Low-Light Object Classification

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Problem Statement

Automated object classification has a variety of applications in real world. Deep Neural Networks perform well in the task of object classification but their performance in low-light conditions is not thoroughly tested.

We aim to improve existing low-light classification technique using a preprocessing pipeline and a fine-tuned deep CNN model.

Use Case

A large number of accidents and injuries occur because of the reduced visibility in low-light, particularly during night time. Automated object classification can aid drivers to make timely decisions.
Deep sea exploration and wildlife animal classification are difficult tasks when it is not feasible to obtain good quality images.

We intend to improve classification in such scenarios through our work.

Literature Review

The authors of [1] used a Resnet-50 model, pre-trained using ImageNet, for improving classification performance of ExDark dataset. The performance can be improved by a new preprocessing pipeline using [3] for dynamic histogram equalization for contrast enhancement.

Paper [2] and [5] provide the details about concepts of deep CNNs and Resnet that we'll can exploit for classification task after performing preprocessing.

Dataset

ExDARK [1]
7,363 low-light images, 12 classes

COCO [4]
200K+ labeled images, 80 classes

Project tasks and timeline

Tasks

A. Processing the images to make them suitable for object detection. Low light images have low dynamic range which results in loss of detail. Our task would be to enhance the image so that object detection becomes easy/feasible.
B. Use pre-processed images and select an optimal model for classification.

Timeline

A. Learning technologies to be used. Image enhancing algorithms, CNNs, pyTorch. **(1.5 weeks)**
B. Modifying dataset: enhancing input images through preprocessing pipeline. **(2 week)**
C. Applying conventional object detection / conventional techniques to these images. **(2 weeks)**
D. Optimizing models for the modified dataset (enhanced images might not be as good as pictures clicked in daylight) **(1.5 weeks)**

[1] Getting to Know Low-light Images with The Exclusively Dark Dataset, arXiv:1805.11227 [cs.CV]
[3] M. A.-A.-Wadud et al.: A Dynamic Histogram Equalization for Image Contrast Enhancement, 2007
[5] A. Krizhevsky, I. Sutskever, and G. Hinton. ImageNet classification with deep convolutional neural networks. In NIPS, 2012
[2] Deep Residual Learning for Image Recognition, arXiv:1512.03385v1 [cs.CV]
[4] COCO: Common Objects in Context, http://cocodataset.org