CUSTOMIZING PRE-TRAINED MODEL FOR CV CLASSIFICATION

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Computer Vision Over-Training

During the training of a big network, the model will reach a point where it will cease generalizing and start learning the statistical noise in the training dataset. Due to the overfitting of the training dataset, the generalization error will grow, making the model less helpful for making predictions on fresh data.

The learning rate of our computer vision model is very low which leads to a drastic rise to the epochs. This, in itself, leads to the cases where over-training occurs and we see an over-trained model. Additionally, a general rule of thumb from statistics point of view is that high variance leads to overfitting of the model.

Training methods to prevent over-training

There are different ways using which we can prevent over-training of the model viz a vis model performance and optimal learning rate.

Firstly, by monitoring the performance of the model continuously, we can estimate the over-training of the model and prevent it from happening. Parameters like *train_loss* and *valid_loss* in addition to the epochs are essential in the estimation of the training and learning rates. Moreover, when the *valid_loss (*validation loss) rate plateaus, or there is no change in the performance metrics, it indicates that the training needs to be stopped.

Additionally, the learning rate need to be optimized as well for preventing over-training of the model. In our data set of pets, the minimum optimal learning rate was 1e-03 which was scaled logarithmically as a value between 3e-03 and 4e-03 to maintain the order of magnitude of the learning rate.

Estimating the point where training should be stopped

It is vital to know when training of a model should be stopped. Firstly, the sensitivity of the timeframe of a project should always be taken in consideration as we cannot keep training the model for days and weeks when the timeline doesn't allow it.

Secondly, the training should be stopped for a neural network when *error* (difference between the desired output and actual output) is below the defined threshold value. The number of iterations or epochs should also be considered to stop the training when they rise above their respective threshold values.

Thirdly, parameter *accuracy* of the model can also be considered as one of the quality metrics to estimate and check when to decide to stop training. We can utilize the graph of *train_loss* and *valid_loss* to check the breakpoint where *valid_loss* crosses the *train_loss* and it steepens.

Performance of the Image Classification

The image classes with the best performance are: Pug, Beagle, Newfoundland, English Cooker Spainiel, and Havanese. The image classes with the worst performance are: American Bulldog, Ragdoll, Staffordshire Bull Terrier, American Pitbull Terrier, and Birman.

The worst performing image classes were selected based on the frequency of the incorrect predictions in them. Moreover, we can also observe that the distribution is extremely skewed based on the confusion matrix. This model can be held for mistakes such as confusing different categories with each other and not predicting the right one; making the same mistakes again and again. This indicates the worst performing image classes suffered the mistake of the model where it is having difficulty distinguishing certain categories from one another.

Some of the remedial methods or improvements for this setback can be adding more data for such categories to allow the model to train better for them and avoid the mistake of distinguishing categories incorrectly. Additionally, implementation of dropout methodology can also help prevent this issue and also overfitting of the mode.

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