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CS783

Assignment 2

Image Classification

Team Members

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Training Dataset Pre-processing

1.For coarse classification, we combined images from all subclasses for all coarse classes and used 4:1 split for training and validation sets.

2.For fine classification, we again used 4:1 split for training and validation sets.

3.Since dataset was small, we have used Data Augmentation in order to achieve better and more diverse training examples using ImageDataGenerator class in Keras Library.

Methods used for Feature Extraction

1.Inception V3 (input_size = 299 x 299)

2.MobileNet V2 (input_size = 224 x 224)

Coarse – for coarse classification, we have used Inception V3 model.

We froze all layers except last 2 blocks i.e. froze a total of 249 layers and trained on the rest to limit the number of learned parameters.

Approx. 13 million parameters

Fine – for fine classification, we have used MobileNet V2 model.

We froze all layers except the last block i.e. froze a total of 135 layers and trained on the rest to limit the number of learned parameters.

Approx. 2 million parameters for each fine class model

Total Parameters = (13+(2*5)) = 23 million

Experimentation

1.First, we tried our own CNN which was 3 layers deep, but performed miserably as dataset was very small.

2.Then we shifted to Transfer Learning. We tried different CNN architectures like Xception, VGG16, VGG19, Inception, MobileNet, DenseNet, etc.

3.We finally chose Inception V3 and MobileNet V2 considering their performance and constrains on number of parameters.

4.We tried different Batch Sizes (8,16,32,64), different Learning Rates (0.01,0.001 and 0.0001), number of EPOCHS and several optimizers (rmsprop, adam, SGD).

5.For coarse we chose learning rate = 0.0001 and for fine we chose it to be 0.001. We kept batch size the same for all training, equal to 32, and optimizer as 'rmsprop'. We chose EPOCHS=15 for all models, except flowers which worked best at EPOCHS=30.

6.In Data Augmentation, we tried different values of Rotation_Angle (40-60 degrees), Width_shift_range (0.2-0.4), Height_shift_range (0.2-0.4), Shear_range (0.2-0.4), Zoom-range (0.2-0.4) etc.

Problems Faced

1.We mainly faced problem in fine classification of Birds class. This class had the least amount of training examples and the highest number of subclasses to predict.

2.We tried all models described above for Birds alone (even tried InceptionResnet V2), tuned all hyperparameters involved viz. learning rate, epochs (went from 5 to 2500), optimizers, etc.

3.We tried fierce Data Augmentation on Birds class to improve training examples and validation accuracy, but to no avail.

4.In the end, we could not achieve satisfactory accuracy on Birds class.

Scope for Improvement

We hope to achieve better accuracy on all classes using Ensemble Techniques.

We can use Bagging and Boosting to finally predict on the basis of majority votes of different models.

Hashes

coarse - b80f489f0ff9a97ecfd629e10712da85

dog - e87ef14fc9abd3d265c2545d28bcdb28

aircraft - 7b49ba4cf731f26eb44ea04bfe5bb7f9

flower - 8728a1013ff76c559323b018453598c1

car - a823b9432fb5961d51ecb9d1bdc5ff2f

bird - 5a20b6683d9463da4515fad79ddff266

output - 403b29a8c62e93363db821bae11a7d1d