Object Detection using CNN

Group 6

Road Map

- Objective
- Data
- Model Strategy
- Technique
- Model Performance
- Further Improvements
- Conclusion

Objective

Our idea for this project is to build a model that is capable to **detect certain objects** in the images and highlight them with selective color.

Applications:

- This technique is highly used in **healthcare**.
- **Digital artists** take few hours to color the image but now with deep learning it is possible to color image in few seconds.

Data

We have sourced data from **Caltech256** image data set.

- Caltech's image collection procedure was by rating the images good, bad, not applicable.
- 92,652 images were collected from google and pic search, out of which **32.1%(30,608)** were good and kept.
- There are 256 object categories, and at least **80 images** per category.
- To name few categories: Sports equipment, plants, insects, animals, etc.

http://www.vision.caltech.edu/Image_Datasets/Caltech256/

Model Strategy

- Recently Deep Learning has seen many advancements, especially objective detection in images.
- Convolution Neural Network (CNN) are complex feed forward networks.
- CNNs are used for image classification and recognition because of its high accuracy.
- Our model was built for image classification. So, **CNN** was the best fit.

Technique

Stage 1

Input Layer

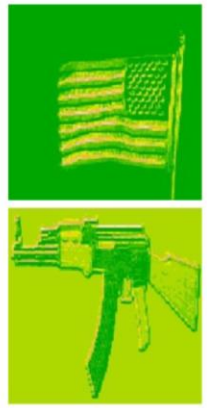
*Here we are giving input image shape as **150, 150 ,3** i.e height, width, channel. Since, its in RGB color space.*

Stage 2

Convnet Layer 1

*We are introducing the input shape to convolution layer with kernel size **3x3.** This layer learns local patterns of image in small 2D window of 3x3 patterns*

Filters : 32
Activation : Relu

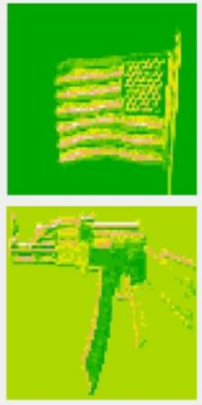


Stage 3

Max Pooling Layer 2

This layer consists of extracting windows from the inpute feature maps and outputting maximum value of each channel. Difference from previous layer is that it down samples the feature maps by 2x2

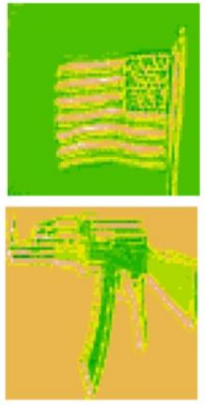
Filters : 32
Activation : Relu



Stage 4

Convet Layer 2

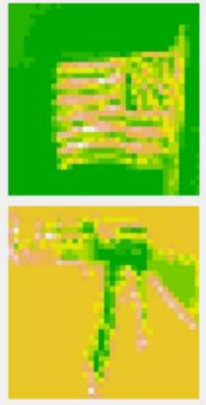
Kernel Size : 3x3
Filters : 64
Activation : Relu



Stage 5

Max Pooling Layer 2

Window Size : 2x2
Strides : 2

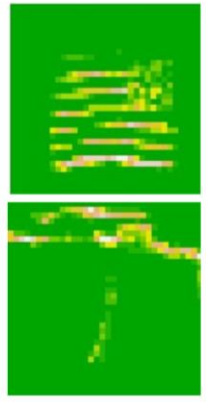


Stage 6

Convet Layer 3

Kernel Size : 3x3
Filters : 128
Activation : Relu

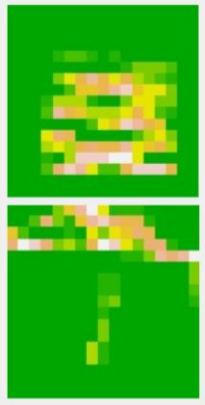
Here, we increase filters to make network more complex and extract more feature maps.



Stage 7

Max Pooling Layer 3

Window Size : 2x2
Strides : 2



Stage 8

Convet Layer 4

Kernel Size : 3x3
Filters : 128
Activation : Relu

Stage 9

Max Pooling Layer 4

Window Size : 2x2
Strides : 2

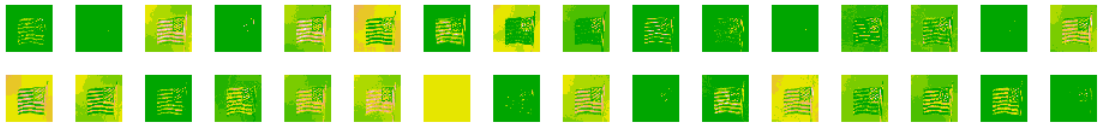
Stage 10

Dense Layer

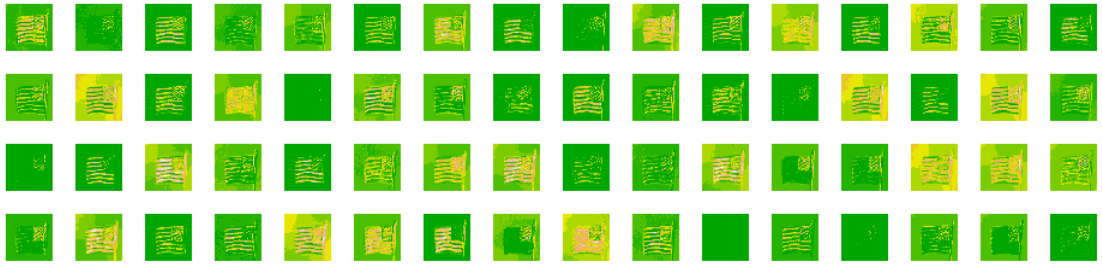
We will convert Convolution layer to Dense Layers. To achieve this we have flatten the layer and used dropout regularization to prevent over fitting
Since its a classification task and has two levels, we used "sigmoid" as activation function.

Technique

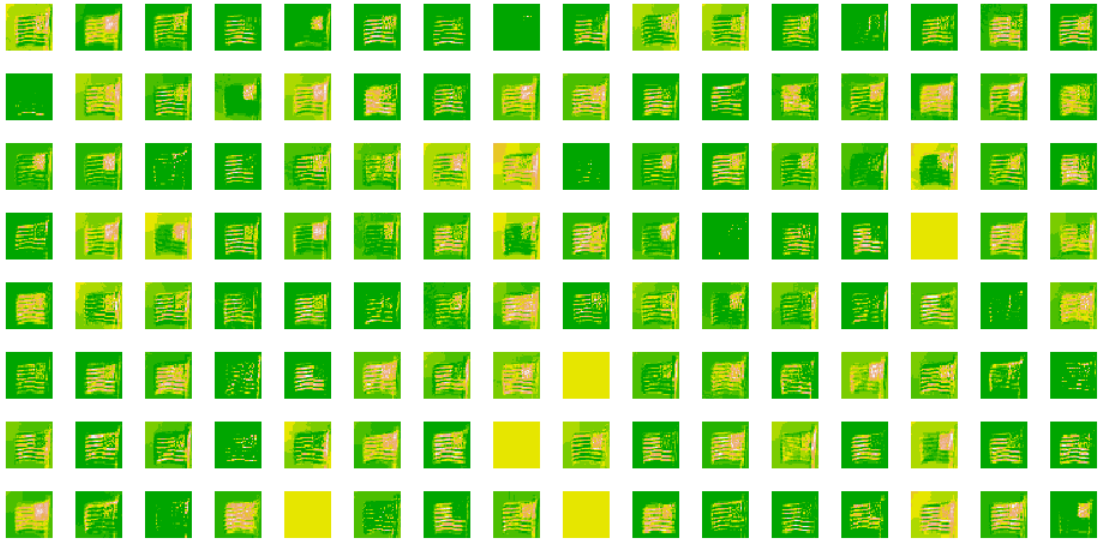
Convolution Layer 1



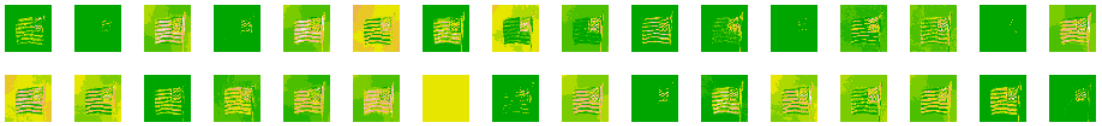
Convolution Layer 2



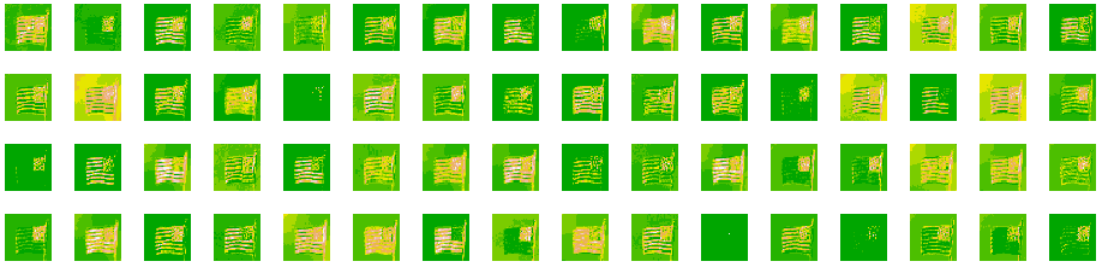
Convolution Layer 3



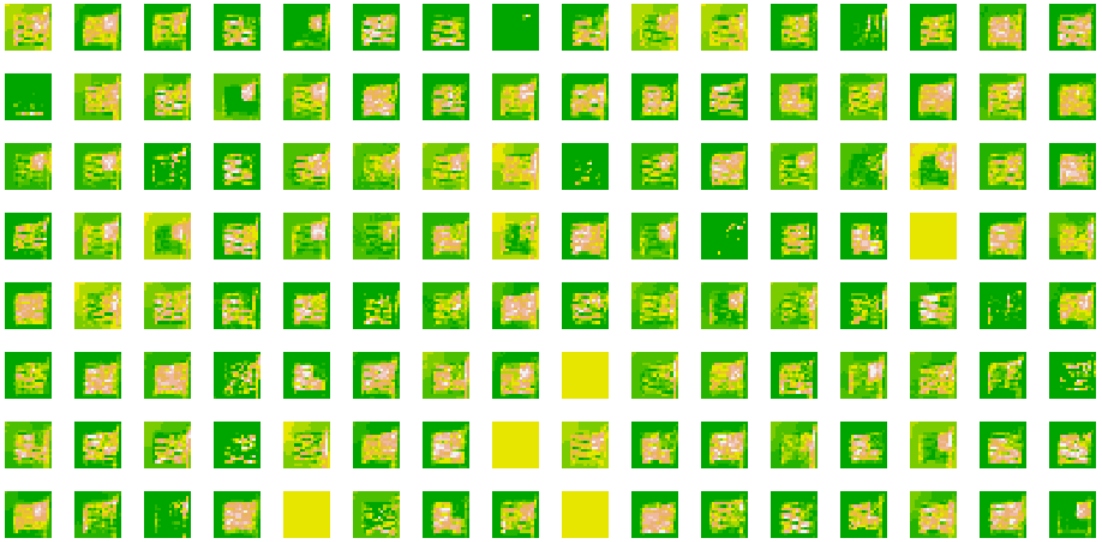
Max Pooling Layer 1



Max Pooling Layer 2



Max Pooling Layer 3



Model Refinement

- In order to achieve **82.5%** accuracy of the model, we have tuned several hyper-tuning parameters.
  - Every convolution layer we have increased model complexity by incrementing number of filters.
  - We flatten the pooled feature map into a **1D tensor**. By introducing dropout regularization we tried to prevent model from over fitting.
  - In dense layers, we have used **512 nodes** for a hidden layer.

Conclusion

- We successfully built a model to classify the images and corresponding RGB values of these images were stored in array format.
- When we give a B/W image to the model, it will be able to classify the image.
- Due to lack of computing power, we couldn’t proceed to our secondary objective, where this model is capable to colorize the given B/W image.

Further Improvements

- Presuming we have enough computing power;
  - We could train this model further with more image data and extract RGB color values for every object in an image.
  - Using this trained models, we can colorize a black and white image or an old distorted images.

- References:
  - https://towardsdatascience.com/colorizing-images-with-a-convolutional-neural-network-3692d71956e2
  - https://towardsdatascience.com/colorizing-old-b-w-photos-and-videos-with-the-help-of-ai-76ba086f15ec