modification

Normalization

Derive code for finding mean and standard deviation values for **Dog** and **Cat** dataset and then normalize all images based on those values.

Transform

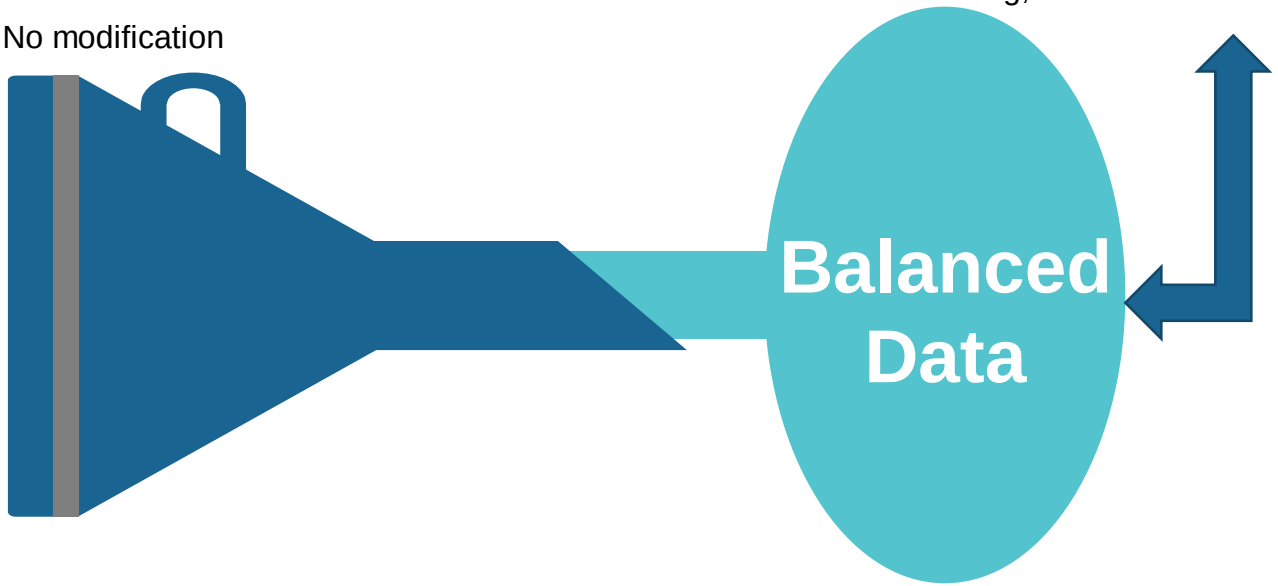
Resizing, Cropping, Converting and Flip to all 3 datasets

Split

Divide datasets of fish and cat into 3 parts:
Train – 70%, Validate – 10%, Test – 20%
For Dog, **Train – 80% and Test – 20%**

Imbalanced Data

1010011010010000101010011110111011010110101010000111001010110010101001110101001010100010101101011010110110100010101110001010100001



Methodology

CNN Architecture

ResNet-18

Last New Layer :

in_features □ 512 □ 256 □ out_features (number of classes).

ResNet-50

Last New Layer :

in_features □ 512 □ out_features

MobileNetV2

Last New Layer:

in_features □ out_features

Model Training

Train From Scratch

- Don’t load pre-trained weights in to the model and model will be encounter this kind of data first time
- 9 instances (3 for each dataset)

Transfer Learning

- Load previously trained weights to model andthe model already know similar images to problem statement in prior.
- 6 instances (3 each for dog & fish only)

Hyper-Parameter Tuning

Learning-rate

- 0.001 (default)
- 0.01
- 0.0001
- 0.0015
- 0.00075
- 0.005

Loss Function

- CrossEntropyLoss (default)
- NLLLoss
- MultiMarginLoss

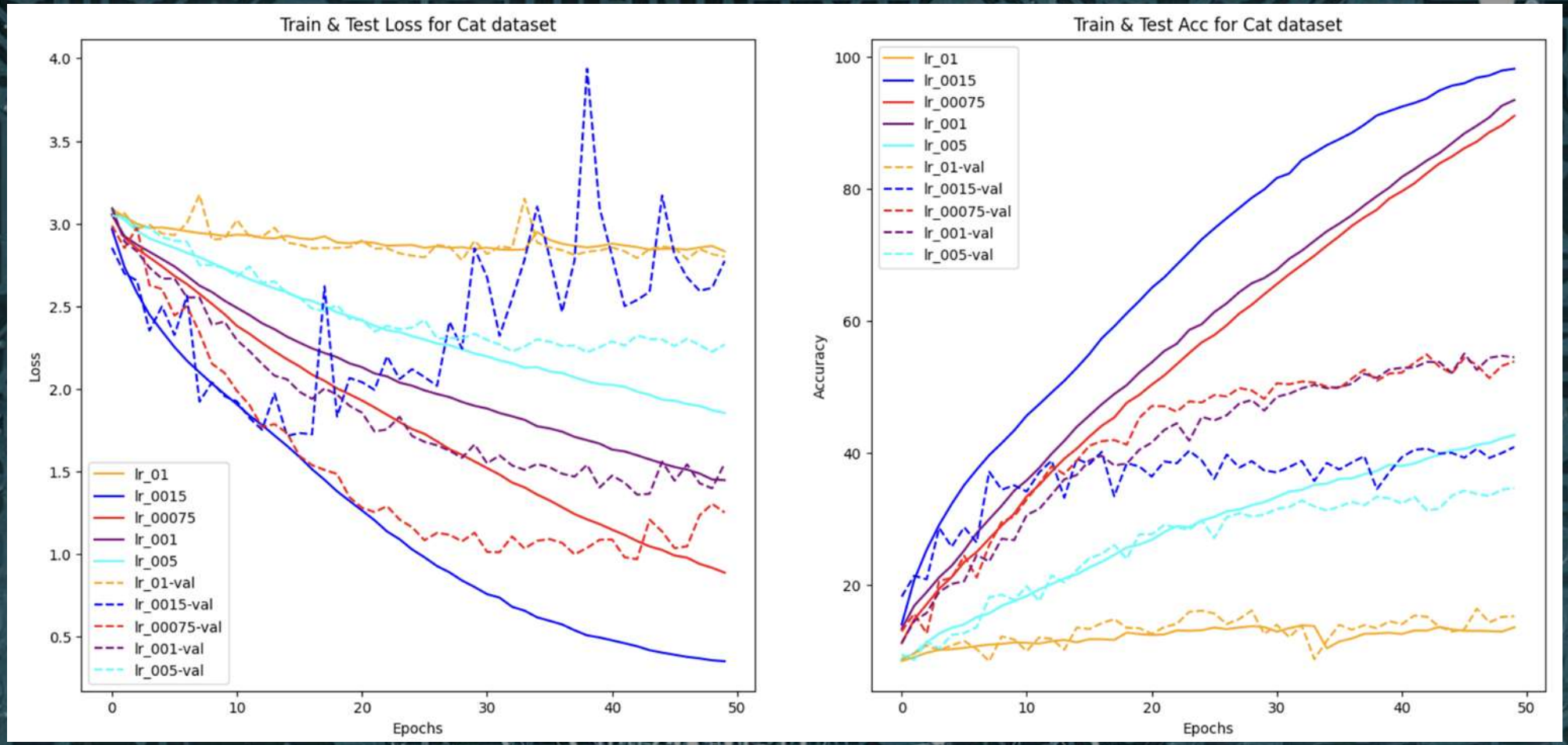
Results of 2 different training methods

Train from Scratch

	ResNet - 18			ResNet - 50			MobileNetV2		
	D	F	C	D	F	C	D	F	C
Accuracy (%)	69	99	58	69	91	58	64	81	63
Precision (%)	48	99	50	60	92	54	65	85	69
Recall (%)	41	99	49	56	91	51	62	81	51
F-1score (%)	41	99	49	56	91	55	63	80	69
Time/ epoch (seconds)	100	100	500	120	148	784	90	120	477

Transfer Learning

	ResNet - 18		ResNet - 50		MobileNetV2	
	D	F	D	F	D	F
Accuracy (%)	77	98	83	97	80	99
Precision (%)	78	99	84	98	81	100
Recall (%)	77	99	83	98	80	100
F-1score (%)	76	99	82	98	80	100
Time/ epoch (seconds)	128	100	146	112	122	99



Results of Hyper-parameter Tuning

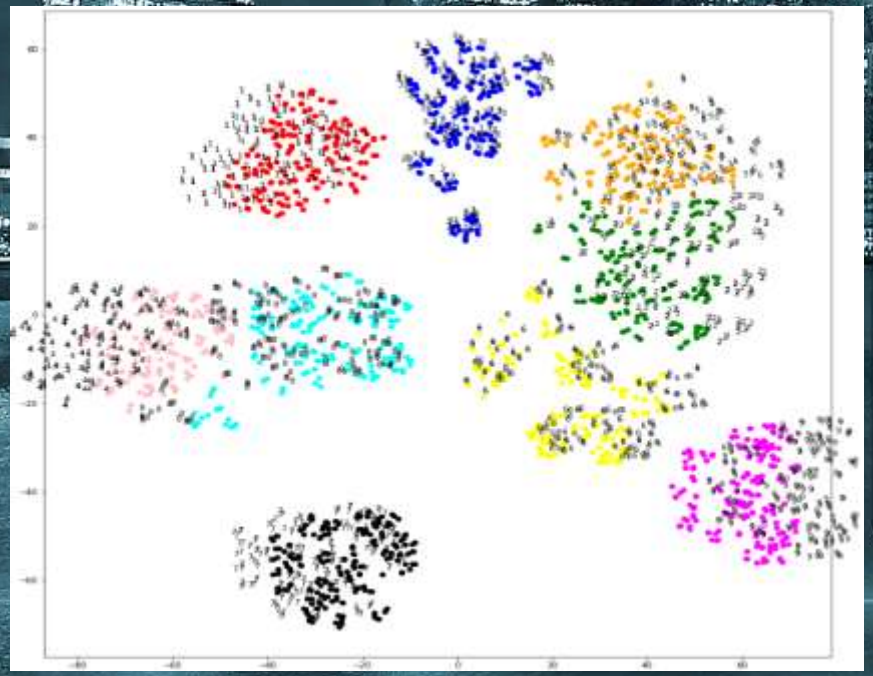
Cat ResNet18 model

As from previous table, one can analyze that this model gave worst results for all evaluation indices and that's why we opted this model for hyper-parameter tuning.

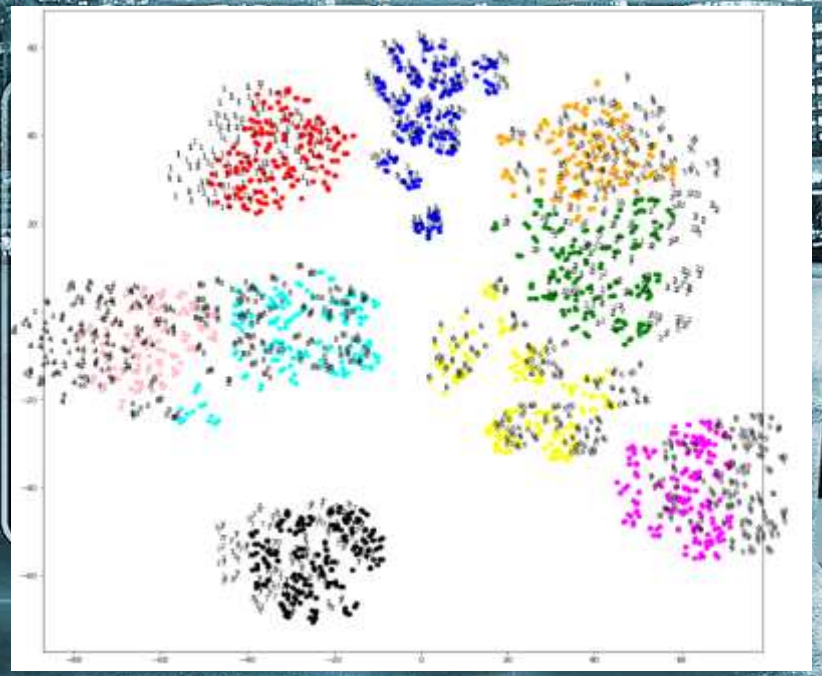
Results of TSNE

- We have shown the plots on transfer learning results for fish dataset below.
- We have shown more results of TSNE for dog and fish on train from scratch instances in the report

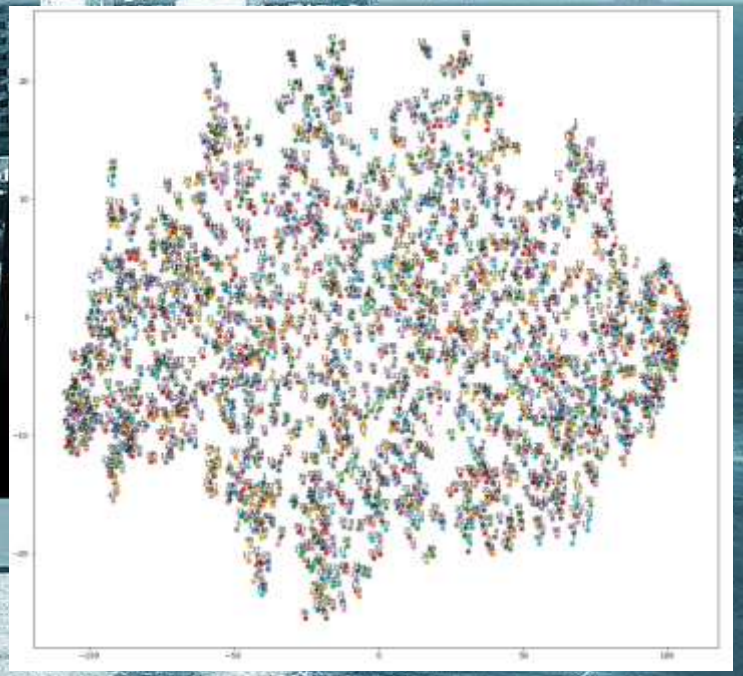
TSNE Plot for ResNet 18 -Fish



TSNE Plot for ResNet 50 -Fish



TSNE Plot for ResNet50-Dog



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THANK YOU