Image Augmentation for Improvement of Performance of Deep Learning Image Classifiers

Minh Nguyen, Ryan Singman

Problem Statement

Deep convolutional neural networks have been shown to perform remarkably well in image classification tasks in recent years. However, these networks require extremely large training sets in order to train effectively and avoid overfitting. This problem of generalization can be critical to certain tasks, where it is either not possible or not feasible to obtain a suitably large dataset [1].

Intended Approach

Image augmentation is the technique of deriving augmented images from an existing training set and creating a new training set from the original and augmented images. Using the technique of image augmentation, deep learning image classifiers can achieve superior performance with smaller datasets, thus alleviating the data collection and labeling problem. We intend to utilize a variety of image augmentation techniques, including but not limited to:

- crop
- rotate
- translate
- flip (horizontal, vertical)
- invert
- histogram equalize
- lowpass filter
- bandpass filter
- highpass filter
- adaptive median filtering

We intend to evaluate which set of image augmentations result in the best performing classifier. To evaluate the different image augmentation algorithms effect on image classification, we will implement and test with an image classifier using deep convolutional networks. We are currently considering the following architectures:

- ResNet (50, 101)
- InceptionV3
- VGG19
- Stacking Deep CNN

The image classifiers will be compared using many metrics, including classification accuracy, logarithmic loss, area under curve, mean squared error, and others. We will be using the **imagenette** dataset, provided by FastAI [2].

Expected Outcomes

We expect to find that the set of image augmentations that contains the most image augmentation techniques will be the most effective at training the image classifier. Additionally, we expect that the affine transformations will be the most impactful image augmentations, more so than the frequency domain filtering transformations.

References

[1] C. Shorten and T. M. Khoshgoftaar, "A survey on Image Data Augmentation for Deep Learning," Journal of Big Data, vol. 6, no. 1, 2019.

[2] Fastai, "fastai/imagenette," GitHub. [Online]. Available: https://github.com/fastai/imagenette. [Accessed: 08-Apr-2021].