CSC321 Winter 2018 Assignment 2

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Part A.SOLUTION

(1) Describe the model RegressionCNN. How many convolution layers does it have? What are the filter sizes and number of filters at each layer? Construct a table or draw a diagram.

There are 6 convolution layers in model RegressionCNN.

Layer Name	Filter Size	Number of Filters
downconv1	3 x 3	32
downconv2	3 x 3	64
rfconv	3 x 3	64
upconv1	3 x 3	32
upconv2	3 x 3	3
finalconv	3 x 3	3

(2) Run colour_regression.py. This will load a set of trained weights, and should generate some images showing validation outputs. Do the results look good to you? Why or why not?
The results do not look good.The predicted images is not colorful as source images. And the color of predicted images is tend to be grey and green.

(3) A colour space [1] is a choice of mapping of colours into three-dimensional coordinates. Some colours could be close together in one colour space, but further apart in others. The RGB colour space is probably the most familiar to you, but most state of the art colourization models do not use RGB colour space. The model used in colour_regression.py computes squared error in RGB colour space. How could using the RGB colour space be problematic?

Since RGB colour space does not include some features which are influential to how human perceive colour, RGB colour space could be problematic.

(4) Most state of the art colourization models frame colourization as a classification problem in- stead of a regression problem. Why? (Hint: what does minimizing squared error encourage?)

If we treat the colorization as a regression problem, it is very likely get more grey-color predicted images which minimize squared error. If we treat it as classification problem, we can avoid this problem.

Part B. SOLUTION

(1)

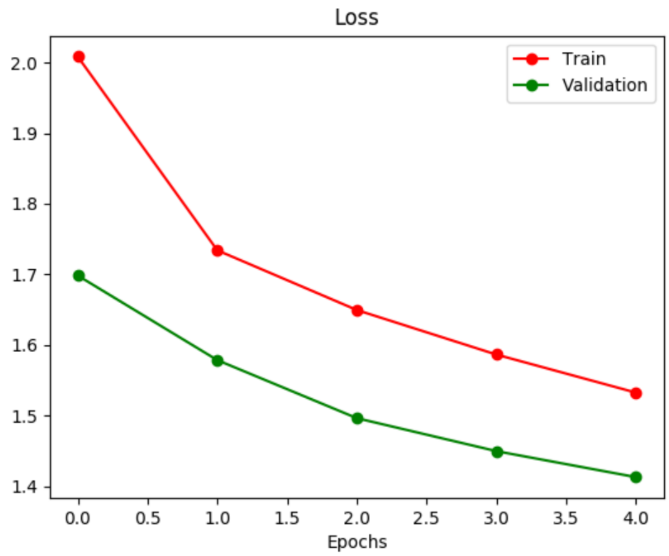
(2) Run the following command: python colourization.py –model CNN –checkpoint weights/cnn_k3_f32.pkl –valid This will load a set of trained weights for your CNN model, and should generate some images showing the trained result. How do the result compare to the previous model?

Compared to the result from previous model, the performance get promoted in term of color but the predicted images become more blurred.

Part C. SOLUTION

(1)

(2) Training Curve



(3) How does the result compare to the previous model? Did skip connections improve the validation loss and accuracy? Did the skip connections improve the output qualitatively? How? Give at least two reasons why skip connections might improve the performance of our CNN models.

CNN: validation loss = 1.5881, validation accuracy = 41.1%
UNet: validation loss = 1.4074, validation accuracy = 48.1%

Following are the result from previous model, the result with pre-trained weights Unet model and the result with after-trained weights Unet model:

Summary: The predicted image looks better than the previous one. And the validation loss and accuracy get promoted. The two possible reasons are:

1. It improves model's generalization.

2. The information from primary layers can be sent to later layers, which could compensate the information lost during upsampling.

Part D. SOLUTION

(1) Let A be input channel size and B be the output channel size.

Filter	Number of weights	Size of receptive field
3 x 3 convolutions	9 x A x B	3 x 3
5 x 5 convolutions	25 x A x B	5 x 5
3 x 3 convolutions with dilation 1	9 x A x B	5 x 5

(2) The reason we replaces the middle convolution with a dilated 1 convolution is that if we have lager receptive field, we can get similar result as max pooling to upsampling in the middle convolution.

Part E. SOLUTION

(1) Visualize the activations of the CNN for a few test examples. How are the activation in the first few layers different from the later layers? You do not need to attach the output images to your writeup, only descriptions of what you see.

Compared to the activations from later laters, there are more clearer contours in the activation in the frst few layers.

(2) Visualize the activations of the UNet for a few test examples. How do the activations differ from the CNN activations?

Compared to CNN activations, the activations of the UNet looks more dark.

Part F. SOLUTION

(1) Data augmentation can be helpful when the training set size is small. Which of these data augmentation methods do you think would have been helpful for our CNN models, and why?

a.Augmenting via flipping each image upside down
b.Augmenting via flipping each image left to right

By flipping the image vertically or horizontally, we can provide more different training examples.

(2) We also did not tune any hyperparameters for this assignment. What are some hyperparam- eters that could be tuned? List five.
learning rate, convolution filter size, stride, dilation, pooling filter size.