Image Colourisation Project

Jun-Aug 2020 | WTEF Project | Deep Learning

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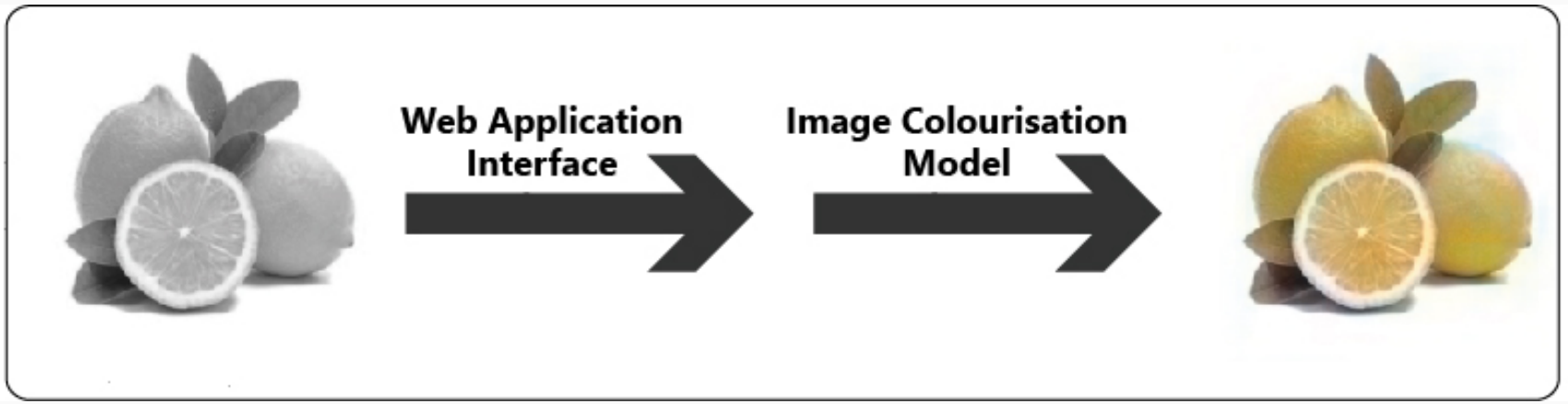
31 August 2020

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

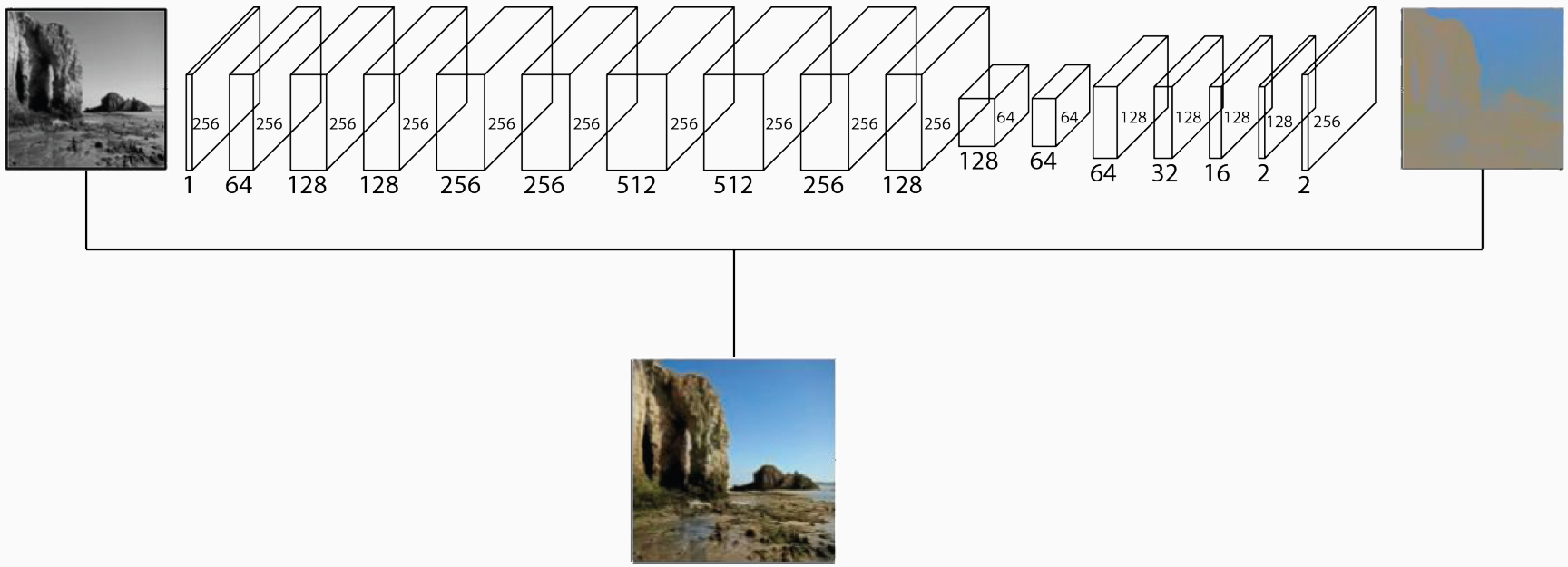
CIELAB Colour Space

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

Technology Stack

- **Building the Model**
  - PyTorch
- **Datasets and Version Control**
  - Kaggle
- **Web App**
  - Streamlit
- **Cloud Platform**
  - Heroku

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
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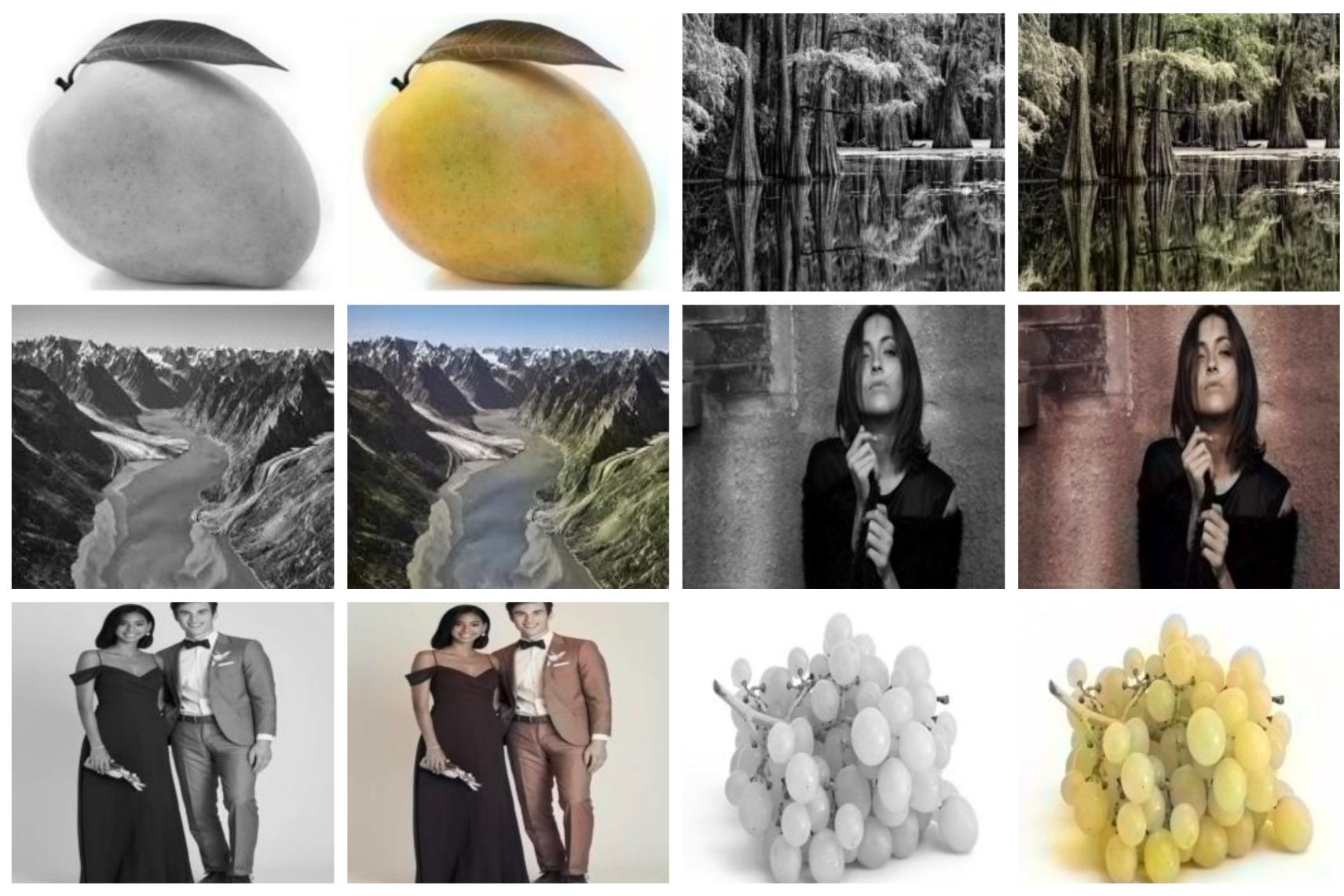
- No Mathematical Parameters like Accuracy to check results

Datasets

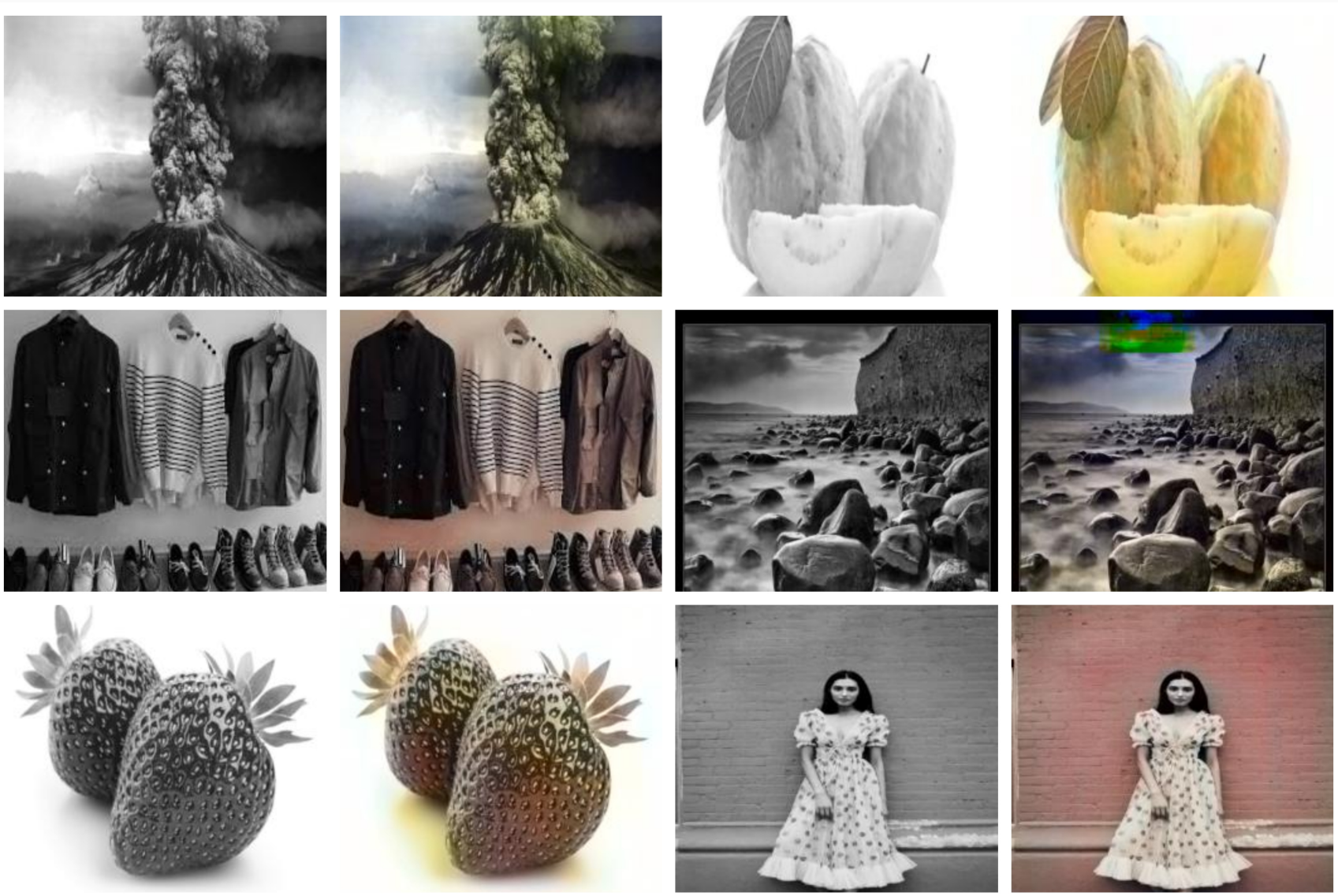
Trained on approximately 313K images

- ImageNet(50K Images)
- Flickr
- Landscape Classification
- Scene Classification
- Fruits 360
- Fruits Recognition
- Clothes Classification

Results: Pass



Results: Fail



Web Application and Deployment

Web App:

- Made with Streamlit
- Why Streamlit:
    1. Reducing app code to Python scripts
    2. Treating widgets like variables
    3. Reusing data with memoization

Deployment:

- Heroku as the cloud platform

Further Improvements

- **Model**
  1. Generalising on more themes
  2. Automating the classification of themes
  3. Incorporating Data augmentation
  4. Compatibility with all image sizes
- **Web App**
  1. Using Flask along with HTML/CSS/JS to customize better

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

Questions and Suggestions?