



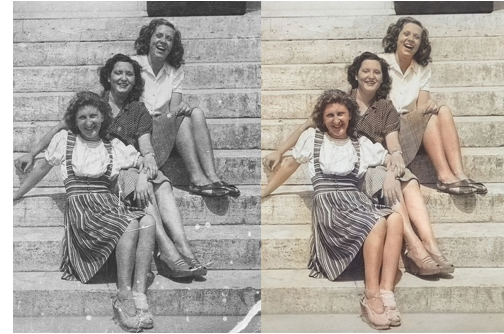
# Image Colorization for Vintage Portraits

## Team Members:

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# Motivation & Tasks

- Photos act as a visual memory for today's society which gives them immense historical and emotional value
- For this reason it is important to colorize and restore them to their original glory
- Traditionally colorization and restoration was done by hand, which is a very time consuming task and also requires a special artistic skill-set
- We propose to develop a convolutional neural network based model that performs two main tasks:
  - Image colorization of vintage portraits from grayscale to full color
  - Removal of salt and pepper noise and scratches as part of restoration
- The primary benefit of this technique over the conventional methods is that restoration and colorization of images can be done at scale with a very consistent level of quality.



# Goals & Challenges



## Challenges:

- Preprocessing of the dataset to simulate realistic vintage photography from available digital (RGB) images
- Implementation of preliminary DL-based model for baseline performance and proof of concept
- Literature available related to this task is scarce
- Implementation and training stabilization of a GAN configuration for this task in the improvement phase

## Goals (for mid-term):

- ☐ Literature Review
- ☐ Dataset Preprocessing
- ☐ Implementation and Training of the Baseline Model

# Methods



Task	Methodology
Literature Review	<ul style="list-style-type: none"><li>• Explore both conventional and deep-learning based techniques used for image coloration and restoration</li></ul>
Dataset Preprocessing	<ul style="list-style-type: none"><li>• Use low-level image processing to implement a filter that simulates the attributes of actual vintage images (greyscale, salt &amp; pepper noise, scratches, etc) and generate a supervised dataset for training</li><li>• Python libraries like Scikit-Image, NumPy, SciPy and openCV will be used for this task</li></ul>
Preliminary Model Implementation	<ul style="list-style-type: none"><li>• Based on the literature review done earlier we will implement a DL-based model along with its training (using standard regression loss functions) and testing scripts</li><li>• We will use PyTorch Deep Learning framework for this step</li></ul>

## Methods (contd.)



Task	Methodology
Evaluation	<ul style="list-style-type: none"><li>• We will use both well-defined numerical metrics (like PSNR, SSIM etc) and visual fidelity (for Just-Noticeable Difference evaluation) in order to determine the model performance</li></ul>
Improvement	<ul style="list-style-type: none"><li>• Lastly, we will work on implementation of a GAN configuration for model improvement.</li><li>• The discriminator will be implemented using transfer learning (alexnet, resnet etc)</li></ul>

# Dataset

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## UTKFace

- + Available for non-commercial use
- + Includes over 20k portrait images with both captured in the wild and controlled environments
- + The dataset is evenly distributed in terms of age, gender and ethnicity
- We will need to preprocess the dataset to produce vintage like images for model training



# Evaluation



## Overall Performance Evaluation:

- We will use the following metrics for evaluating the overall performance of the model
  - Peak-Signal to Noise Ratio (or MSE)
  - Structural Similarity Index
  - Perceptual Loss

## Visual Fidelity Evaluation:

- We will also perform a visual analysis to evaluate Just-Noticeable Difference (JND) in generated and ground-truth images
  - This is crucial to determine if any unwanted artifacts are produced by the model

# References



- [UTKFace | Large Scale Face Dataset](#)
- [Image Coloration Survey](#)