

## SML Kaggle Assignment

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### Methodologies

#### Dataset

1. Load the data (images) from the folder and the labels from the CSV file.
2. Data Preprocessing.
  - a. Open the image.
  - b. Resize the images (original 64x64), and resize them to 100x100. This is done as models like Inception Net and Dense Net take an image of this size.
  - c. Convert them into a numpy array for further processing.
  - d. Rescale the image.
  - e. Append images.
  - f. Convert labels also to numpy array.
  - g. Labels must also be converted to categorical, as we have 25 classes.
  - h. The same has to be done with the test data.

**Note:** Data Augmentation such as flipping the image, zooming, and shifting was also performed, but the model performed badly with it; to it, the preprocessing was done with the above only.

### Experiments

1. Different models have been applied to the processed dataset. Mostly deep learning models as they perform better for classification tasks.
2. The first model is CNN, the base model with simple Con2D, maxPool, and Dense layers.
3. The second model is VGG16, and its variation, VGG19, performed better using a pre-trained weights imagenet.
4. Dense Net and Inceptionnet were also tried.
5. MobileNetV2 is also good for classification, and it gave the best accuracy and results on Kaggle.

Epochs	25
Loss	categorical_crossentropy
optimizer	Adam

### Observations

1. Mobilenetv2 performs best for this classification task.
2. The below table shows the results with accuracy, precision, and recall

Model	Accuracy	Precision	Recall
CNN	99	0.90	0.90
VGG16	55.32	0.3	0.80
VGG19	93.90	0.95	0.92
RESNET50	9.1	0.3	0.2
MOBILENETV2	<b>87.89</b>	<b>0.9397</b>	<b>0.8383</b>

## Results

1. CNN model overfits for more epochs, but for lesser, it performs well, giving **36** percent accuracy on Kaggle.
2. Though VGG16's accuracy is not as good as CNN, CNN overfitted, and VGG performs better on test data with **51.4** percent accuracy.
3. VGG19 performs poorly than VGG16 and gives **45.4** accuracy on test data.
4. ResNet50 accuracy is very bad and performs badly on test data with only **15%** accuracy
5. MobileNetV2 performed best with **64.9** percent accuracy on test data.

## Analysis

1. MobileNetV2 is a highly efficient deep-learning model for image classification because it uses depthwise separable convolutions and linear bottlenecks. These features reduce the model's memory footprint and computational cost while maintaining high accuracy.
2. More training leads to overfitting, as in the case of CNN, so was run for lesser epochs.
3. Data Augmentation did not play a role in increasing the accuracy.

## Inferences

1. The data must be pre-processed before training as we have images, so they must be processed.
2. The base model performs well, but MobileNetV2 still performs best.
3. More epochs overfit the data, and accuracy on Kaggle is less.
4. Hyperparameters play an important role.
5. ML models don't give good accuracy and so DL models are used.
6. Data Augmentation did not do an accuracy increase.