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Let there be Color!

Image colorisation using deep convolutional networks

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Introduction

- Goal: Grayscale Image $\Longrightarrow$ Reconstruct the color channels $\Longrightarrow$ Color Image
- Why?
  - Colorisation of historical photographs
  - Other ”channel inference” tasks could exist.
- How?
  - *Let there be Color!: Joint End-to-end Learning of Global and Local Image Priors for Automatic Image Colorization with Simultaneous Classification* (Iizuka et al. 2016)
  - Train a CNN for the colorization task
  - Retrieve features at different scales for colorization, assisted by classification

The model

Input: Grayscale 224 $\times$ 224 image

Output: 224 $\times$ 224 $\times$ 2 Color Channels a*b* (CIELAB) + Classification label

Different components:

- Low-Level Features network
- Mid-Level Features network
- Global Features network
- Colorization network
- Classification network

Hybrid loss: Colorization (real target) + Classification (assistance loss)

$$L(l_{pred}, l_{gt}, y_{pred}, y_{gt}) = MSE(l_{pred}, l_{gt}) + \alpha CrossEntropy(y_{pred}, y_{gt})$$

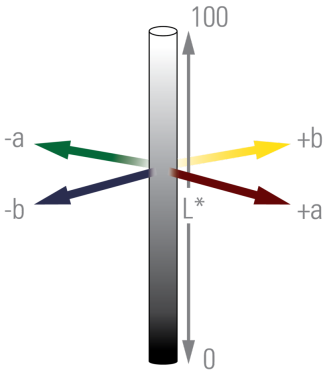

Figure: The CIELAB color space

Architecture: an illustration

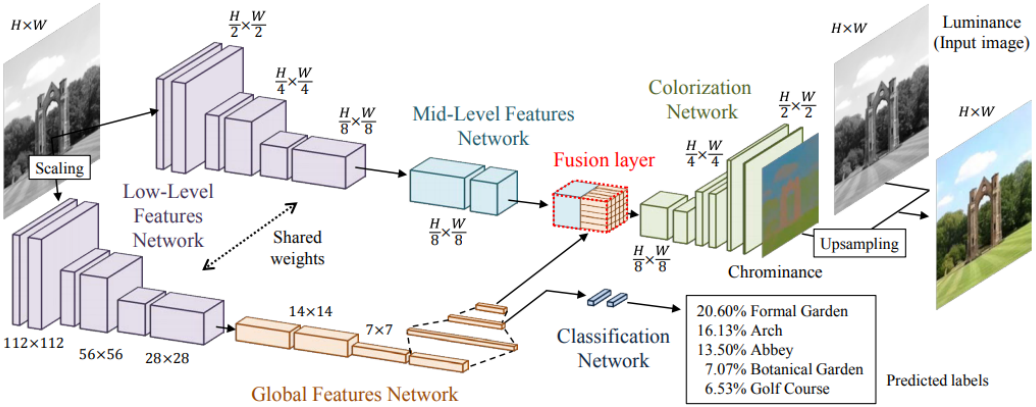

Figure: The architecture of the model

Our implementation: specificities

- Framework: Python + Pytorch-Lightning
- Few differences with the paper:
  - Adam optimizer
  - Batch size of 32
  - No batch normalization
  - Hidden units in the classifier (to allow more classes)
- Training:
  - 365 images classes, 1000 images each ($\approx 20\%$ of the Places365 dataset).
  - $\approx$ 2h per epoch on a Tesla P100 GPU
  - 14 epochs to reach a minimum validation loss $\Longrightarrow$ 30h total training
- Achieved good and plausible results. To reach as good as the paper:
  - More finetuning
  - More computing power (i.e. larger training)

Results: Some examples

More results can be found in our report. In most cases, the colorization is plausible.

Results: Failure cases

”Sepia” effect

Wrong understanding

- Our work: study, implementation and training of an end-to-end deep learning method to colorize images
- Good and plausible results on a various range of 224×224 images
- More time and computational power to reach performances as good as the paper
- Possible enhancements: Residual connections (for details, e.g. leaves), adversarial loss...

Thank you for listening !