

LDR Data Augmentation for Convolutional Neural Network Construction

by

Michael Curry

Submitted to the Department of Computer Science
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Abstract

Dataset size directly impacts the ability of a neural network to learn generalized patterns. A limited dataset in both size and breath generates overfitting in the model. Overfitting is the neural network learning too specifically to the training data and not general enough for the scope of test data. Data Augmentation is used to create new training data from a limited dataset. Classical techniques such as flipping, rotating, translating, and transforming the color channels are ways the data can be augmented while keeping true it's individual categorical label. In this paper I propose a technique utilizing blending modes to highlight features within the dynamic range of the image information. The Multiply and Screen blending modes are used to focus the data on the shadows (dark areas with Multiply) and highlights (light areas with Screen) respectively. The augmented data is fed into the neural network to create a generalized model. While this model does not reach high levels of accuracy it builds a foundation. On this foundation the unaugmented data is fed into the network to finely tune the model. Results to follow...

Thesis Supervisor: Min Chen
Title: Associate Professor

Acknowledgments

For Damien and Colette.

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Chapter 1

Introduction

Since the advent of photography practitioners have been searching for process to maximize the detail in their images. The photographic image is inherently a limited representation of our visual reality. Each image sacrifices certain elements to produce a generalized view of the scene.

Photography in its earliest form was a practice in capturing brightness values. It's invention in the 1800's as a Black and White medium was our first semi-permanent (all physical prints fade over time) process to capture our visual existence. Photography democratized the image creation process away from the artist and allows all of us the ability to curate our visual world.

The digitalization of the image created the opportunity to . . . The discrete nature limits the dynamic range and compresses the visual relationships.

Overfitting is a major issue with a limited dataset. The best CNN models come from big data. The more images available the better the ability of the model to form a more generalized view of the relationships in the data.

Image issues: Limited size, lighting, exposure, viewpoint, occlusion, background, scale, . . .

My Thesis will focus on lighting and exposure issues.

Maximize the information in the dataset by creating a more generalized representation by training on the full dynamic range of the image.

Multiply: $f(a, b) = a * b$

Screen: $f(a, b) = 1 - (1 - a)(1 - b)$

1.1 Section sample 2

1.1.1 Subsection sample

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1.1.2 Subsection with list

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1. Item 1.
2. Item 2.
3. Item 3.

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1.2 Section sample 3

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1.2.1 Another subsection sample

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Sed quis dapibus libero. Curabitur id finibus nulla, sed semper felis. Proin dapibus nulla interdum, bibendum tortor et, blandit sapien. Etiam pretium tristique tortor non lacinia. Aliquam dapibus turpis lorem, sit amet porta ex dignissim vitae. In neque felis, sagittis sed ullamcorper lacinia, lobortis ut turpis. Nam quis aliquet justo. Nam eros mi, aliquam vel massa ac, ornare dignissim erat. This is done by using some combination of

$$a_i = a_j + a_k$$

$$a_i = 2a_j + a_k$$

$$a_i = 4a_j + a_k$$

$$a_i = 8a_j + a_k$$

$$a_i = a_j - a_k$$

$$a_i = a_j \ll mshift$$

instead of the multiplication. For example, you could use:

$$r = 4s + s$$

$$r = r + r$$

Or by xx:

$$t = 2s + s$$

$$r = 2t + s$$

$$r = 8r + t$$

Cras pharetra ligula nec lectus bibendum, euismod mattis purus cursus. Nullam ut mi molestie purus ultricies lacinia. Phasellus sed orci ac lacus convallis vestibulum. Quisque id nulla ut ipsum finibus vehicula. Curabitur scelerisque erat lobortis, dapibus purus eget, faucibus sapien. Nam enim leo, faucibus id ante sed, fringilla luctus eros. Morbi vulputate, purus at commodo aliquet, turpis dolor sollicitudin libero, id vehicula risus dui sit amet nulla. Sed auctor efficitur urna. Praesent sagittis tellus ac velit vestibulum dignissim. Vivamus justo enim, pellentesque eu posuere id, mattis vitae felis. Aliquam id tincidunt diam. Class aptent taciti sociosqu ad litora torquent per conubia nostra, per inceptos himenaeos. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas.

Appendix A

Tables

Table A.1: Armadillos

Armadillos	are
our	friends

Appendix B

Figures

Figure B-1: Armadillo slaying lawyer.

Figure B-2: Armadillo eradicating national debt.

Bibliography