The Effect of Image Resolution on Neural Network Performance

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Introduction

- State of the art neural networks are becoming deeper and more costly to evaluate.
- One potential way to decrease the computational cost of a image classification CNN is to use lower resolution training and testing images.
- Computation = O(Resolution^2)
- It is unclear how changing the resolution will affect the performance (testing accuracy) of the CNN.

Goal: Provide guidelines on the resolution necessary for various tasks.

Data Sets

Bird Bike

- Easy data set
- Two categories: birds and bikes

Animals 10 - Kaggle

- Moderately difficult data set
- 10 categories: different animals (dog, cat, horse, spider, butterfly, chicken, sheep, cow, squirrel, elephant)

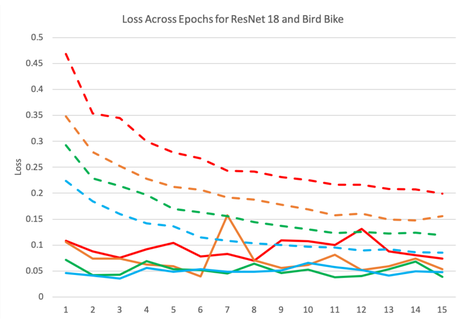
Birds 200

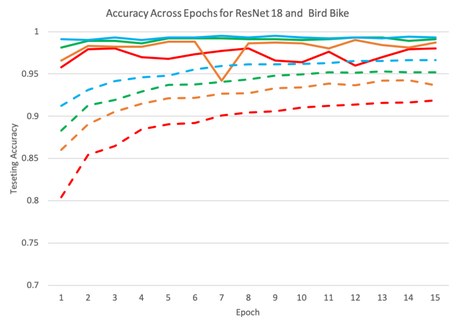
- Difficult data set
- 200 categories (different species of birds)

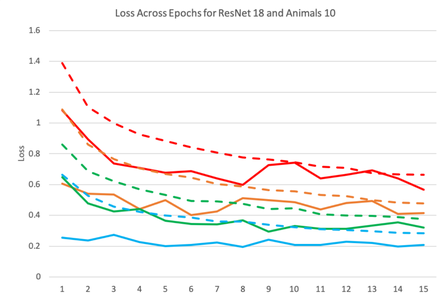
Methods

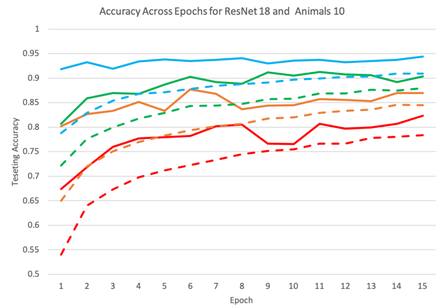
- 224x224 serves as the baseline model.
- We also down-sampled images to 65x65, 97x97x, 129x129.
- Trained and tested ResNet 18, ResNet 34, ResNet 50, and ResNet 101 models.
- The primary metric for evaluating the different models is the testing accuracy of the model.
- Observed the training and validation accuracy of the model.

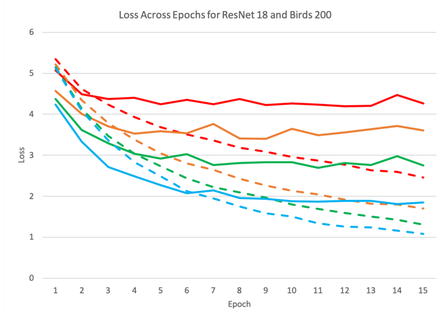
Results

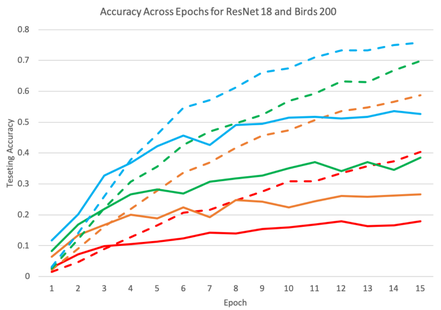


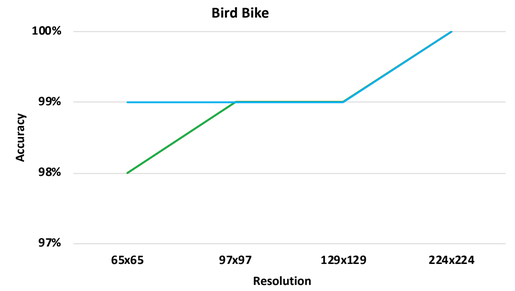


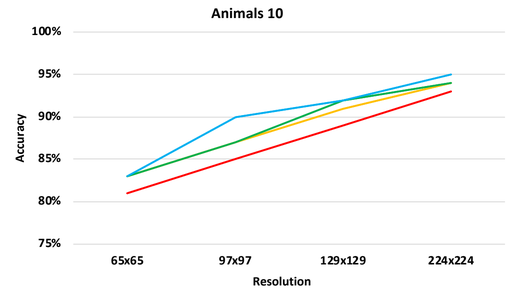


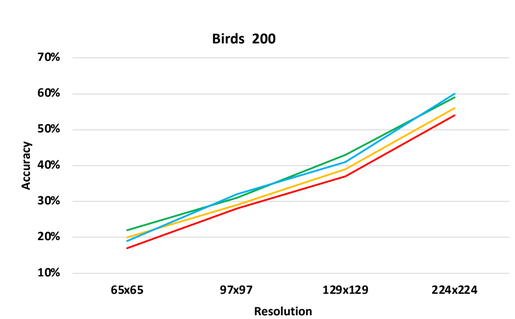


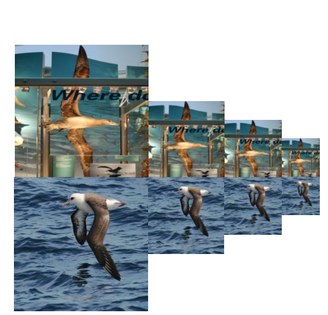












Conclusion and Future Work

- For easy tasks, images with low resolution (64x64) can be used to lower computational costs.
- For moderate tasks, images with moderate resolutions (97x97 or 129x129 can be used.
- Difficult tasks should use images with standard resolution (224x224).
- We hope to develop a method which allows you to determine the resolution needed for a task without using models.

References

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