Dr. Akhilesh Das Gupta Institute Of Professional Studies

Department of Artificial Intelligence & Data Science

Practicum (Integrated Project) - AIDS260

PROGRESS REPORT

1. Project Identification:

<table>
<tr><td><b>1.1</b></td><td><b>Project Title</b></td><td><b><i>Image to pencil recognition using Machine Learning Techniques and Open CV</i></b></td></tr>
<tr><td><b>1.2</b></td><td><b>Group members</b></td><td>
<table>
<tr><th>S.no</th><th>Member Name</th><th>Roll no.</th><th>Role</th></tr>
<tr><td><b>1.</b></td><td>KASAK</td><td>02715611922</td><td>Designing and implementing the layout, navigation,and interactive features & tasks related to document creation, editing, and formatting, including text manipulation, styling, and document layout</td></tr>
<tr><td><b>2.</b></td><td>JYOTI RANA</td><td>05415611922</td><td>Building and maintaining the server-side components handling user authentication and authorization, managing server logic , security, and performance</td></tr>
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2. Project Insights:

2.1	**Thematic Areas**	☑ Research ☐ S/W development ☐ Industry Automation ☐ Institute Automation ☐ Others
2.2	**Keywords**	Image processing Grayscale conversion Edge enhancement Gaussian conversion.
2.3	**Utilization Scope**	☐ Domestic ☐ commercial ☐ Industrial ☐ Scientific ☐ Global ☐ National ☐ State ☐ District ☑ ADGIPS ☑ University ☐ External ☐ Sponser ☐ Others
2.4	Major task	The main aim of an image to pencil sketch project is to automatically convert a digital image into a greyscale image that resembles a pencil sketch. It aims to bridge the gap between a digital photograph and a traditional pencil sketch, offering a creative way to transform images.
2.5	Software Packages Tool & Programming Languages	Programming language- Python Modules- os, cv2, io, kivy Libraries- Numpy

3. Relevant Study Material:

		S.no	**Author name, title, Publishing year & Edition**
3.1	**Books & Other Printed Material**	**1.**	Saeko Takagi†, Noriyuki Matsuda, Masato Soga, Hirokazu Taki, Takashi Shima, Fujiichi Yoshimoto *“An Educational Tool for Basic Techniques in Beginner’s Pencil Drawing”* Proceedings of Computer Graphics International Conference, CGI · August 2003.
		2.	Jin Zhou, Baoxin Li *“AUTOMATIC GENERATION OF PENCIL-SKETCH LIKE DRAWINGS”* 0-7803-9332-5/05/$20.00 ©2005 IEEE.
		3.	Shuo Sun Tianjin, Dongwei Huang Tianjin *“Efficient Region-Based Pencil Drawing”* WSCG '2007: Full s Proceedings University of West Bohemia Plzen Czech Republic, January 29 – February 1, 2007, p. 279-286.
		4.	Heekyung Yang, Yunmi Kwon, & Kyungha Min *“A Stylized Approach for Pencil Drawing from Photographs”* Eurographics Symposium on Rendering 2012 Fredo Durand and Diego Gutierrez.
		5.	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.
		6.	Yijun Li, Chen Fang, Aaron Hertzmann, Eli Shechtman, Ming-Hsuan Yang *“Im2Pencil: Controllable Pencil Illustration from*

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<tr><td></td><td><i>Photographs”</i>. IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR), 2019, pp. 1525-1534.</td></tr>
<tr><td><b>7.</b></td><td>Zhengyan Tong, Xuanhong Chen, Bingbing Ni, Xiaohang Wang <i>“Sketch Generation with Drawing Process Guided by Vector Flow and Grayscale”</i> The Thirty-Fifth AAAI Conference on Artificial Intelligence (AAAI-21).</td></tr>
<tr><td><b>8.</b></td><td>HUAPING ZHOU, CHAO ZHOU, AND XIAOYAN WANG <i>“Pencil Drawing Generation Algorithm Based on GMED”</i> Digital Object Identifier 10.1109/ACCESS.2021.3065428.</td></tr>
<tr><td><b>9.</b></td><td>Dong Wang, Guiqing Li, Chengying Gao, Shengwu Fu, and Yun Liang, <i>“Feature-preserving colour pencil drawings from photographs”</i> Computational Visual Media, https://doi.org/10.1007/s41095-022-0320-6 Vol. 9, No. 4, December 2023, 807–825</td></tr>
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<td><b>3.2</b></td>
<td><b>Online Web / Resources</b></td>
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<tr><th>S.no</th><th>Url of webpage</th></tr>
<tr><td><b>1.</b></td><td>About - OpenCV (https://opencv.org/about/)</td></tr>
<tr><td><b>2.</b></td><td>What is OpenCV? The Complete Guide (2024) - viso.ai (https://viso.ai/computer-vision/opencv/)</td></tr>
<tr><td><b>3.</b></td><td>Introduction to Kivy ; A Cross-platform Python Framework - GeeksforGeeks (https://www.geeksforgeeks.org/introduction-to-kivy/)</td></tr>
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4.	Introduction | Machine Learning | Google for Developers (https://developers.google.com/machine-learning/gan)
5.	Understanding Variational Autoencoders (VAEs) | by Joseph Rocca | Towards Data Science (https://towardsdatascience.com/understanding-variational-autoencoders-vaes-f70510919f73?gi=295d841ff1fb)
6.	LIC (Line Integral Convolution) / LIC Source Code (zhanpingliu.org) (http://www.zhanpingliu.org/research/flowvis/lic/lic.htm)
7.	numpy · PyPI (https://pypi.org/project/numpy/)
8.	Why to use Grayscale Conversion during Image Processing? (isahit.com) (https://www.isahit.com/blog/why-to-use-grayscale-conversion-during-image-processing)
9.	Image Processing Algorithms Part 7: Colour Inversion And Solarisation | Dreamland Fantasy Studios (dfstudios.co.uk) (https://www.dfstudios.co.uk/articles/programming/image-programming-algorithms/image-processing-algorithms-part-7-colour-inversion-solarisation/)
10.	Image Processing with Python: Blurring Images (datacarpentry.org) (https://datacarpentry.org/image-processing/06-blurring.html)

4. Objective/ Scope

The image-to-pencil project aims to develop a powerful program that can automatically transform digital photos into realistic pencil sketches. This requires advancements in image processing techniques, feature extraction, and model training to achieve an accurate artistic conversion.

The "Image to Pencil Sketch" project is used to generate quick, visually appealing concept sketches for product designs, illustrations, or marketing materials. Architects could leverage it to create initial sketches of building plans or landscapes, laying the groundwork for further development. Educators could even incorporate the app into art or design classes, allowing students to learn about light, shadow, texture, and composition through image analysis and transformation. And marketing and advertising professionals could utilize the app to create unique and eye-catching visuals for campaigns, flyers, or social media advertisements. By offering this artistic twist on photos, the project has the potential to enhance workflows across various professions.

5. Utilization

Technical Illustration Enhancement: Converting complex technical drawings (e.g., schematics, engineering diagrams) to pencil sketches can improve clarity by removing unnecessary details and emphasizing key features.

Data Visualization Abstraction: It removes clutter and shows main trends, making it clear for exploring or presenting data.

3D Model Visualization and Prototyping: Pencil sketches can be a quick and effective way to visualize 3D models during the design and prototyping phase. It allows designers to explore different perspectives and iterate on ideas without the need for complex rendering software.

Image Preprocessing for Object Recognition: In computer vision tasks, converting images to pencil sketches can act as a pre-processing step. By simplifying the image and focusing on edges and shapes, the sketch can make it easier for algorithms to identify objects within the image.

Patent Sketching: It generates simple, clear illustrations for patent applications. This can be particularly useful for capturing the essence of an invention without the need for detailed technical drawings.

6. Literature Study

Several researches have contributed to advancements in “image-to-pencil sketch” recognition.

In recent research [1], an AI-powered system was developed to help beginners learn basic pencil drawing techniques. It assesses the user's sketches and provides guidance based on the motif data through four subsystems, including motif feature extraction, sketch feature extraction, error identification, and advice generation and presentation. The advice is presented through a 3D model, which helps users understand the errors in their sketches.

In a separate investigation [2], introduced a new algorithm that turns personal photos into pencil sketch-like drawings using gradient transformation and final smoothing for visually striking results.

Further studies result in [3], in the generation of automatic pencil drawings using Line Integral Convolution (LIC), the goal of the algorithm is to enhance image quality by improving image segmentation and texture direction detection techniques. It is achieved by a graph-based segmentation algorithm and a region-based approach for creating white noise and texture directions, resulting in pencil drawings that closely resemble real artistic styles.

In another study [4], the SBL method is introduced which creates pencil drawings in various styles with a filter to control the direction and colour of pencil strokes. extracting linear features, generating a noise distribution, and determining noise values to achieve the desired pencil drawing effects.

One more study result [5] involves two stages: generating a stroke layer to represent shapes and producing tonal textures to depict brightness and shades. These layers are combined to create a non-photorealistic pencil drawing.

In another study [6] a two-branch model is developed to generate sketchy outlines and tonal shading from pencil drawings. Clean outlines and tonal illustrations are extracted from the original drawings, and the model creates different pencil styles in a user-controllable manner.

In the next study [7] the technique extracts a direction field, generates stroke paths, and renders pencil strokes with consideration of image tone and illumination. It can automatically produce pencil sketches from images with little user interaction.

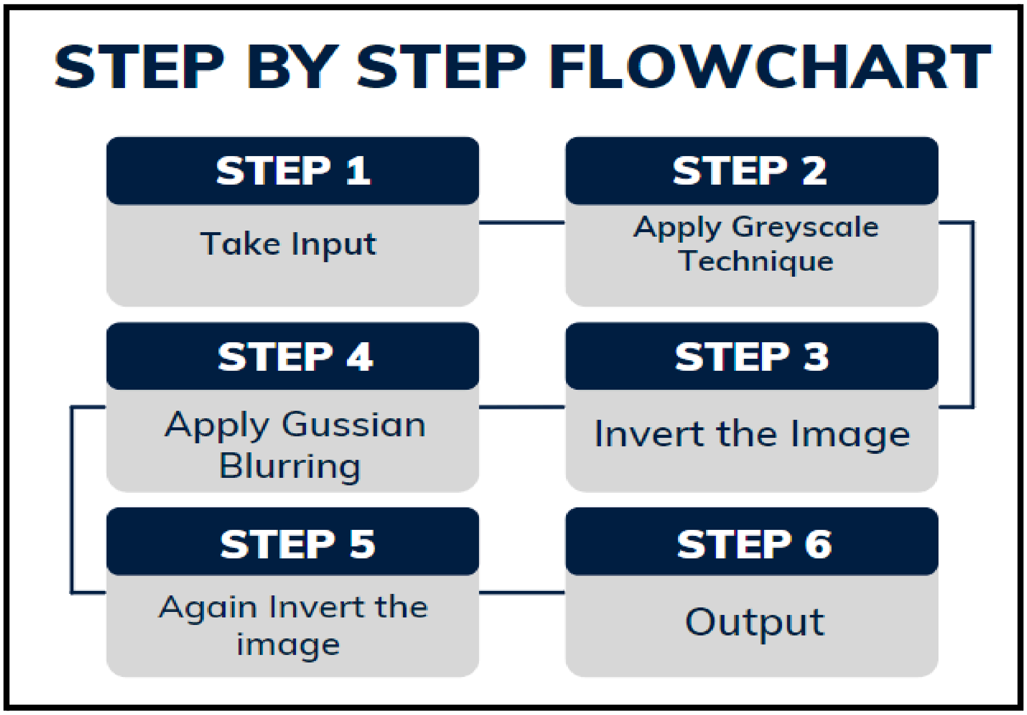
In one separate study [8] introduced a new algorithm called GMED which can create high-quality pencil drawings from natural images. It uses gradient maps and morphological operations to extract lines, and texture filling and tone mapping to create a realistic effect.

One more study [9] proposes a method for generating feature-preserving colour pencil drawings from photographs by enhancing lightness and reducing saturation The approach includes devising lightness enhancement and saturation reduction mappings to mimic the tonal style of colour pencil drawings, resulting in superior tone capture and feature preservation.

8. Methodology

S.no	List of Project Milestones	Deliverable	Expected Number of Days Complete	Percent Complete
1.	Choosing a programming language and libraries and making strategies for working on projects.		Completed	100%
2.	Develop Algorithm		Completed	100%
3.	Making it usable		3-4 Days	40%
4.	Monitoring and Controlling		Checking on each phase	70%

9. Executed Work:



STEP BY STEP FLOWCHART

STEP 1

Take Input

STEP 2

Apply Greyscale Technique

STEP 3

Invert the Image

STEP 4

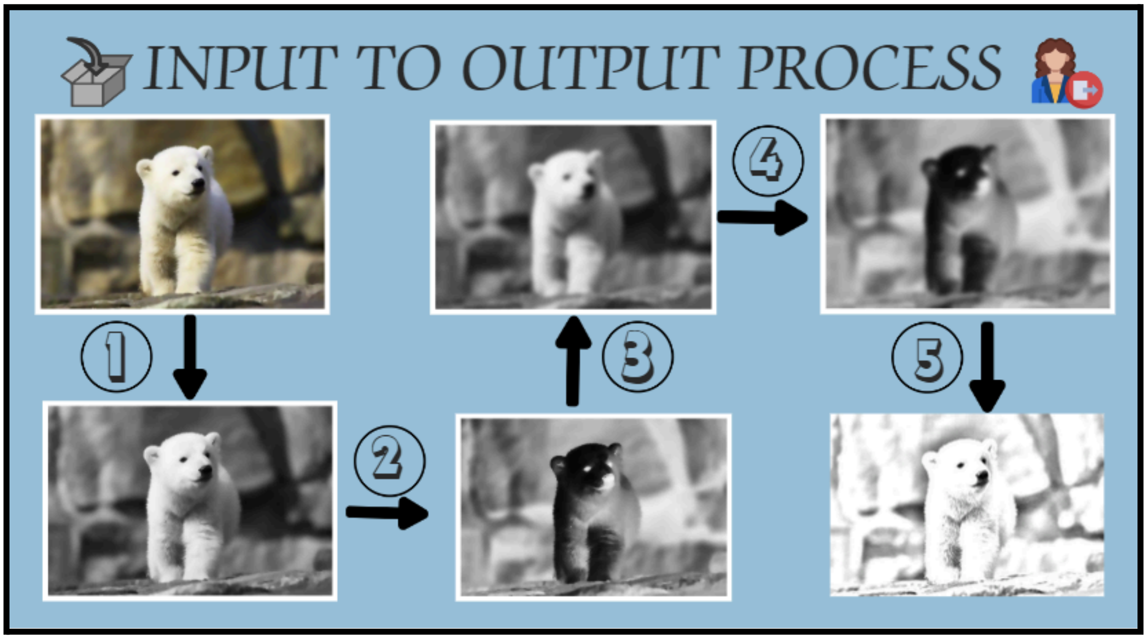
Apply Gussian Blurring

STEP 5

Again Invert the image

STEP 6

Output



10. Remaining Work:

As the project nears completion, it's important to ensure that it's functional and accessible to others who may want to use it. One of the remaining tasks that needs to be tackled is making the project usable for third parties. This involves implementing the necessary features and functionalities so that individuals or organizations can easily access the project and take full advantage of it.

Making the project available to 3rd party allows a wider audience to utilize the project, whether for personal or professional use. It also helps to increase the visibility of the project and attract more potential users or collaborators.

11. References:

[11] Saeko Takagi†, Noriyuki Matsuda, Masato Soga, Hirokazu Taki, Takashi Shima, Fujiichi Yoshimoto “An Educational Tool for Basic Techniques in Beginner’s Pencil Drawing” Proceedings of Computer Graphics International Conference, CGI · August 2003.

[12]Jin Zhou, Baoxin Li “AUTOMATIC GENERATION OF PENCIL-SKETCH LIKE DRAWINGS” 0-7803-9332-5/05/$20.00 ©2005 IEEE.

[13] Shuo Sun Tianjin, Dongwei Huang Tianjin “Efficient Region-Based Pencil Drawing” WSCG '2007: Full s Proceedings University of West Bohemia Plzen Czech Republic, January 29 – February 1, 2007, p. 279-286.

[14] Heekyung Yang, Yunmi Kwon, & Kyungha Min “A Stylized Approach for Pencil Drawing from Photographs” Eurographics Symposium on Rendering 2012 Fredo Durand and Diego Gutierrez.

[15] 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.

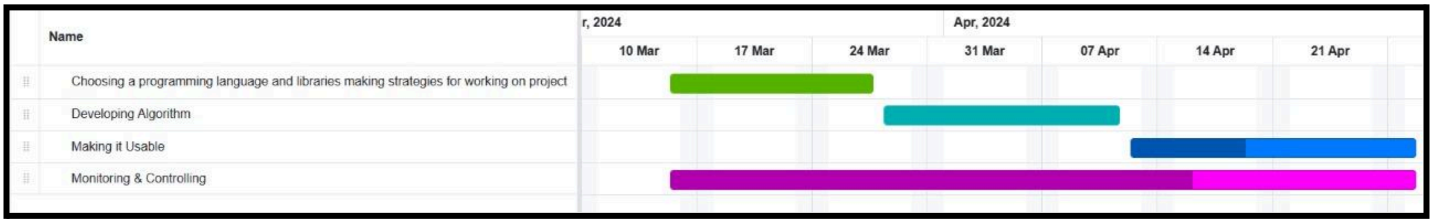
[16]Yijun Li, Chen Fang, Aaron Hertzmann, Eli Shechtman, Ming-Hsuan Yang “Im2Pencil: Controllable Pencil Illustration from Photographs”. IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR), 2019, pp. 1525-1534.

[17] 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).

[18] HUAPING ZHOU, CHAO ZHOU, AND XIAOYAN WANG "Pencil Drawing Generation Algorithm Based on GMED" Digital Object Identifier 10.1109/ACCESS.2021.3065428.

[19] Dong Wang, Guiqing Li, Chengying Gao, Shengwu Fu, and Yun Liang, "Feature-preserving colour pencil drawings from photographs" Computational Visual Media, https://doi.org/10.1007/s41095-022-0320-6 Vol. 9, No. 4, December 2023, 807–825

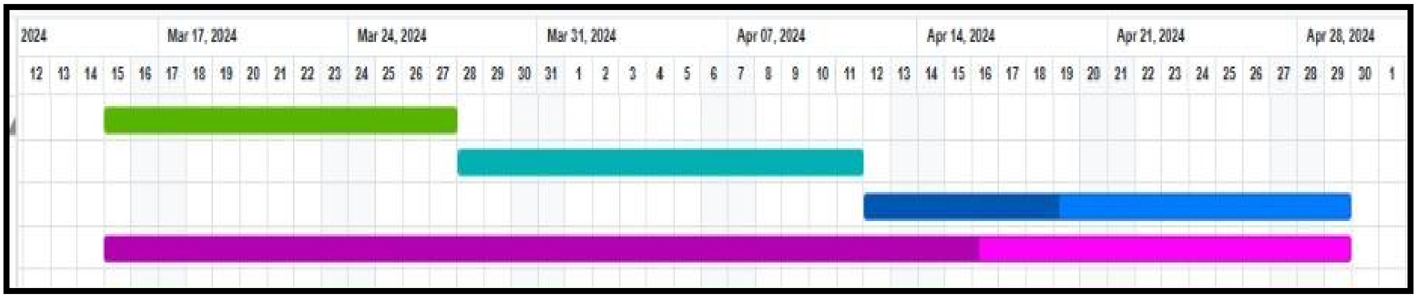
12. Gantt Chart:



This chart tracks the progress of four tasks associated with completing a project:

- Choosing a programming language and libraries & making strategies for working on projects.
- Developing Algorithm
- Making it Usable
- Monitoring & Controlling

Each task has a bar that shows the planned duration for its completion. The bars are divided into sections that likely represent milestones or stages within the task. The shading on the bars indicates progress made on the tasks. Here's a breakdown of the information for each task:



- **Choosing a programming language and libraries making strategies for working on projects:** This task started on March 15th, 2024, and was completed by March 27th, 2024. This task involves selecting the appropriate programming language for the project and creating plans to ensure smooth execution of the project (also known as requirement analysis).
- **Developing Algorithm:** This task began on March 27th, 2024, and continued through April 11th, 2024. This task involves creating algorithms that can convert an image into a pencil sketch.
- **Making it Usable:** This task began on April 12th, 2024. This task involves designing and implementing a user interface (UI) for your image-to-sketch conversion tool if it's intended for use by others. It involves testing your tool with real users to ensure it's easy to understand and use.
- **Monitoring & Controlling:** The task started on April 15th, 2024, and will continue until its completion. It requires monitoring the progress of development tasks according to the planned schedule, as well as identifying potential risks that may impact the project, such as delays, technical challenges, or resource limitations. This task also aims to ensure that the project remains within budget and timeline constraints.

Evaluation by Examiner

Please ✓ if work is satisfactory or □ if work is not satisfactory and therefore requires a revision.

Section	Internal Examiner	Remarks by Internal Examiner	Remarks
1. Project identification			
2. Project insights			
3. Relevant study material			
4. Objective/Scope			
5. Expected outputs			
6. Utilization			
7. Literature study/Data collection			
8. Methodology			
9. Executed work			
10. Remaining work			
11. References			
12. Gantt chart			
Overall performance			
Signature and date			