IMAGE TO PENCIL SKETCH USING CYCLE GAN

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INTRODUCTION

Relevance in current scenario

In today's digital world, AI is being used to create amazing art and photo effects. One interesting application is turning real images into pencil sketches automatically. Traditional methods use filters or edge detection, but CycleGAN, a deep learning model, learns to do this more artistically.

Advantages

- Realistic Sketches – It produces detailed and artistic sketches rather than just rough outlines.
- Fully Automatic – No need for manual sketching or complex editing.
- Works on Any Image – Can be used on portraits, landscapes, or any type of photo.

Real-Time Applications

- Digital Art & Cartoon Making – Used by artists and designers to create pencil sketch effects.
- Photo Editing & Mobile Apps – Many apps use this technology to add sketch filters.
- Forensic Sketching – Can help in crime investigations by generating sketches from photos
- Gaming & Animation – Used in creating stylized characters or game scenes.
- Style Transfer (e.g., Monet paintings ↔ real photos) 🎨
- Object Transformation (e.g., horse ↔ zebra, summer ↔ winter landscapes) 🏜️↔🏔️
- Medical Imaging (e.g., MRI ↔ CT scan translation) 🏥
- Face & Expression Swapping 😃↔😠

Limitations

- Needs a Large Image Collection – Training the AI requires a lot of images and sketches.
- Not Perfect for Every Image – The model might work well for some pictures but not for others.
- Takes a Long Time to Train – The learning process can take hours or even days.
- Needs Adjustments – The AI needs fine-tuning to give the best results

OBJECTIVE

The objective of this project is to create an AI model that can turn any photo into a realistic pencil sketch automatically. This will help artists, designers, and photo editors by making sketch generation easy, fast, and more creative without needing manual effort.

LITERATURE REVIEW

TITLE OF THE PAPER : Translation of architectural sketch images to building images using cycle GAN.

Year of Publication : 2022

METHODOLOGY

This project uses CycleGAN, an AI model, to convert architectural sketches into building images and vice versa without needing perfectly matched training data. Images of sketches and buildings are collected from Google, cleaned, resized, and enhanced to improve training quality. Duplicate images are removed using image hashing, and data augmentation techniques are applied to make the AI more accurate.

- The CycleGAN model has two generators (to create images) and two discriminators (to check if images look real).Over time, both improve through competition between them. The Generator tries to trick the Discriminator by making better images,The Discriminator tries to catch fake images and improve its accuracy.

The final model is deployed on a web app using Flask, where users can upload an image and get a sketch or building conversion. The app also lets users adjust brightness for day or night effects.

ADVANTAGES

- In this we are using unpaired datasets which reduces effort of collecting data.
- Gives high quality detailed and realistic sketch.
- We can integrate into creative software for designers and artists to automate sketch creation.
- With cycle GAN, can perform image to sketch and vice versa.

LIMITATIONS

- Data Dependency: The quality of generated images heavily relies on the quality and diversity of the training data.
- Detail Loss: Some finer architectural details might get lost during the translation process.
- Generalization: The model might not work well for all types of architectural styles or complex designs.
- Training Time: Training CycleGAN can be resource-intensive and time-consuming.

GAP IN STUDY

- Diverse Architectural Styles: The study might focus on a limited range of building designs, meaning it may not work well for all types of architecture, like modern versus traditional styles.
- Insufficient Data: If the model was trained on a small set of sketches and images, it may struggle to generate good results for new or different designs that it hasn't seen before.
- Real-Time Generation: The research might not have explored how to make the image generation process faster, which is important for applications that need quick results, like in architectural design meetings.
- User-Friendly Tools: There may be a lack of tools or interfaces that allow users (like architects) to easily adjust or guide the image generation process according to their needs.

PROBLEM STATEMENT

- The Image-to-Sketch Transformation problem is about teaching a computer to convert a regular photo into a hand-drawn sketch without needing a human artist. Imagine you take a picture of a cat, and an AI model transforms it into a pencil-like drawing, just like an artist would. The challenge is to make sure the sketch keeps all the important details while looking realistic and natural. This is useful for art, design, and even tasks like turning real-world objects into line drawings for animation or comics. The AI learns this by studying lots of images and their corresponding sketches, or sometimes even without exact before-and-after examples using smart techniques like CycleGAN.

PROPOSED METHOD

Step 1: Collecting the Dataset

Since CycleGAN works with unpaired images, we need two sets of images:

- Domain A: Real-world images (photos of people, landscapes, buildings, etc.).
- Domain B: Pencil sketches (hand-drawn or digitally created).

Step 2: Preprocessing the Data

Before training the model, we need to prepare the images:

- Resize all images to 256×256 pixels for consistency.
- Convert images to grayscale if working with color sketches.
- Remove duplicate using Image Hashing.
- Normalize pixel values between -1 and 1 for faster training.

Step 3: Building the CycleGAN Model

Understanding CycleGAN

- CycleGAN has two generators and two discriminators:
- Generator A → B (Converts real images into sketches).
- Generator B → A (Converts sketches back into real images).
- Discriminator A (Distinguishes between real and generated real images).
- Discriminator B (Distinguishes between real and generated sketches).

Model Architecture

- Generators use an encoder-decoder with ResNet blocks.
- Discriminators use PatchGAN, which looks at small patches of an image to determine if it's real or fake.

Step 4: Training the CycleGAN Model

- Use Google Colab or a GPU-powered system to speed up training.
- Load the preprocessed dataset and divide it into training and testing sets.
- Train the CycleGAN model using Keras and TensorFlow.

Step 5: Testing and Evaluating the Model

- Input real images into the trained model and check the generated sketches.
- Compare AI-generated sketches with real hand-drawn sketches.
- Use metrics like Mean Squared Error (MSE)

METRICS

Mean Squared Error (MSE):

MSE measures the average squared difference between the original (real) and the generated (fake) images. It's a simple and intuitive metric but might not always align with perceptual quality.

Formula:

$$MSE = 1/N\left(\sum_{I=1}^{N} (xi - yi)^2\right)$$

Where:

- xi is the pixel value of the original image.
- yi is the pixel value of the generated image.
- N is the total number of pixels in the image.

Disadvantages

- Needs a Powerful Computer – Training the AI requires a good GPU and high processing power.
- Difficult to Train – Requires a well-prepared dataset and fine-tuning to get the best results.
- Might Lose Small Details – Some fine details from the original image might not appear in the sketch.

DATASETS

The total data which is images and sketches of faces are divided into two parts ,one for training and one for testing.

- train_images:images used for training purposes
- train_sketches:sketches used for training purposes
- test_images:images used for testing purposes
- test_sketches:sketches used for testing purposes

TIME LINE

January to February:

- Data Collection & Preprocessing Research & Dataset Gathering,Data Cleaning &Annotation

February to mid February :

- Model Development & Training Implement CycleGAN architecture,Start training CycleGAN with a small dataset subset,Full Training & Debugging

mid February to March:

- Improve training stability by:
  Adjusting for sharper sketches,
  Adding feature normalization,
- Test model on real-world images outside the dataset

CONCLUSION

In this project, we used CycleGAN to convert images into pencil sketches and vice versa without needing matching image pairs. The generator learns to create realistic sketches from photos and realistic photos from sketches, while the discriminator checks if they look real. Over time, both improve through competition. We used deep learning techniques like ResNet blocks, and data augmentation to make the model more accurate. This technology can be useful in art, design, and automation. While the results are impressive, challenges like training time and minor quality issues still exist.


THANK
YOU