Image Colourisation Project

Jun-Aug 2020 | WTEF Project | Deep Learning

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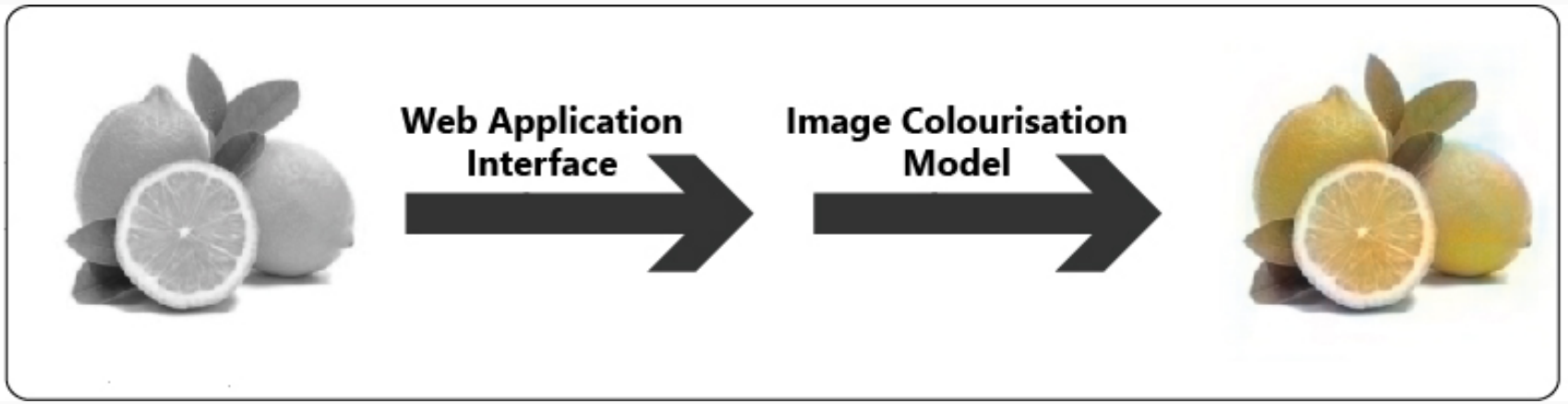
Objective



Motivation





Our journey from being entirely clueless to completing an Image Colourisation project in Deep Learning

Colorful Image Colorization paper by Richard Zhang, Phillip Isola, Alexei A. Efros

To hallucinate the most plausible colour version rather than the ground truth

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Train a CNN to map from a grayscale input to a distribution over quantized colour value outputs

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Challenges

- Advanced Mathematics
- Obtaining the ImageNet Dataset
- Availability of a GPU
- Uploading a 150 GB dataset online

AutoEncoders

A type of Neural Network used to learn representation for a set of data in an unsupervised manner

CIELAB Colour Space

- Why RGB will not work

Grayscale

Only 1 channel

RGB

3 channels

Grayscale

Only 1 channel

RGB

3 channels

Grayscale $\Rightarrow$ RGB

3 channels, but R==G==B

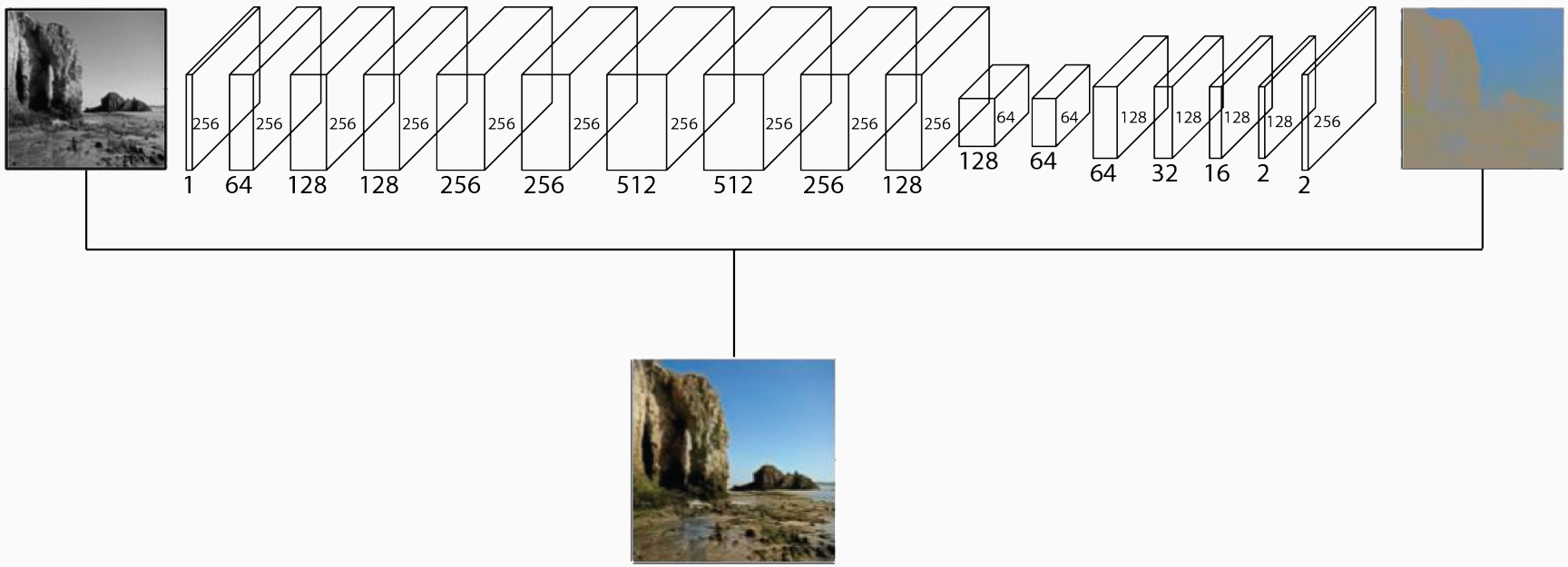
CIELAB Colour Space

- L channel: Lightness
- A channel: green to red
- B channel: blue to yellow

Technology Stack

- **Building the Model**
  - PyTorch
- **Datasets and Version Control**
  - Kaggle
- **Deployment**
  - Heroku
- **Backend Development**
  - Flask
- **Frontend Development**
  - HTML
  - CSS
  - JavaScript

Model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Model

- Loss Function: **MSE Loss**
- Optimiser: **Adam**
- Range of Learning Rates used for training: **1e-3 - 1e-6**

Challenges

- Tensor and Numpy Array interconvertability
- Interoperatability between CPU and CUDA
- Runtime disconnects
- Signal being killed due to memory usage

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- Tensor and Numpy Array interconvertability
- Interoperatability between CPU and CUDA
- Runtime disconnects
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- No Mathematical Parameters like Accuracy to check results

Datasets

- ImageNet
  Trained on 49000 images, Validated on 1000 images
- Fruits 360
  Trained on 66692 images, Validated on 1000 images
- Flickr
  Trained on 30783 images, Validated on 1000 images
- Scene Classification
  Trained on 23335 images, Validated on 1000 images

Results

Further Improvements

- Images following only some certain themes are coloured well
- Incorporating Data augmentation

References

1. Colorful Image Colorization paper by Richard Zhang, Phillip Isola, Alexei A. Efros: https://arxiv.org/pdf/1603.08511.pdf
2. Applications of AutoEncoders - Image Colourisation: https://github.com/bnsreenu/python_for_microscopists

Our Project

- Web Application: https://image-colouriser.herokuapp.com/
- Gitlab: https://gitlab.com/twishabansal/image-colourisation
- Kaggle Notebook: https://www.kaggle.com/sejalgupta01/image-colorization-starter

Questions and Suggestions?