Grayscale Images Colorization

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Starting point--available frameworks

- Framework 1: Convolutional neural network (VGG16)
  - 4 layers, no max pooling
  - Boundary condition: same mode
- Framework 2: Convolutional neural network & ResNet V2
  - Convolution neural network
    - Encoder: 8 convolution layers
    - Fusion: concatenate with ResNet output, 1 convolution layer
    - Decoder: 5 convolution layers, 3 upsampling
  - Pre-trained ResNet

```
#Load weights
inception = InceptionResNetV2(weights='imagenet', include_top=True)
inception.graph = tf.get_default_graph()
```

Dataset and computer specs

- Dataset:
  - Colored image from FlickrAPI (keywords: “portraits”)
  - Single class of images are easier for the model training, but may result in a lack of generalization ability.

```
In [2]: api_key = u'3f2550987c3d0ea5d486835a149e1779'
        api_secret = u'97cda0275103d370'
        flickr = flickrapi.FlickrAPI(api_key, api_secret)
```

```
In [8]: keyword = 'portraits'
        dir_name = 'portraits'
        photos = flickr.walk(text=keyword, tag_mode='all', tags=keyword,extras='url_c',\
                             sort='relevance',per_page=100)
```

- Computer specs:
  - Google Cloud Platform (GPU: 1*Nvidia Tesla P100; 2vCPUs, 13GB Memory)

Test result of framework 1 (dataset size = 8)








Tested parameters for framework 2

- Changed parameters: training dataset size, batch size, epoch

Id	Training dataset size	Batch size	Epoch
1	10	10	1000
2	128	32	1000
3	1024	32	50

Result for group 1 with framework 2



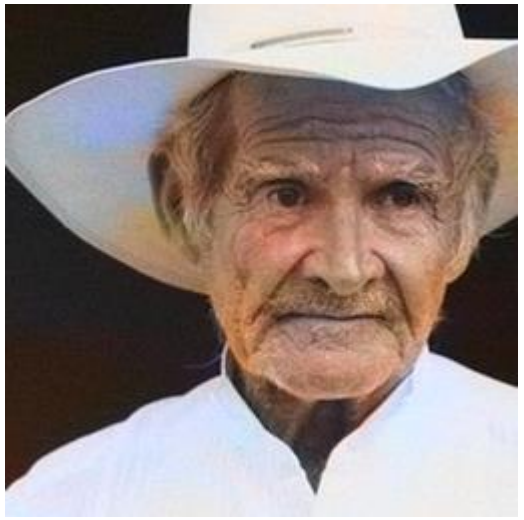





Result for group 2 with framework 2





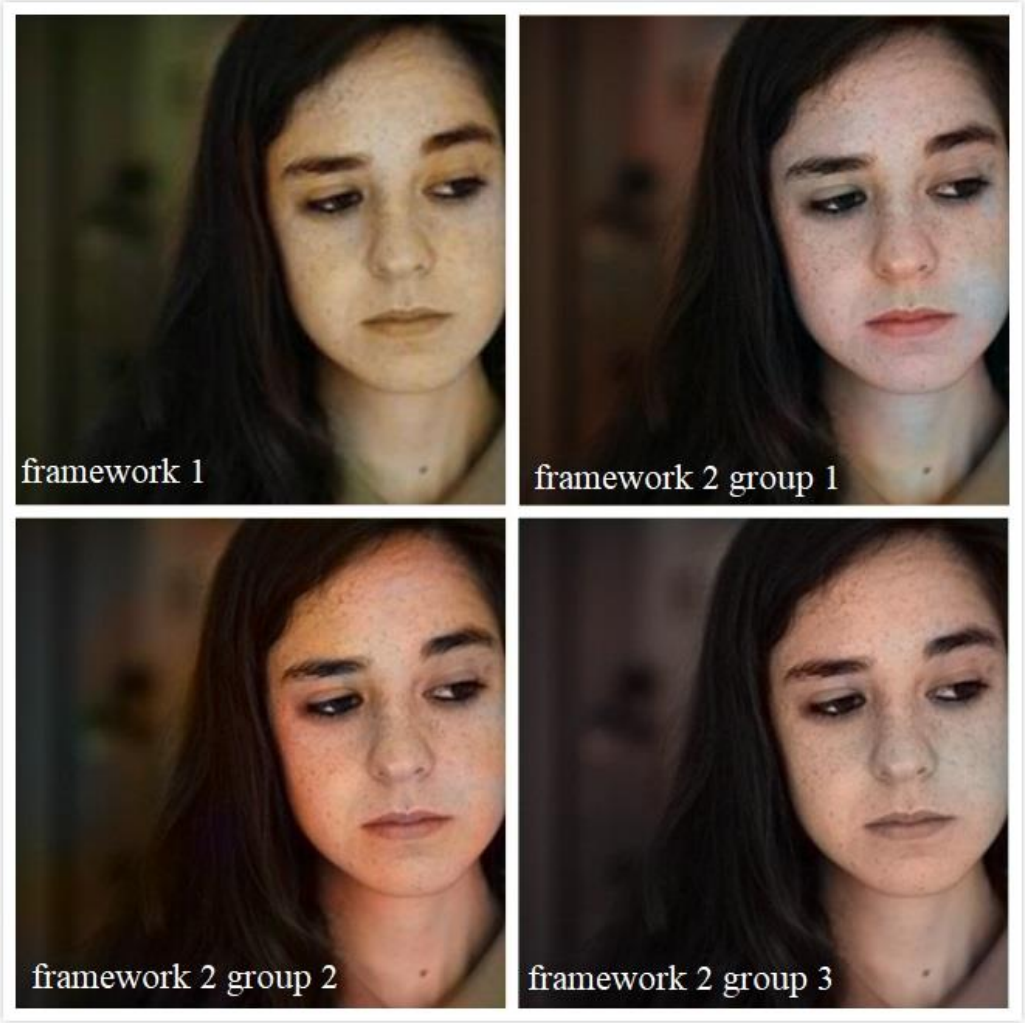
Result for group 3 with framework 2

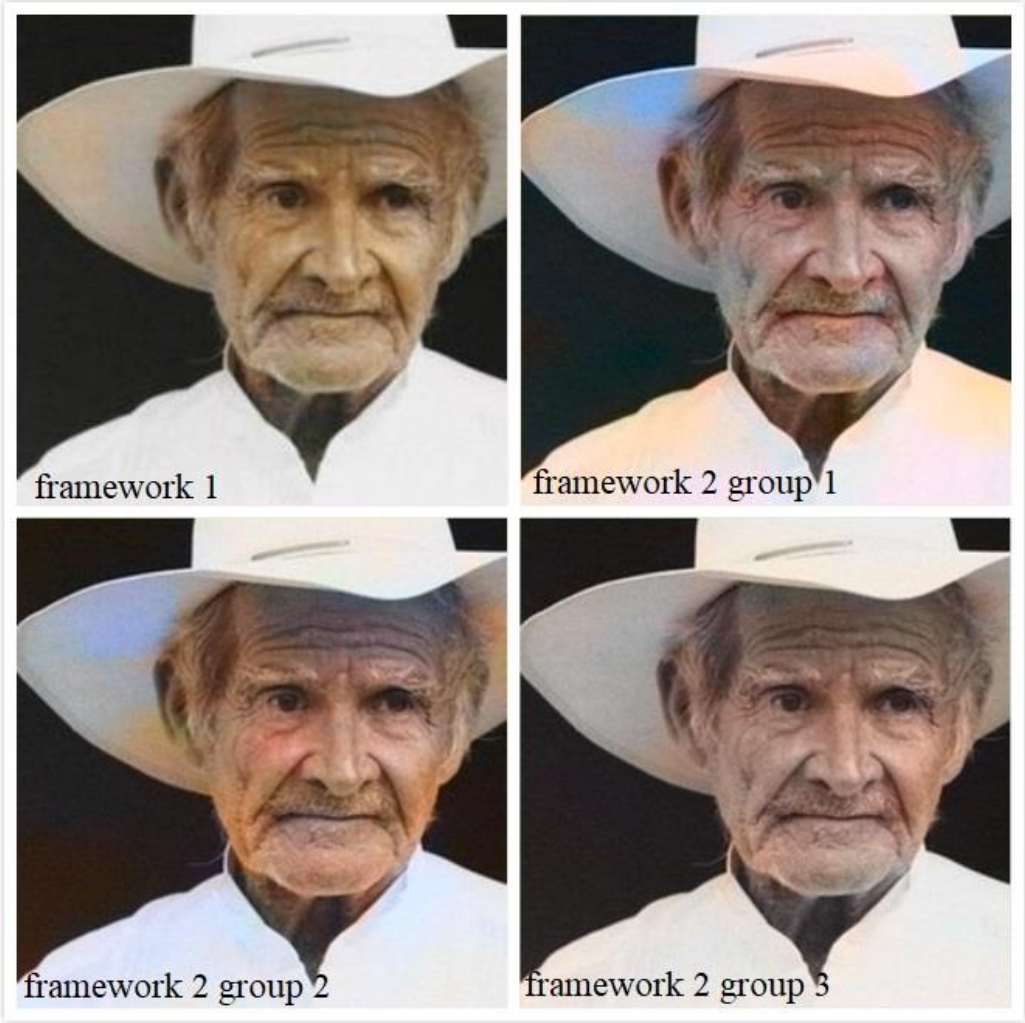







Result comparison





Conclusion

- Framework 1 tends to apply a yellowish tone to the B&W images because the pre-trained VGG 16 structure is not complicated enough (only 4 conv. layers added and no max pooling), may not sufficient for features recognition.
- The group 1 result is mostly unsaturated due to the small training dataset.
- The group 2 result has a relatively correct colorization, but not all the regions are colorized evenly (Eg, for the right side result samples, there are some small blue and green regions on the hat where they should not exist). It may because the batch size has not been properly set, which may influence the process of finding the global optimal.
- The group 3 has better result compared with the previous two because of the larger dataset size and proper batch size. The training epochs for group 3 is only 50 due to the time limitation. We believe if the epoch value increases, the colorization result will be better.

Reference

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