NOTHING'S BLACK OR WHITE

Team 70

PROBLEM → DATA → MODELS → RESULTS → DISCUSSION → DEMO

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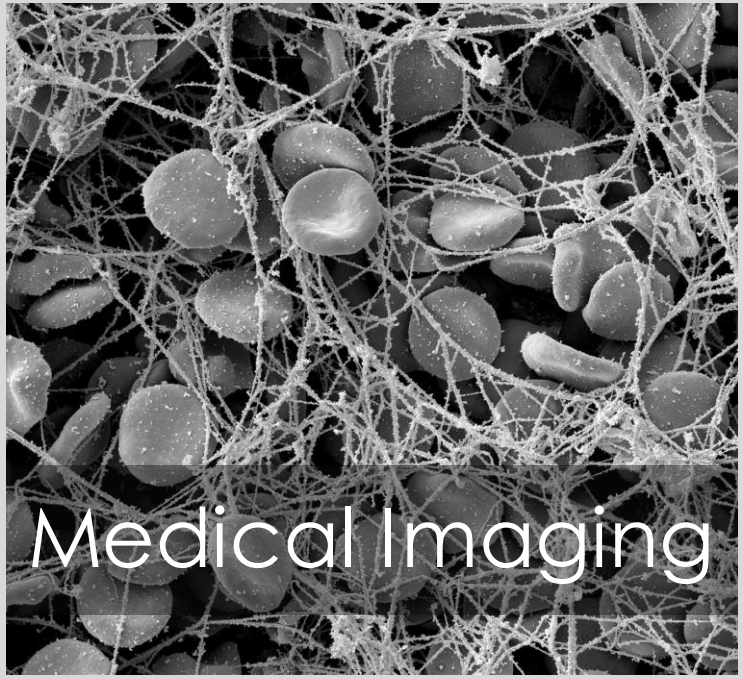
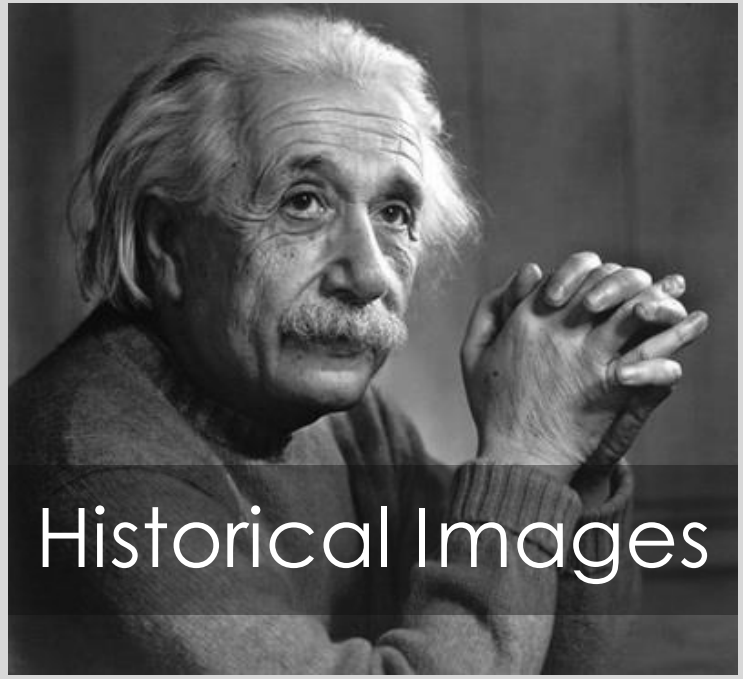
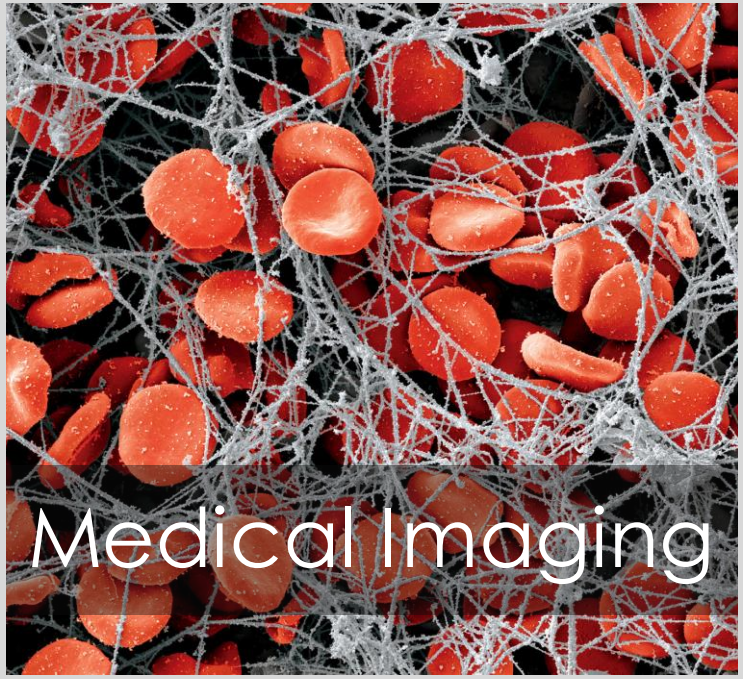
THE PROBLEM

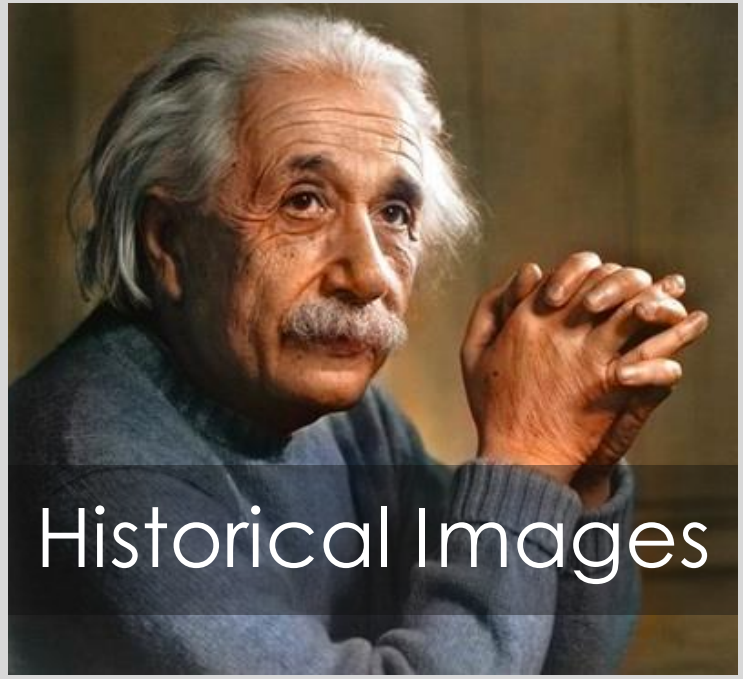
We Are Limited By Grayscale Images



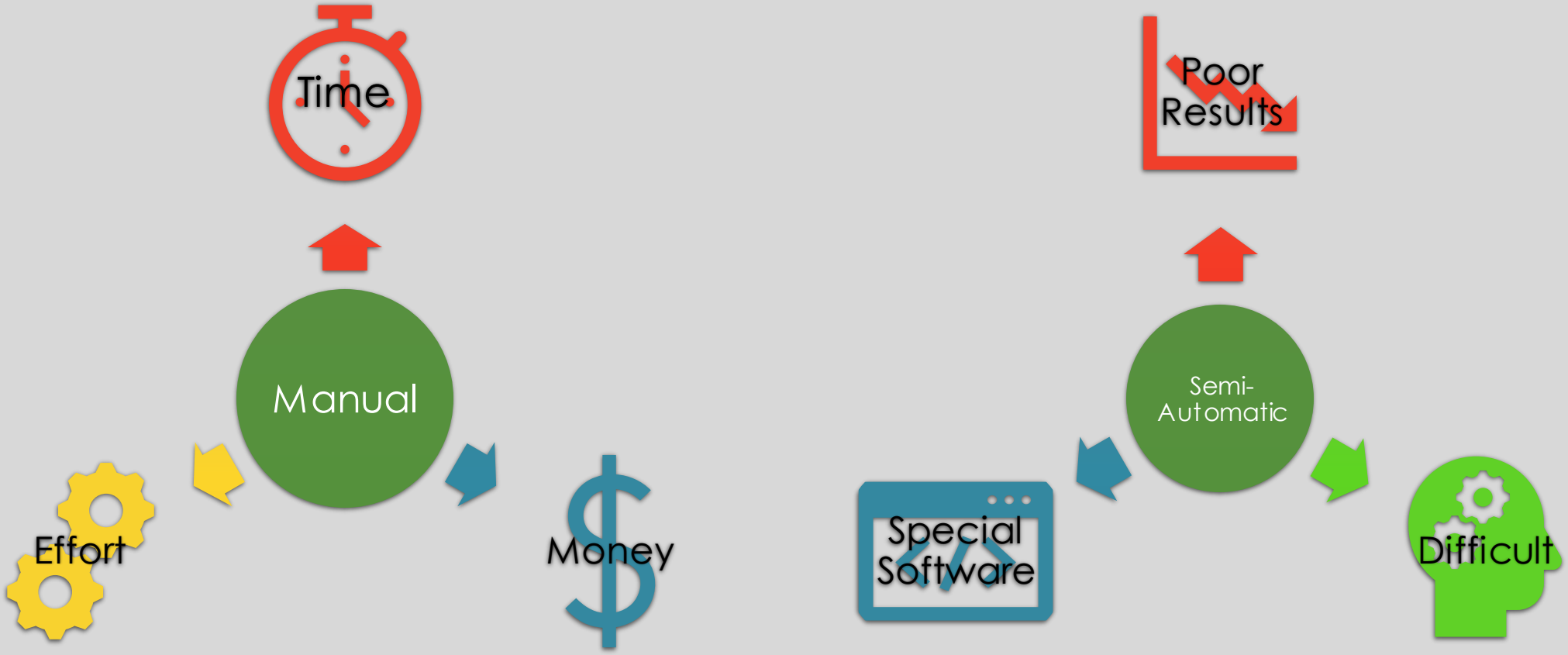


We Are Limited By Grayscale Images



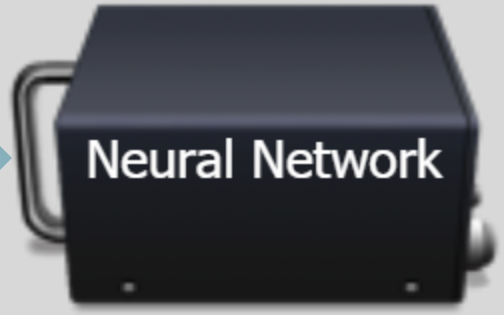


Current Solutions are Unsatisfactory



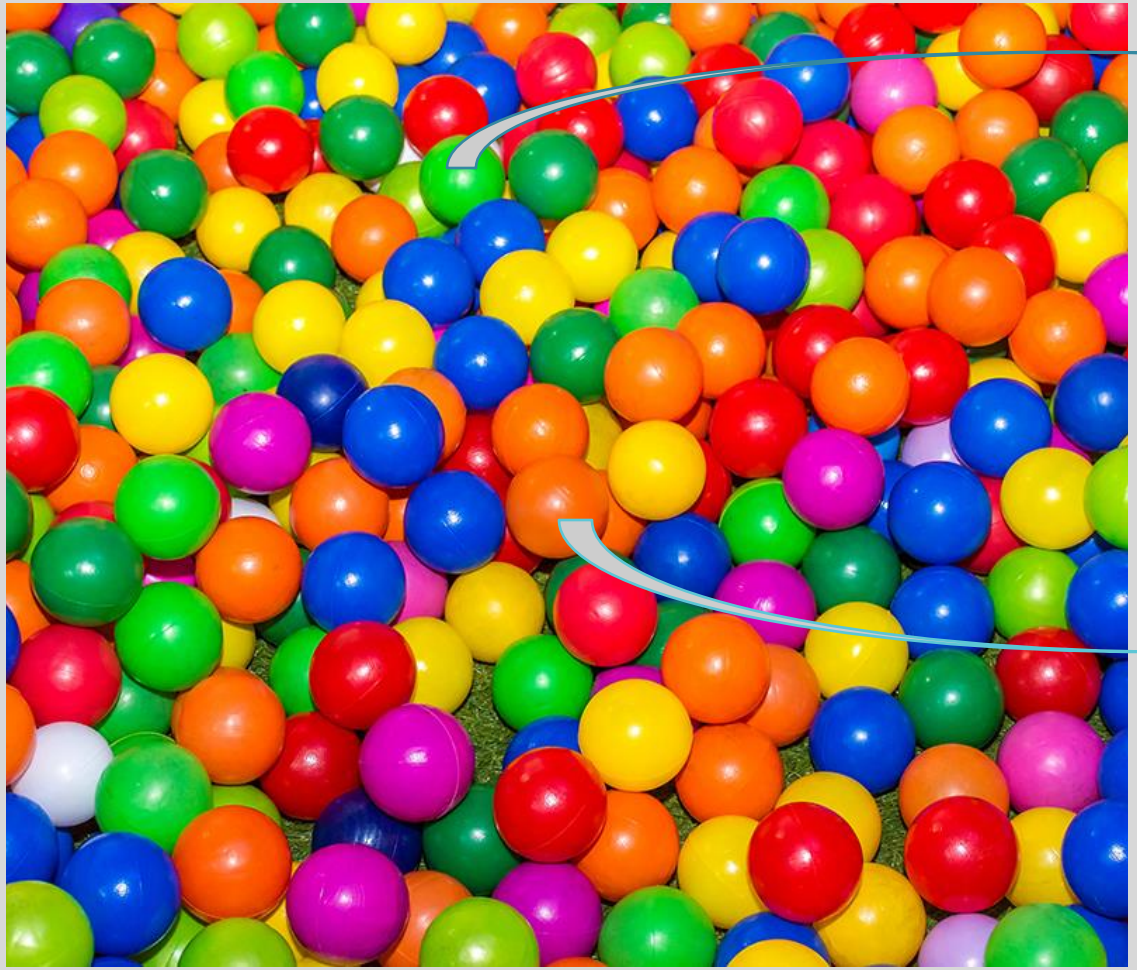
Goal

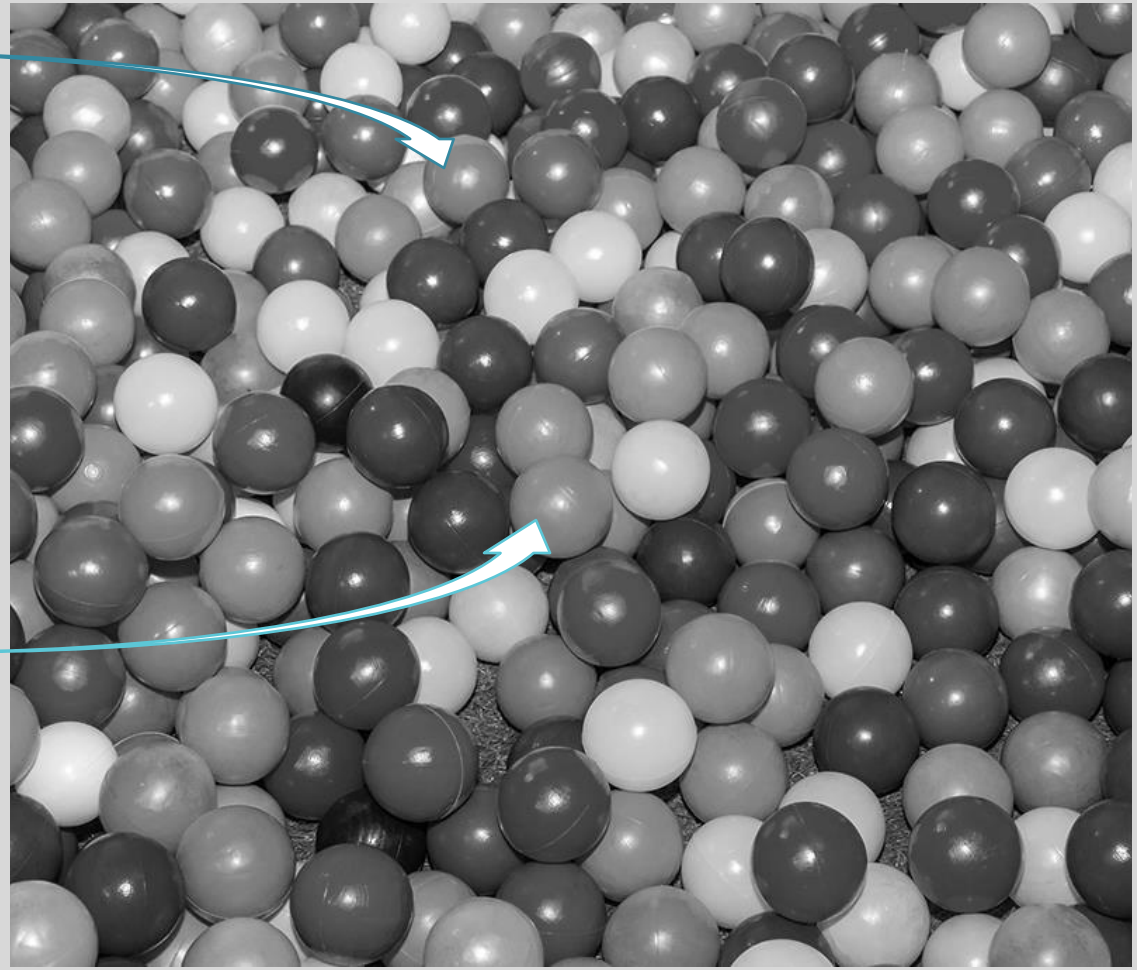
Train



Nuances That Increase Difficulty

Orange and Light Green have the **Same Grayscale** and **Same Shape**





DATA PROCESSING

Data

Flickr30







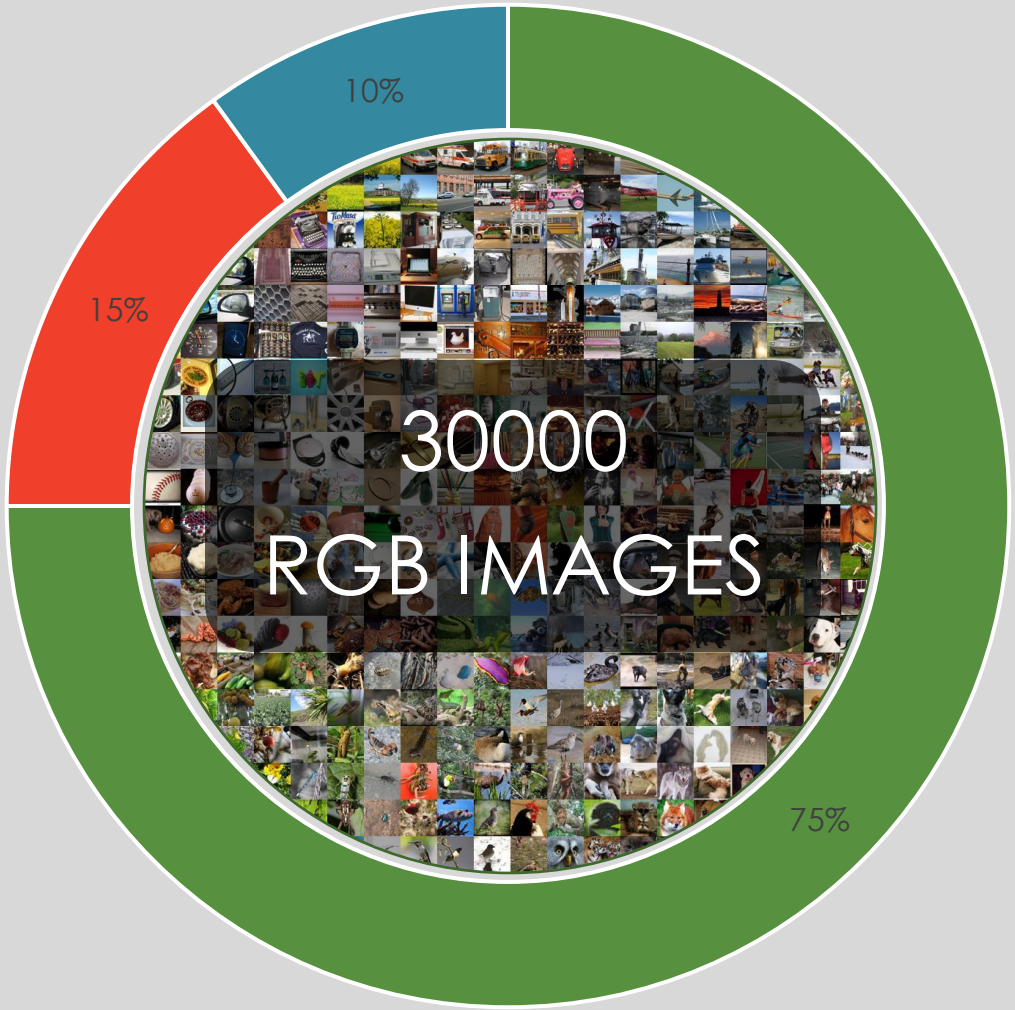
Imagenet







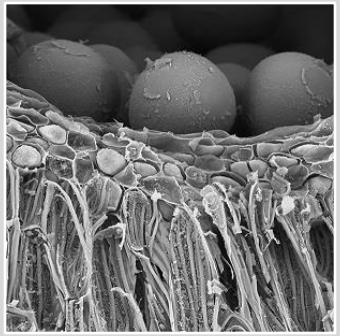
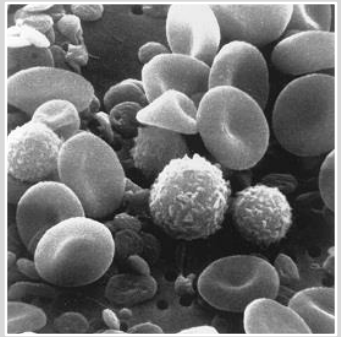
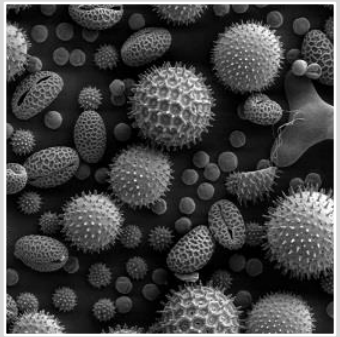

Data Splits



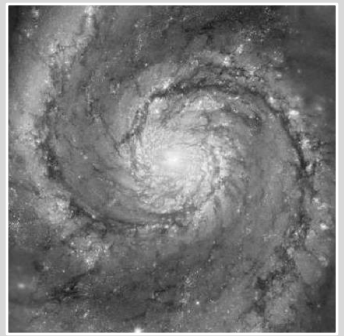
- Training
- Validation
- Testing

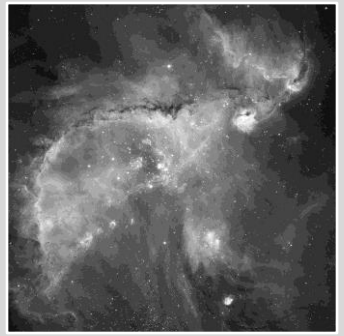
Practical Testing Images

Medical

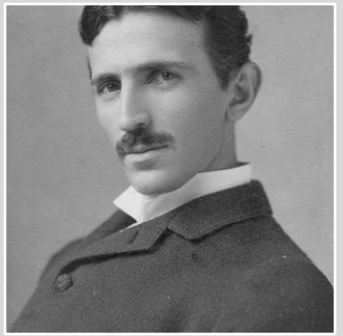
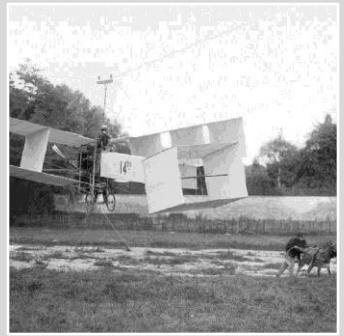





Astronomical






Historical

Data Cleaning

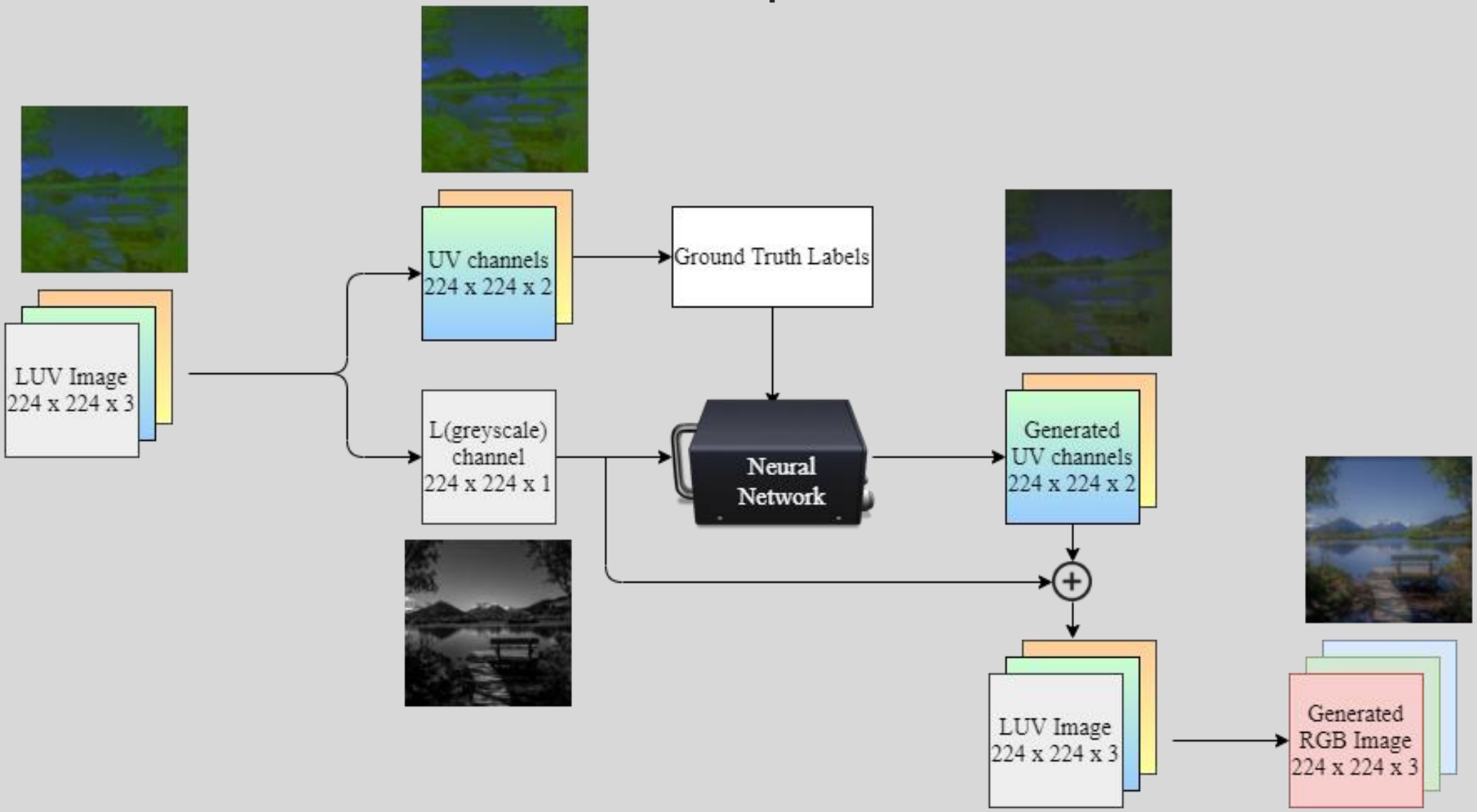
RGB Image
??? x ??? x 3

RGB Image
224 x 224 x 3

LUV Image
224 x 224 x 3

Cleaned input data
to model

Data Pipeline

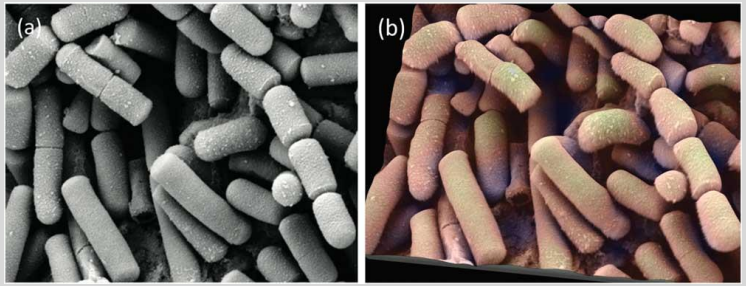


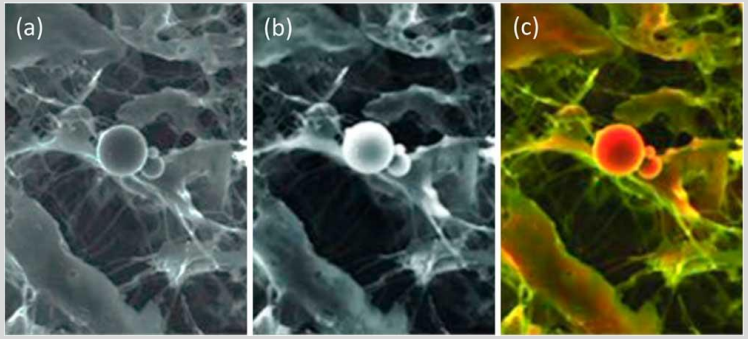
Practical Images May Not Be Real Color

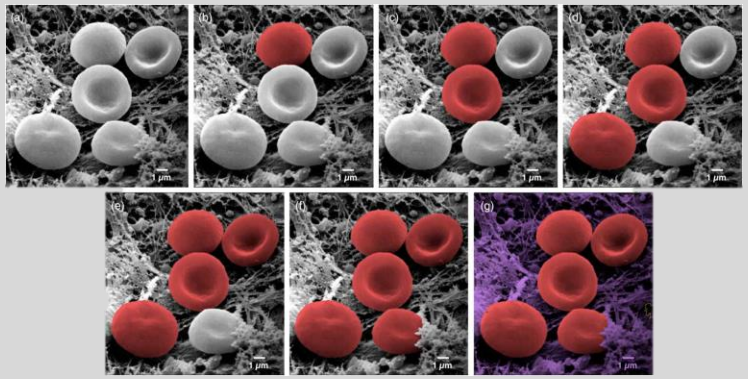
Medical

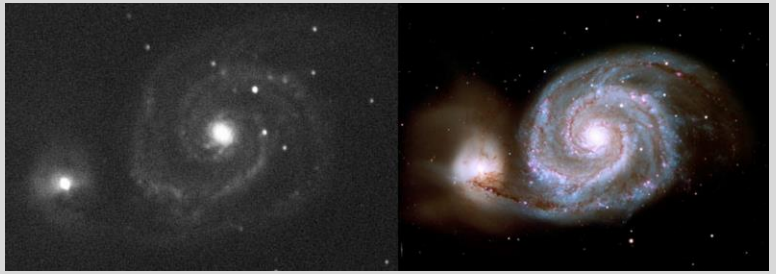
Manually Colorized

Astronomical







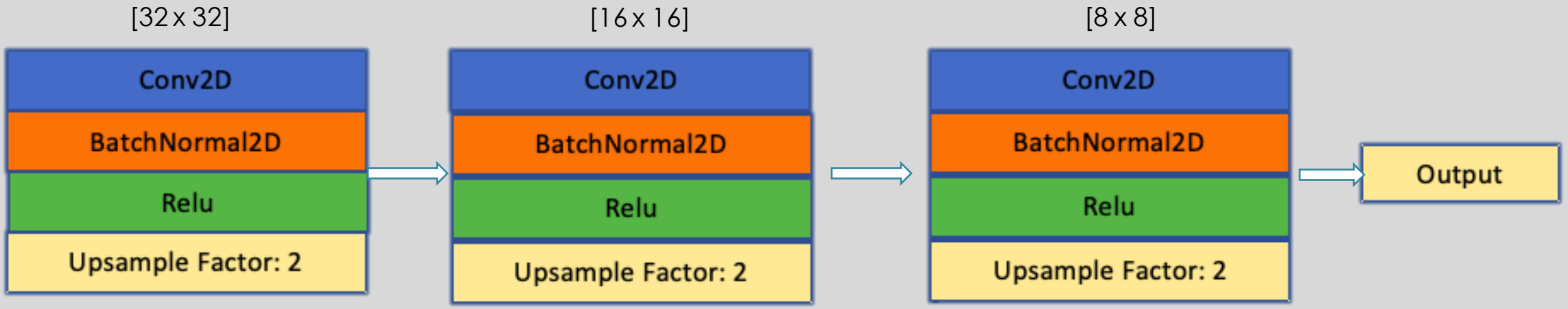


BASELINE MODEL

REGRESSION BASED MODEL

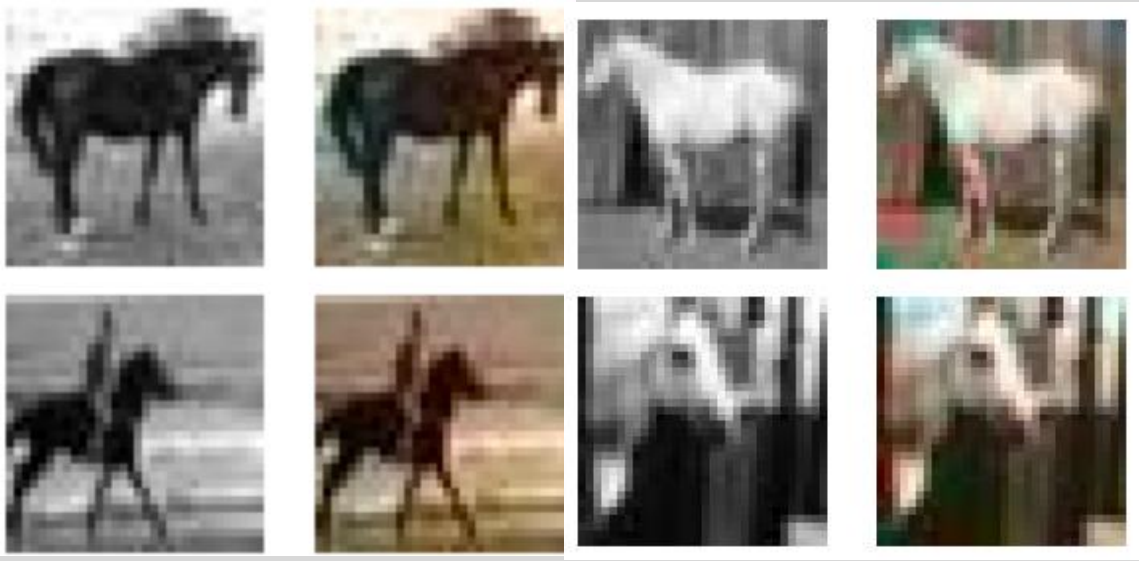
Starter Baseline Model

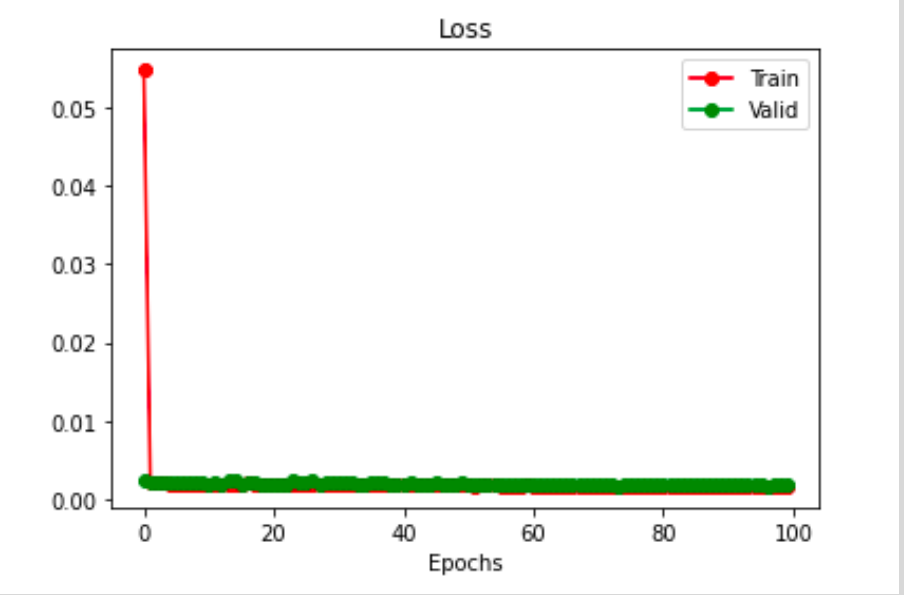
A regression-based CNN Model altered to only take in greyscale inputs.



Results

- Decent results! A good starter But definitely lots of scope for improvement.
- Avg Loss for training : 0.0017
- Avg Loss for validation : 0.0035





INITIAL MODEL

CLASSIFICATION BASED MODEL

Scoping & Defining our Problem

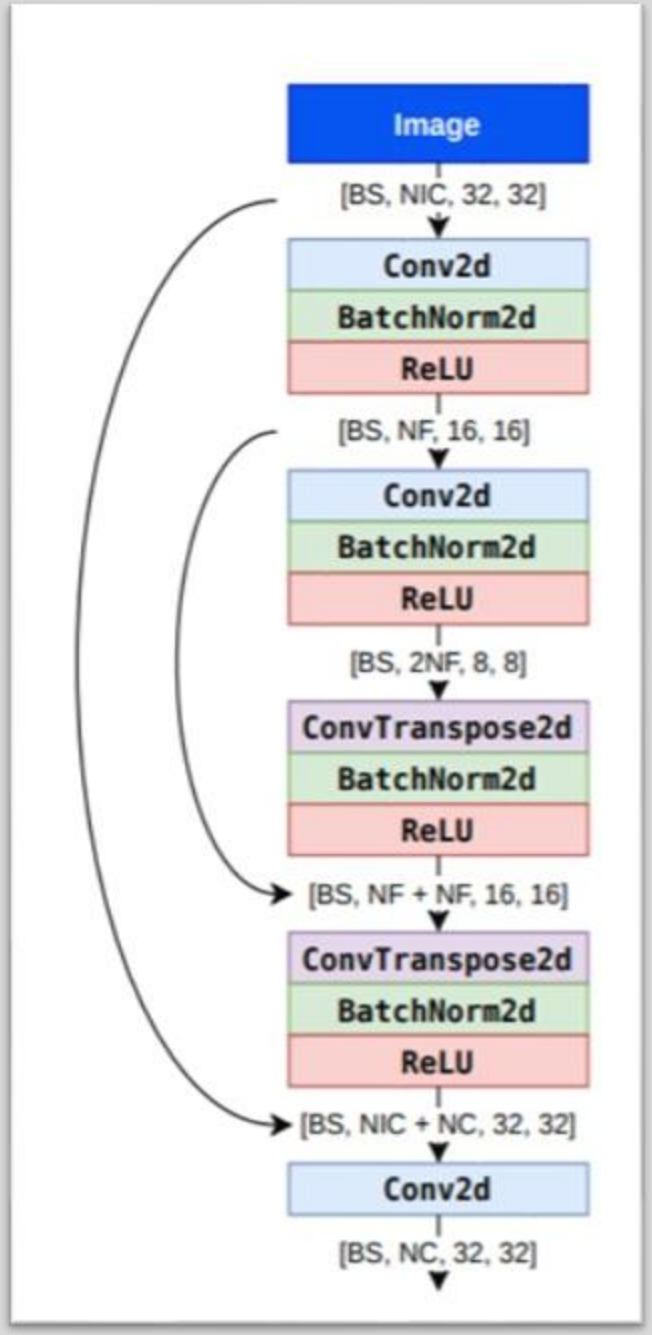
- We will scope the task of image colourization into a pixel-wise classification task
- We label each pixel with one of 24 colours
- The 24 colours are selected using k-means clustering over colours, and selecting cluster centers
- Given a grayscale image, predict each pixel as a color amongst the 24 colors

Dataset & Constraints

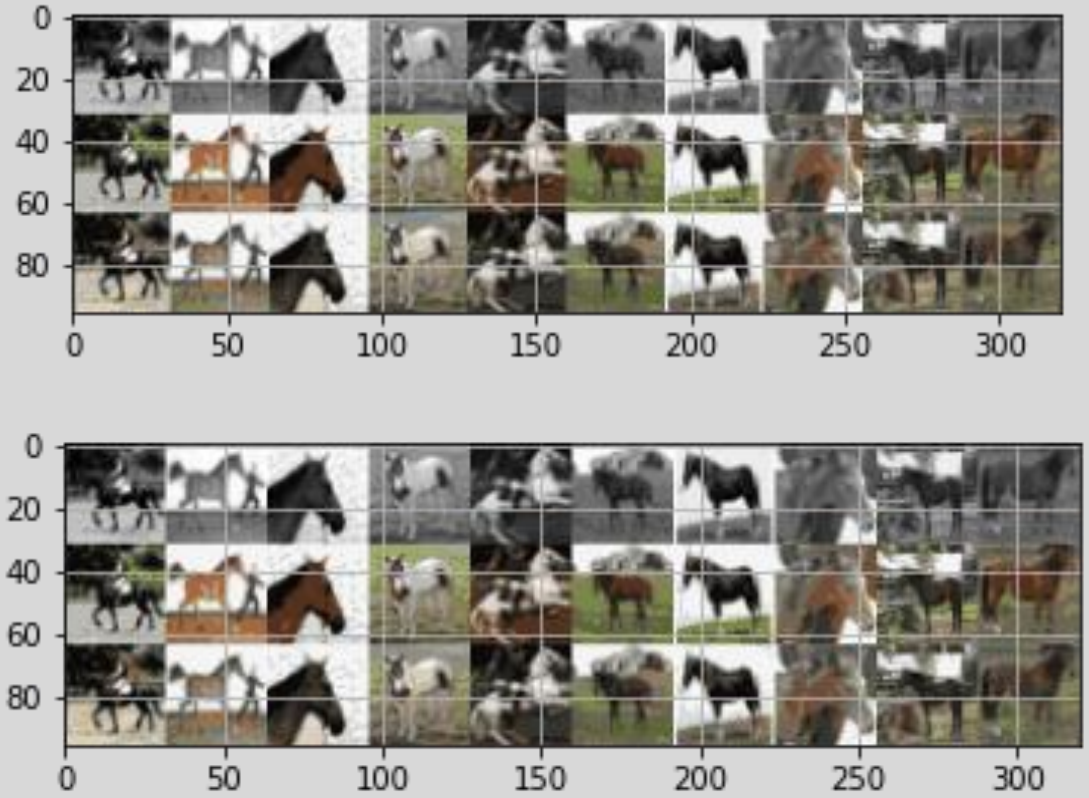
- **CIFAR-10**, which has images of small dimensions 32*32 pixels
  - We just focus on the **“horse”** category of the dataset
- Furthermore, the **error** is calculated by defining distances over RGB space.

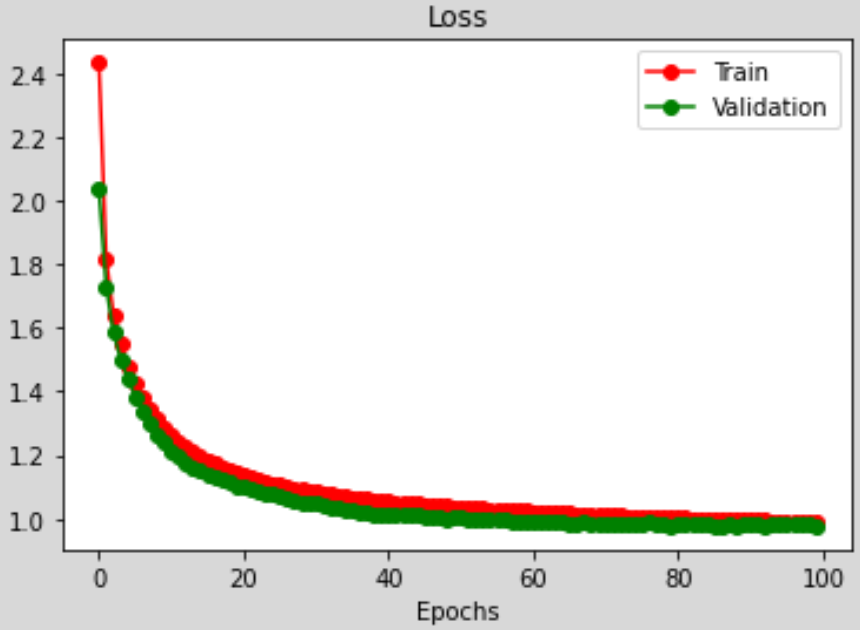
Model Architecture

- The architecture we use is U-NET
- This architecture has following additions over a more basic CNN architecture:
  - Strided & Transposed Convolutions instead of upsampling functions
  - Skip connections



Results & Discussion



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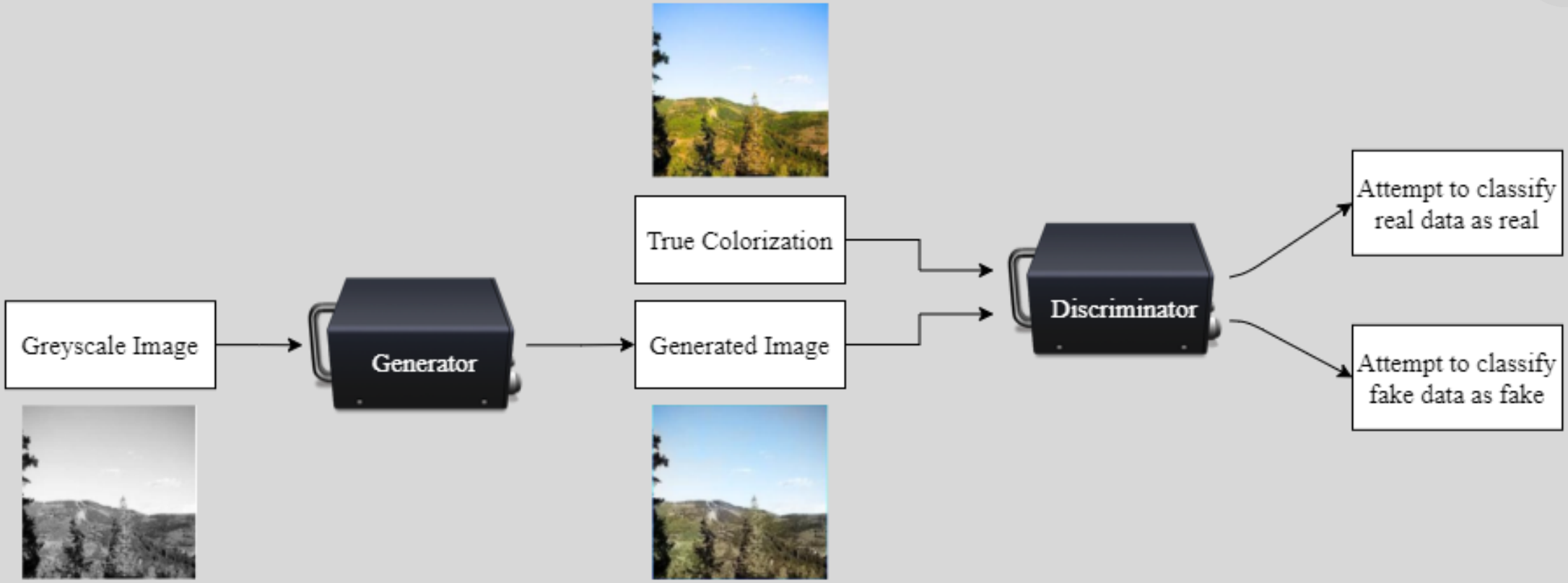
Epoch [100/100], Val Loss: 0.9769, Val Acc: 59.8%, Time(s): 98.27
```

FINAL MODEL

GENERATIVE ADVERSARIAL NETWORK

GAN Architecture Overview



Generator tries to "trick" the Discriminator as they compete and train in parallel

GAN Architecture - Overview

Convolutional Layers/Deconvolutional layers connected via skip net connections

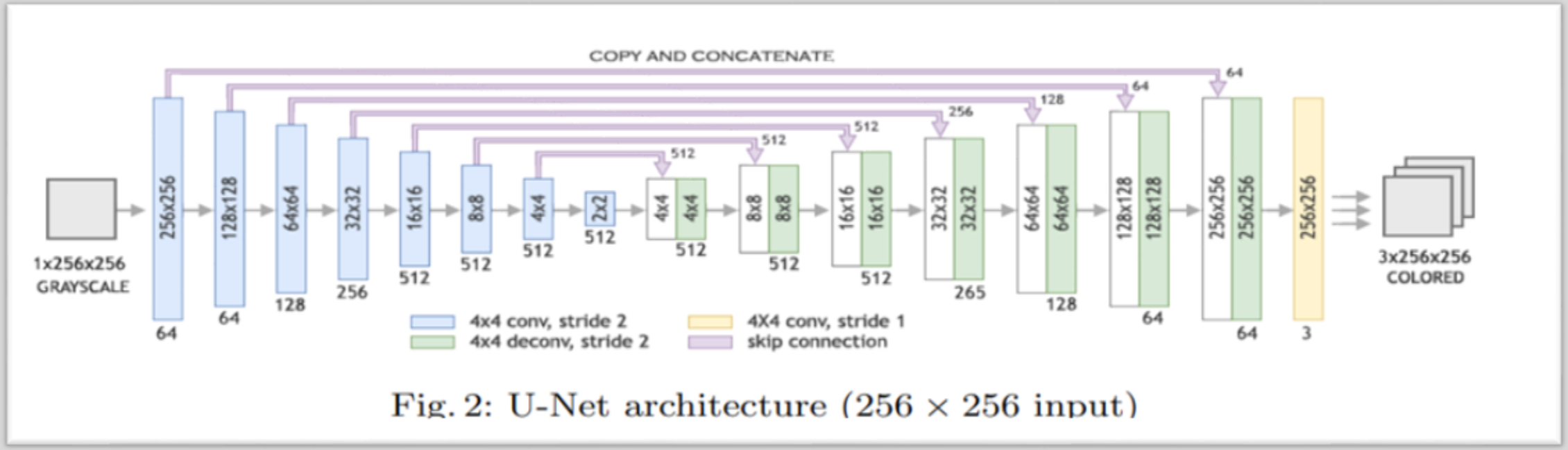
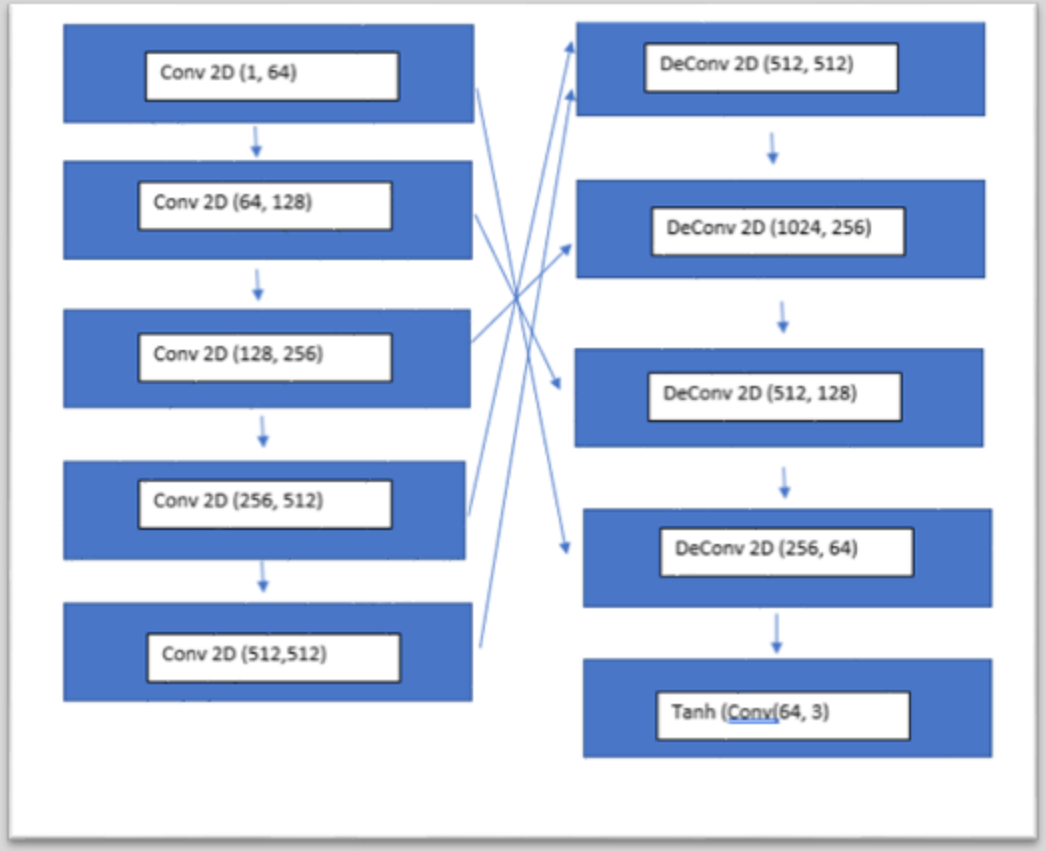


Fig. 2: U-Net architecture (256 × 256 input)

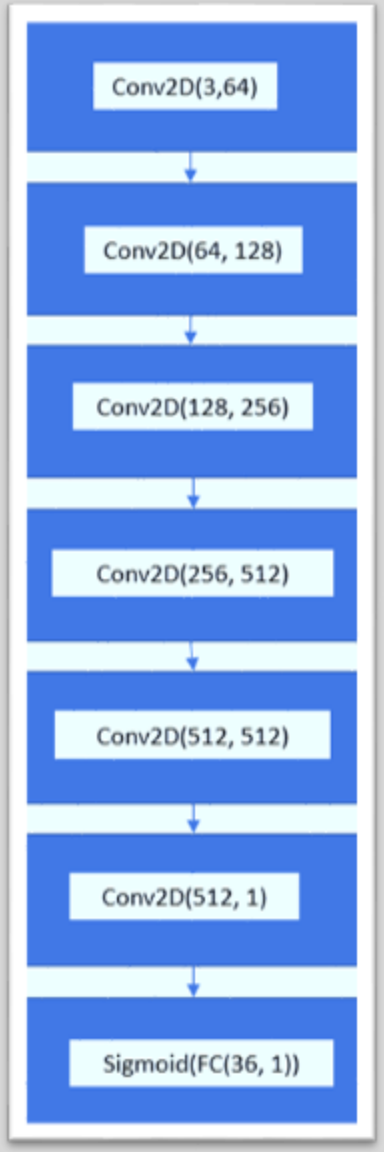
GAN Architecture - Generator

- 5 Convolutional Blocks
  - Conv2d
  - BatchNorm2d
  - ReLU
- 5 Deconvolutional Blocks
  - ConvTranspose2D
  - BatchNorm2D
  - ReLU
- Tanh activation Function

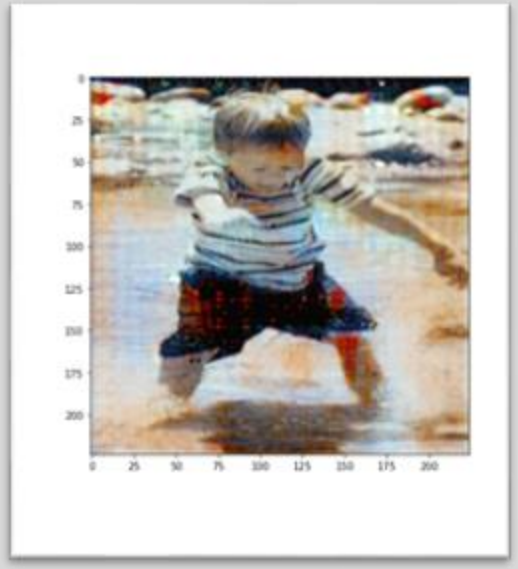


GAN Architecture - Discriminator

- 6 Convolutional Blocks
  - Conv2d
  - BatchNorm2d
  - ReLU
- 1 Fully Connected Layer
- Sigmoid Activation



GAN Results

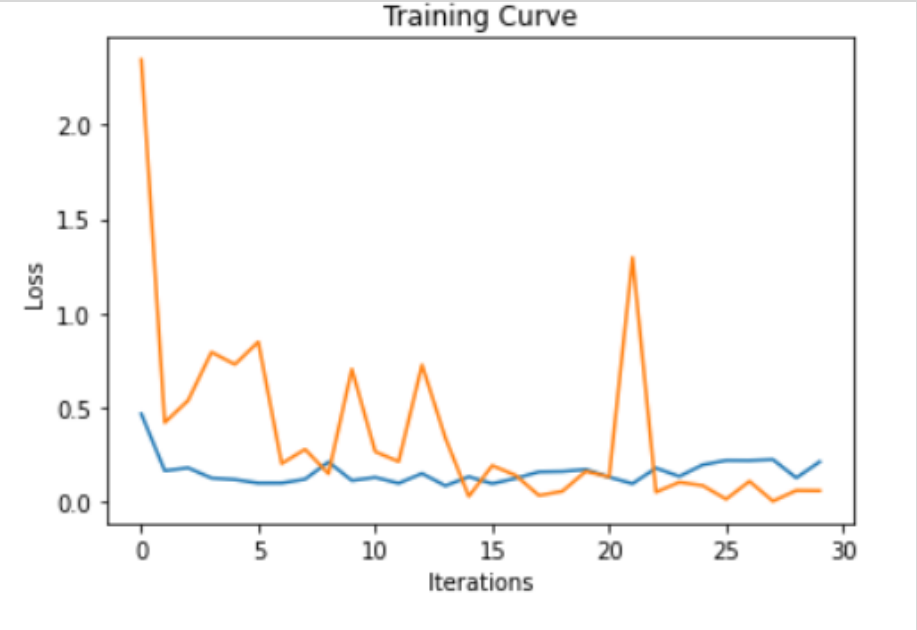



0
50
100
150
200
0
100
200
300
400

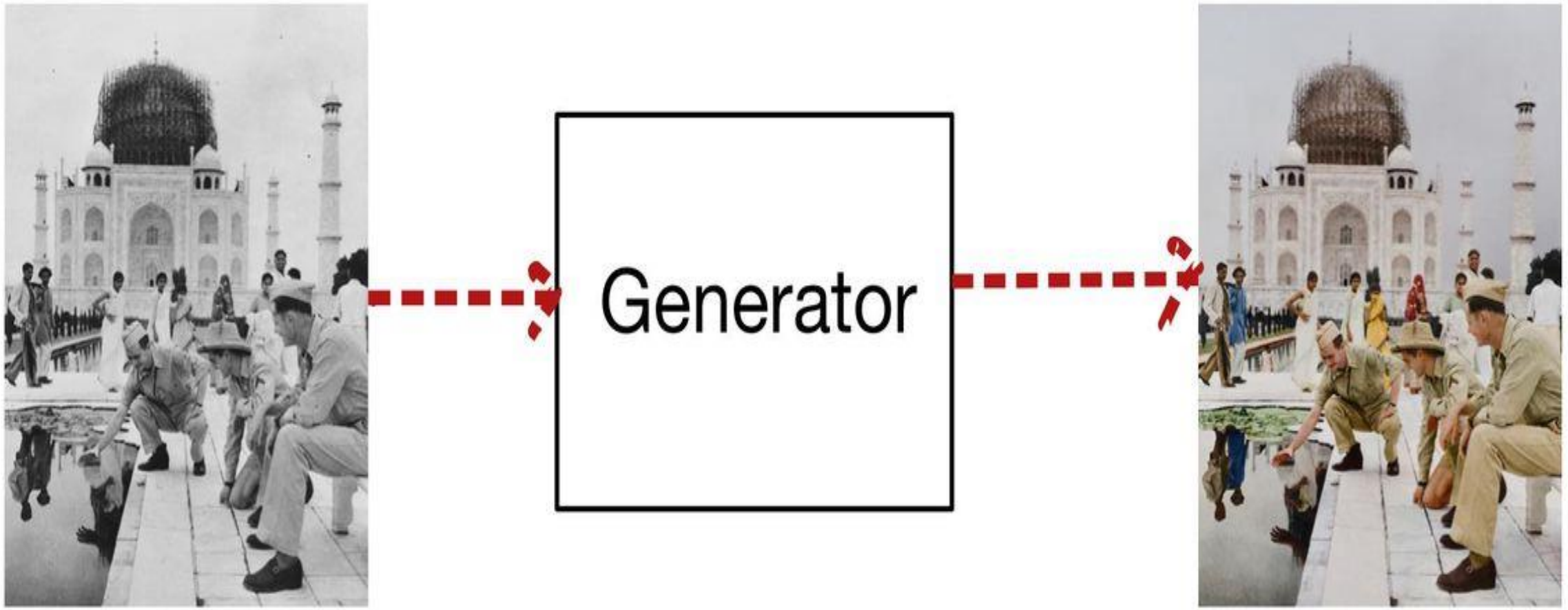

0
50
100
150
200
0
100
200
300
400

GAN Discussion

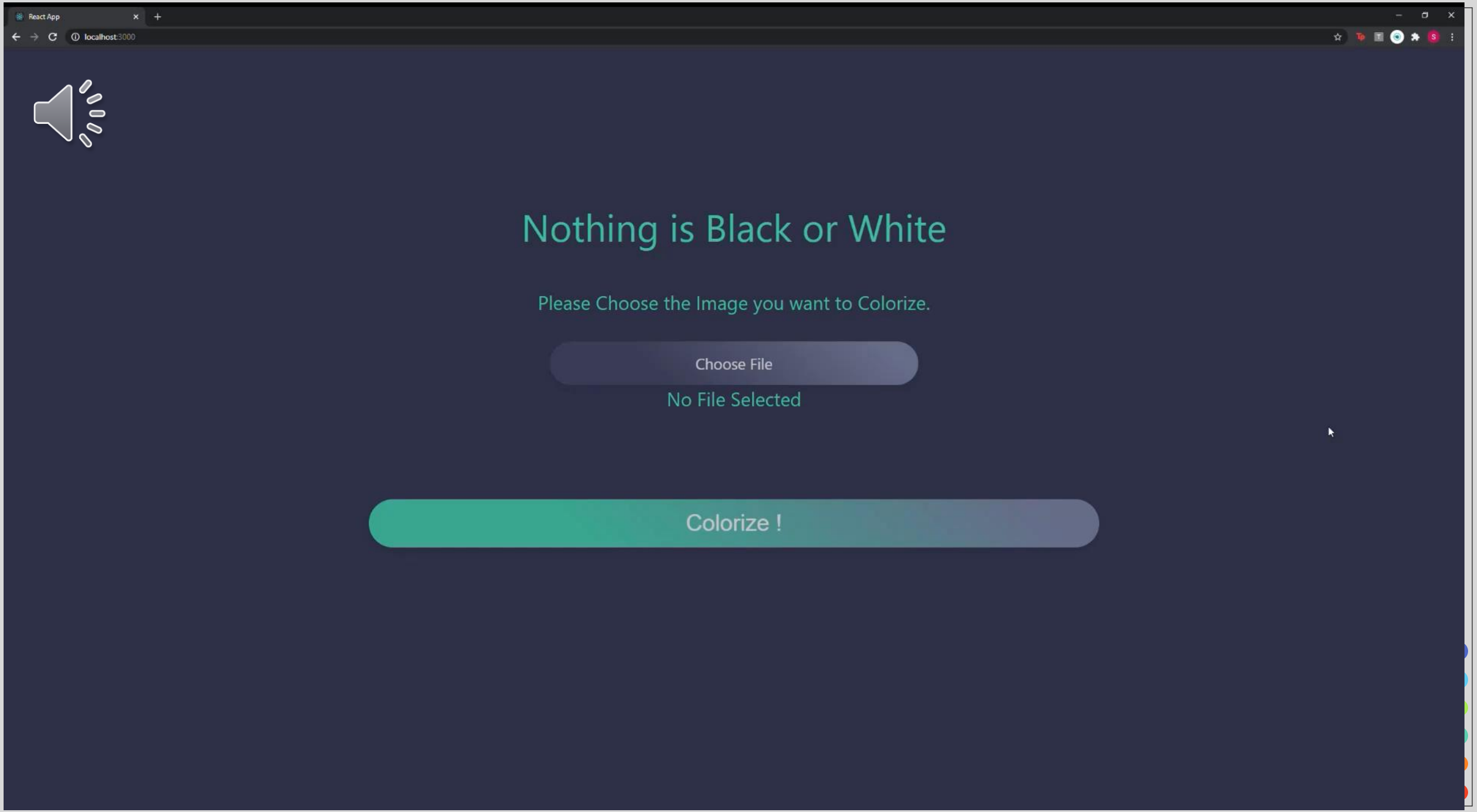
- GAN has abnormal loss graphs
  - Competition between models induces settling at value instead of typical trends
- Qualitative results are best for determining success rate of model
  - Difficult to quantify
- Colors not as vibrant and some incorrect coloring found
  - Could be due to shorter training period/training size



Using AI to do this!



DEMONSTRATION


React App
localhost:3000
Nothing is Black or White
Please Choose the Image you want to Colorize.
Choose File
No File Selected
Colorize !