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Department of Artificial Intelligence & Data Science

PROJECT SYNOPSIS

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Title of the project:

Image to Pencil sketch app.

Name and Designation of the Organization Guide:

Mr. Ritesh Kumar (Assistant Professor) at ADGIPS

ABSTRACT:

- The "Image to Pencil Detection App" project explores the intersection of image processing and artistic expression by developing an application that transforms digital images into realistic pencil sketches.
- This project aims to develop an algorithm or application that automatically transforms digital images into artistic sketches. It will bridge the gap between photography and drawing by analyzing the original image and generating a new image that captures its essence in a stylized, hand-drawn manner.
- The project involves preprocessing steps, feature extraction, and a carefully trained model to achieve a convincing and aesthetically pleasing pencil sketch effect.

- This system helps people understand how painters create pencil drawings, which is a fundamental art form for representing natural scenes.

LITERATURE REVIEW/RELATED RESEARCH OUTCOMES:

❖ Literature Review:

The field of image-to-pencil sketch conversion has seen significant advancement in recent years, fueled by progress in computer vision. Some observed key findings from the literature review are:

- [1] This paper presents an automatic image-based approach for converting greyscale images to pencil sketches, in which strokes follow the image features. The algorithm first extracts a dense direction field automatically using Logical/Linear operators which embody the drawing mechanism. Next, a reconstruction approach based on a sampling-and-interpolation scheme is introduced to generate stroke paths from the direction field. Finally, pencil strokes are rendered along the specified paths with consideration of image tone and artificial illumination. As an important application, the technique is applied to render portraits from images with little user interaction. The experimental results demonstrate that the approach can automatically achieve compelling pencil sketches from reference images.
- [2] This research paper develops a two-branch model that learns separate filters for generating sketchy outlines and tonal shading from a collection of pencil drawings. The training data pairs are created by extracting clean outlines and tonal illustrations from original pencil drawings using image filtering techniques and the drawing styles are manually labelled. In addition, the model creates different pencil styles (e.g., line sketchiness and shading style) in a user-controllable manner.
- [3] This research paper shows the system is implemented to generate pencil-drawing-style images from photographs. It includes two main stages. First, the input image generates a stroke layer to represent the shapes on the image, imitating painters sketching the contours. Then it produces tonal textures, imitating the hatching process when painters depict brightness and shades with pencils. Finally, the two layers are combined to synthesize a non-photorealistic pencil drawing.

❖ **Related research outcomes:**

- [1] The algorithm simulates a popular sketching method, but it may not capture the full range of artistic styles and techniques used by different artists. The level of user interaction and customization options may be limited.
- [2] The pencil drawings that are generated using certain models may not always be an exact representation of the original photo. This issue can be especially prevalent in complex scenes or with certain types of images, which may result in a lack of realism in the final output. Additionally, it's important to note that while these models are designed to capture the intended artistic style of the input photo, there may be variations or discrepancies between the generated drawing and the desired output.
- [3] Human portraits are particularly challenging for this algorithm due to the complexity of facial features. The algorithm may struggle to accurately depict facial expressions, leading to less satisfactory results. The tone map generated may not always be as bright as expected, which can impact the visibility and clarity of the stroke lines in the final output. The algorithm may fail to capture the irregular details present in natural landscapes. This can result in the generation of a sketch that lacks realism or fails to convey the richness of the original scene.

RESEARCH PROBLEM:

- Developing accurate and efficient models that can transform colour images into high-quality pencil sketches.
- This project offers the feature of downloading both the color and sketch versions of the picture.

WHY IS THIS PROBLEM IS SIGNIFICANT/NEEDED FOR THE STUDY:

- **EDUCATIONAL VALUE:** It involves exploring and implementing advanced image processing and deep learning techniques. This offers educational value by providing insights into these technologies and their practical applications.
- **DIGITAL ART EVOLUTION:** Digital art continues to evolve, demanding innovative tools that seamlessly integrate traditional art styles into the digital realm. This offers a bridge between traditional and digital artistic expression.

- **CUSTOMIZATION AND PERSONALIZATION:** It allows users to tailor sketches to their preferences. Implementing customizable parameters and real-time feedback in the app requires technical expertise.
- **EXPRESSIVE CREATIVITY:** The application enhances users' creative outlets by providing a unique way to transform ordinary photos into visually striking pencil sketches. This contributes to fostering a culture of expressive creativity, enabling users to explore their artistic side.

RESEARCH METHODOLOGY:

The research methods commonly used in the literature related to image to pencil sketch include both **technical and artistic approaches**. The technical methods often involve the use of **image processing, software development, and computer vision techniques** to develop algorithms for generating pencil sketches from photographs. On the other hand, the artistic methods focus on **understanding the drawing process** and the characteristics of pencil sketches to create more realistic and controllable results.

The steps to convert the Image to pencil sketches:

Step-1: Importing required libraries.

Step 2: Loading the image.

Step 3: Converting an image into a grayscale image.

Step 4: Inverting the image.

Step 5: Smoothing the image.

TOOLS AND TECHNIQUES TO BE USED:

- **PYTHON:** Python is a versatile programming language commonly used in data analytics and machine learning. Libraries such as NumPy and OpenCV can be utilized for image processing.
- **VS CODE:** VS Code is a free and open-source code editor that offers syntax highlighting, debugging support, and an extension system for users to enhance functionality with extensions.
- **OPEN CV:** OpenCV is used for image processing tasks. It can be employed for pre-processing images, applying filters, and extracting features.

- **OS:** The OS module in Python is part of the standard library and provides a wide range of functions, such as file and directory manipulation, process management, and environment variables.
- **KIVY:** Kivy is a Python framework for creating multi-touch applications with a natural user interface and touch input.

EXPECTED RESULTS OF THE STUDY & FUTURE SCOPE:

❖ EXPECTED RESULTS:

- **Accurate and effective:** The primary expected result is the conversion of image to pencil sketch must be accurate and effective.
- **User satisfaction:** Users find the application easy to use and visually appealing, with customized sketches.
- **Optimized performance:** The application is expected to perform efficiently and be compatible to work on different systems, platforms, etc.

❖ FUTURE SCOPE:

- **Deep learning advancements:** Explore and integrate advancements in deep learning techniques for image processing.
- **Mobile application development:** Expanding the project to create dedicated mobile applications for Android and iOS platforms.
- **Machine learning enhancements:** Train neural networks specifically for sketch generation using larger datasets and investigate generative adversarial networks (GANs) for more realistic sketches.

RESEARCH PAPER:

[1] Zhengyan Tong, Xuanhong Chen, Bingbing Ni, Xiaohang Wang “*Sketch Generation with Drawing Process Guided by Vector Flow and Grayscale*” The Thirty-Fifth AAAI Conference on Artificial Intelligence (AAAI-21)

[2] Yijun Li, Chen Fang, Aaron Hertzmann, Eli Shechtman, Ming-Hsuan Yang “*Im2Pencil: Controllable Pencil Illustration from Photographs*”

[3] Jiang, Yifeng “*Combining Sketch and Tone for Pencil Drawing Rendering*” Rensselaer Polytechnic Institute Department of Electrical, Computer, and Systems Engineering ECSE 4540: Introduction to Image Processing, Spring 2015