Artificial Intelligence & Machine Learning (AIML)

Project: - Colorizing Black & White Images with Deep Learning and OpenCV

Names: **Sec-5**

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Problem Statement:

The project aims to transform grayscale images into colorful visuals using deep learning techniques and OpenCV. The goal is to implement a Python-based solution that employs Convolutional Neural Networks (CNNs) to predict and apply realistic colors to black and white images. This technique can restore old photographs and enhance grayscale images with vibrant colors, providing value in reviving historical images and creating visually engaging outputs from monochrome inputs.

Algorithm:

- **Dataset Preparation:** A large dataset of color images is collected and converted to grayscale to serve as input for training.
- **Model Architecture:** A CNN with convolutional layers for feature extraction and upsampling layers for color prediction is designed.
- **Training:** The CNN is trained on grayscale and color image pairs, adjusting model weights based on the difference between predicted and actual colors.
- **Colorization Process:** Trained CNN colorizes new grayscale images by predicting color components for each pixel.
- **Post-Processing:** OpenCV is used to adjust brightness, contrast, and saturation for enhancing the final image quality.

Tools Used:

- Programming Language: Python (for implementing CNNs and integrating OpenCV)
- Libraries:
  - OpenCV: For image preprocessing and post-processing tasks.
  - TensorFlow/Keras: For building and training the CNN model.
  - NumPy: For numerical computations and data manipulation.
- IDE: Visual Studio Code or Jupyter Notebook for coding and debugging.
- Version Control: Git/GitHub for project version management.

Expected Outcome:

This project will produce a Python-based application that can transform black and white images into colorful visuals using deep learning techniques. The result will be a method capable of restoring old photographs and enhancing grayscale images with realistic and vibrant colors. This demonstrates the effectiveness of CNNs in image processing tasks and showcases how deep learning can be applied to creative and historical preservation applications.