

Introduction

“Embark on a journey where learning meets real world experience. Internship isn’t just about coffee runs; it’s about diving into projects, gaining invaluable skills and crafting a path towards professional success”



Fig 1.1. Introduction

An internship program is designed to provide hands-on experience and meaningful projects that align with our interests and career goals. We'll work closely with experienced professionals, gaining insights, mentorship, and networking opportunities along the way. Whether we are exploring a new field or honing our expertise, our internship is our chance to make a tangible impact while developing the skills needed to thrive in today's dynamic workforce.



Fig 1.2. Team Work

Importance of Internship

- Structured learning
- Hands on experience
- Skill development
- Goal alignment
- Professional networking
- Professional development
- Exploration of career paths
- Resume boost
- Personal growth
- Brand building



Fig 1.3. Importance of Internship

Overall, a well-designed internship program can be mutually beneficial for both the organization and the interns, providing valuable learning experiences, fostering talent development, and contributing to the overall success of the company.

INTERNSHIP OBJECTIVES AND GOALS

- Learning about professionalism, and leadership
- Relating theory with hand-on practical learning
- Mastering Technical Skills
- Gaining Essential Background Knowledge
- Perfecting Interpersonal Skills (Soft Skills)
- Building a Network of Contacts
- Entering to a particular job/ profession/ industry
- Relating passion to career
- Tuning current skills through practicing
- Learning from colleagues and other professionals



Fig 1.4. Internship Goals

I successfully completed an online course internship at YBI Foundation, New Delhi, specializing in the fields of Data Science and Artificial Intelligence. Throughout the internship, I gained valuable experience and acquired a solid foundation of knowledge in these domains. The internship provided me with practical exposure to various techniques and tools used in Data Science and Artificial Intelligence, enabling me to apply them effectively in real-world scenarios. I am confident that the skills and knowledge I have gained during this internship will greatly contribute to my future efforts in these fields.



Fig 1.5. YBI Foundation

Chapter-02

Scope of Data science and artificial Intelligence:



Fig 2.1. Artificial Intelligence

We hear a lot about the trends and [applications of Data Science](#) these days. Now, many questions would have already popped up in your mind such as: ‘**Why do we need Data Science?**’, ‘**What is Data Science?**’, ‘**Is Data Science a good career?**’, and ‘**What are the trends in Data Science in 2024?**’

Let me answer these questions with a practical example. A few days back, I got a job offer through LinkedIn. The concerned HR of the company sent me an email regarding my interview timings. I overlooked the mail because I was quite busy. On the next day, a notification popped up on my mobile phone saying, ‘You have an interview scheduled at 1.30 pm today with Infosys,’ along with the location of the company. Then, I opened Google Maps on my phone to search for the location of the company. It showed me the best route with less traffic to reach the destination. Isn’t it a great technology that assists us in reminding us of important day-to-day tasks?

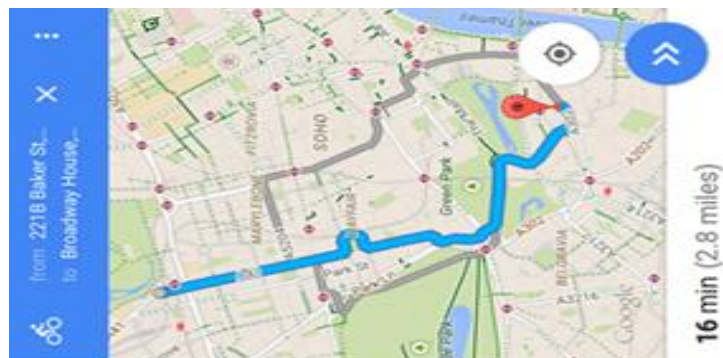


Fig 2.2. Map

Another wonderful real-life example of Data Science is Tesla's self-driving cars. These cars collect real-time data from their surroundings with the help of a camera, IoT sensors, and ultrasonic sensors. After collecting the real-time data, they process the data, visualize it, and use software algorithms to determine the best suitable actions to follow while navigating themselves on a safe drive. In the coming years, these self-driving cars will revolutionize the automobile industry!



Fig 2.3. IOT Sensors

From this, you can infer how fast human beings are moving toward automation in various fields. This is only possible due to the evolution of Data Science. So, Data Science growth depends on the amount of data and the creativity

Data Science is the substructure on which [Artificial Intelligence](#) and [Machine Learning](#) are built. So, it is obvious that the base (Data Science) of automation (robots, chatbots, virtual assistants, etc.) is likely to escalate the employability of skilled individuals. Data Science is one of the trending skills in the market.



Fig 2.4. Robots

Chapter 3

Image Enhancement

Image enhancement is the process of improving the quality and appearance of an image. It can be used to correct flaws or defects in an image, or to simply make an image more visually appealing. Image enhancement techniques can be applied to a wide range of images, including photographs, scans, and digital images. Some common goals of image enhancement include increasing contrast, sharpness, and colorfulness; reducing noise and blur; and correcting distortion and other defects. Image enhancement techniques can be applied manually using image editing software, or automatically using algorithms and computer programs such as OpenCV.



Fig 3.1. Image Enhancement

One fundamental aspect of image enhancement is contrast enhancement, which aims to improve the visibility of details by increasing the difference between the dark and light areas of an image. This can be achieved through techniques like histogram equalization or adaptive contrast stretching. Another important aspect is color enhancement, which adjusts the color balance, saturation, and vibrancy to make the image more visually appealing.

Image enhancement also deals with mitigating noise, which can degrade the quality of images. Techniques like filtering and denoising algorithms are employed to reduce unwanted artifacts and improve overall image clarity. Sharpening algorithms are applied to enhance edge details, making the image more visually appealing and suitable for various applications, including medical imaging, surveillance, and satellite imagery.

Image Transformations using OpenCV in Python

- we are going to learn **Image Transformation** using the **OpenCV** module in Python.

What is Image Transformation?

Image Transformation involves the transformation of image data in order to retrieve information from the image or preprocess the image for further usage. In this tutorial we are going to implement the following image transformation:

- Image Translation
- Reflection
- Rotation
- Scaling
- Cropping
- Shearing in x-axis
- Shearing in y-axis

What is OpenCV?

OpenCV (Open Source Computer Vision Library) is an open-source computer vision and machine learning software library. OpenCV was built to provide a common infrastructure for computer vision applications and to accelerate the use of machine perception in commercial products. By using it, one can process images and videos to identify objects, faces, or even the handwriting of a human. When it is integrated with various libraries, such as [NumPy](#), [Python](#) is capable of processing the [OpenCV](#) array structure for analysis.

➤ Image Translation

[Image translation](#) is the rectilinear shift of an image from one location to another

```
dst = cv.warpAffine(img,M,(cols,rows))
```


➤ Image Reflection

Image reflection is used to flip the image vertically or horizontally.

- To flip the image horizontally:

```
M = np.float32([[1, 0, 0], [0, -1, rows], [0, 0, 1]])
```

- To flip the image vertically:

```
M = np.float32([[-1, 0, cols], [0, 1, 0], [0, 0, 1]])
```

➤ Image Rotation

Image rotation the image is rotated by a definite angle. It is used extensively in data augmentation, especially when it comes to image classification.

```
img_rotation = cv.warpAffine(img,  
                             cv.getRotationMatrix2D((cols/2, rows/2), 30, 0.6),(cols, rows))
```

➤ Image Scaling

Image scaling is a process used to resize a digital image. We perform two things in the image scaling either we enlarge the image or we shrink the image, OpenCV has a built-in function [cv2.resize\(\)](#) for image scaling.

- Shrinking an image:

```
img_shrunked = cv2.resize(image, (350, 300),  
                           interpolation = cv2.INTER_AREA)
```

- Enlarging Image:

```
img_enlarged = cv2.resize(img_shrunked, None,  
                          fx=1.5, fy=1.5,  
                          interpolation=cv2.INTER_CUBIC)
```

➤ Image Cropping

Cropping is the removal of unwanted outer areas from an image.

```
cropped_img = img[100:300, 100:300]
```

➤ Image Shearing in X-Axis

While the shearing image is on the x-axis, the boundaries of the image that are parallel to the x-axis keep their location, and the edges parallel to the y-axis change their place depending on the shearing factor.

```
M = np.float32([[1, 0.5, 0], [0, 1, 0], [0, 0, 1]])
sheared_img = cv.warpPerspective(img, M,
                                (int(cols*1.5),
                                 int(rows*1.5)))
```

➤ Image Shearing in Y-Axis

When shearing is done in the y-axis direction, the boundaries of the image that are parallel to the y-axis keep their location, and the edges parallel to the x-axis change their place depending on the shearing factor.

```
M = np.float32([[1, 0, 0], [0.5, 1, 0], [0, 0, 1]])
sheared_img = cv.warpPerspective(img, M,
                                (int(cols*1.5),
                                 int(rows*1.5)))
```

Chapter 4

Motion Deblurring

Motion deblurring is a crucial image processing technique aimed at rectifying the blurriness induced by motion during image capture. When a camera moves or an object within the scene is in motion during exposure, it leads to motion blur, degrading image quality and impacting visual clarity. This phenomenon is particularly evident in low-light conditions or when using slow shutter speeds.

The primary goal of motion deblurring is to restore sharpness and enhance the overall quality of images affected by motion blur. Various algorithms and approaches have been developed to address this challenge, ranging from traditional methods to advanced deep learning techniques. Traditional methods often involve estimating the motion trajectory and compensating for it, while more recent deep learning approaches leverage neural networks to learn complex mappings between blurry and sharp image pairs.

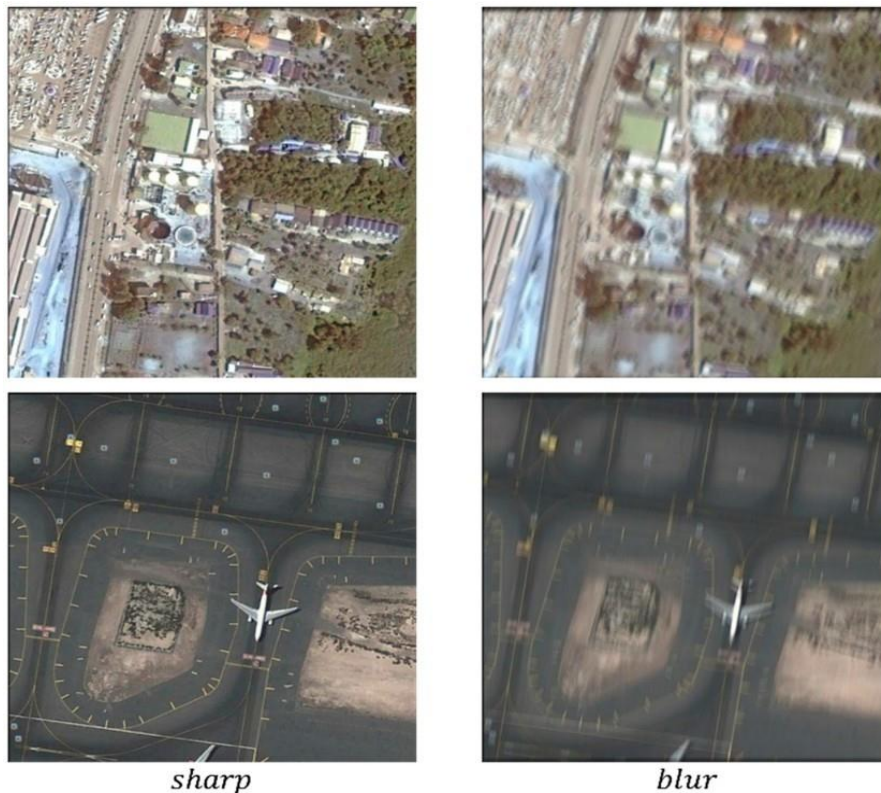


Fig 4.1. Motion Deblurring

Motion deblurring algorithms consider factors such as the direction, intensity, and duration of motion blur, utilizing mathematical models and image processing techniques to reverse the effects of motion. These methods play a crucial role in fields such as photography, surveillance, medical imaging, and computer vision, where obtaining clear and detailed images is essential for analysis and decision-making.

Image Super Resolution

Image super-resolution is a sophisticated image processing technique designed to enhance the resolution and quality of low-resolution images, thereby generating high-resolution counterparts with finer details. This technology is particularly valuable in various applications, such as medical imaging, surveillance, satellite imagery, and digital photography, where obtaining high-quality visuals is essential.



Fig 4.2. Image Super Resolution

The primary goal of image super-resolution is to reconstruct missing or degraded details in an image, surpassing the limitations imposed by the original resolution. Traditional interpolation methods often result in blurry or pixelated images, making them less suitable for critical tasks. Super-resolution algorithms employ advanced deep learning models, convolutional neural networks (CNNs), and machine learning techniques to intelligently predict and generate missing pixel information.

Image super-resolution plays a pivotal role in improving the perceptual quality of images, aiding in tasks that demand high-resolution inputs, such as facial recognition, medical diagnostics, and satellite image analysis. As technology continues to evolve, image super-resolution remains a dynamic field with ongoing research and development, constantly pushing the boundaries of what is achievable in enhancing image quality and detail.

Low Light to High Light Image Enhancement

Low light to high light image enhancement is a crucial process in digital image processing, aiming to improve visibility and quality in challenging lighting conditions. In low light scenarios, images often suffer from poor contrast, high noise, and reduced details. Various algorithms, such as histogram equalization and tone mapping, are employed to adjust brightness, contrast, and color balance, revealing hidden details in underexposed regions.

Dynamic range adjustment, particularly through High Dynamic Range (HDR) techniques, plays a significant role in transitioning from low light to high light, expanding pixel intensity ranges to cover a broader spectrum. Denoising methods are also used to mitigate noise inherent in low light conditions, utilizing filters or advanced machine learning techniques.

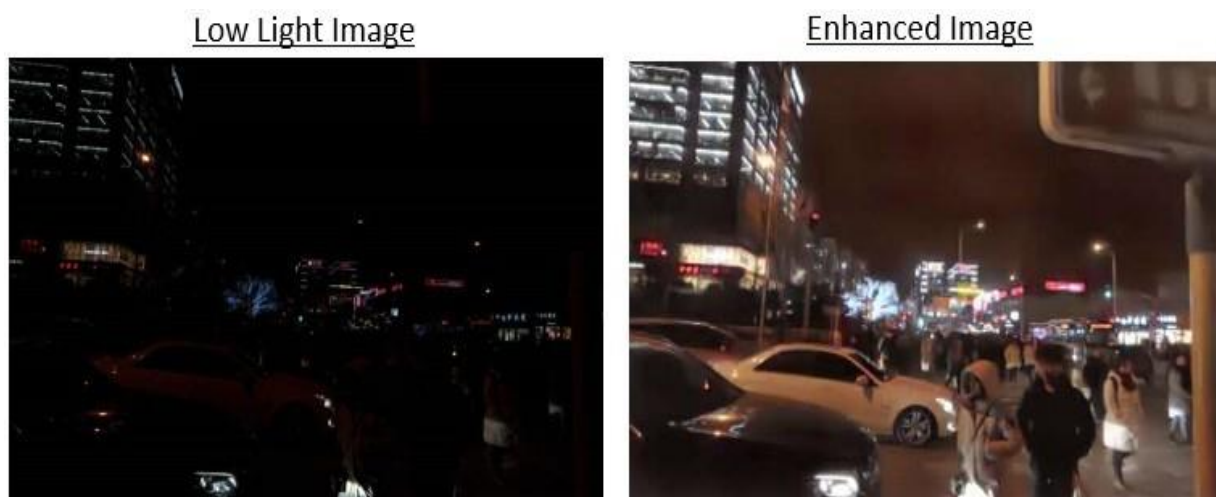


Fig 4.3. Low Light Image Enhancement

Beyond aesthetic improvements, low light to high light image enhancement has practical applications in surveillance, medical imaging, and industries where image quality is crucial. Ongoing research and development continue to explore more sophisticated methods for efficient image enhancement in challenging lighting conditions.

Chapter-5

Problem statement and Objective

Problem Statement

In the domain of image enhancement through deep learning, the challenges of motion deblurring, image super resolution, and low light to high light enhancement persist. This research seeks to:

- Develop robust deep learning models for real-time motion deblurring, considering variations in intensity and direction.
- Enhance image super resolution techniques by exploring scalable architectures and balancing computational efficiency with quality.
- Address low light challenges, devising adaptive algorithms for noise reduction, color correction, and contrast enhancement.

Objective

The objective of this project is to develop Deep Learning Models, which can be used for Image Enhancement. Specifically this project aims :

- Develop specialized deep learning models for motion deblurring, image super resolution, and low light to high light image enhancement.
- Investigate and address variations in motion blur intensities, directions, and complexities for robust model performance.
- Explore scalable architectures for image super resolution, optimizing the balance between computational efficiency and high-quality output.
- Develop adaptive algorithms for low light image enhancement, dynamically adjusting parameters for noise reduction, color correction, and contrast enhancement.
- Evaluate and optimize the real-time applicability of motion deblurring techniques, particularly in dynamic scenarios like video surveillance.
- Validate and benchmark the developed models in practical applications, emphasizing domains such as medical imaging, surveillance, and photography.

Chapter-6

Code implementation

#Import the necessary libraries

```
import cv2
import matplotlib.pyplot as plt
import numpy as np
```

Load the image

```
image = cv2.imread('GFG.jpeg')
```

#Plot the original image

```
plt.subplot(1, 2, 1)
plt.title("Original")
plt.imshow(image)
```

Adjust the brightness and contrast

Adjusts the brightness by adding 10 to each pixel value

```
brightness = 10
```

Adjusts the contrast by scaling the pixel values by 2.3

```
contrast = 2.3
```

```
image2 = cv2.addWeighted(image, contrast, np.zeros(image.shape, image.dtype), 0,
brightness)
```

#Save the image

```
cv2.imwrite('modified_image.jpg', image2)
```

#Plot the contrast image

```
plt.subplot(1, 2, 2)
plt.title("Brightness & contrast")
plt.imshow(image2)
plt.show()
```

Out put



In this example, the brightness of the image is adjusted by adding 10 to each pixel value, and the contrast is adjusted by scaling the pixel values by 2.3.

#Import the necessary libraries

```
import cv2
import matplotlib.pyplot as plt
import numpy as np
```

Load the image

```
image = cv2.imread('GFG.jpeg')
```

#Plot the original image

```
plt.subplot(1, 2, 1)
plt.title("Original")
plt.imshow(image)
```

Create the sharpening kernel

```
kernel = np.array([[0, -1, 0], [-1, 5, -1], [0, -1, 0]])
```

Sharpen the image

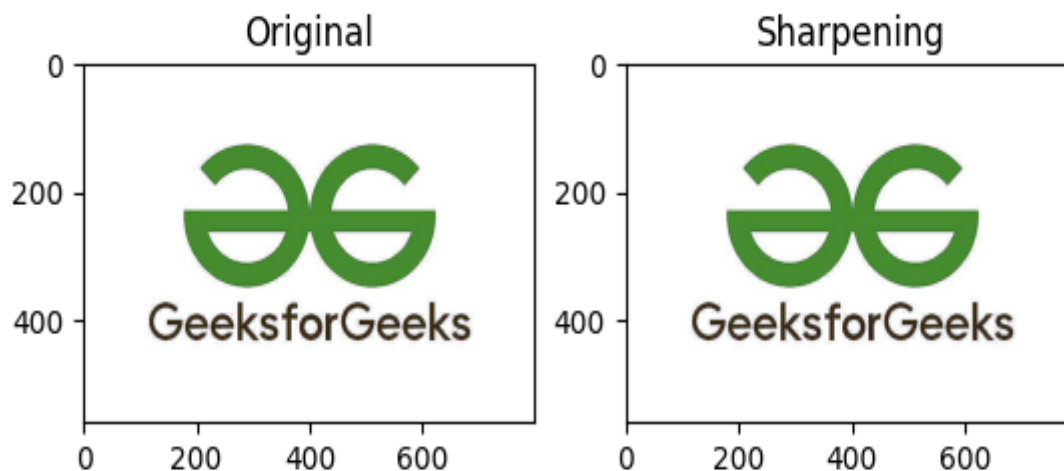
```
sharpened_image = cv2.filter2D(image, -1, kernel)
```

#Save the image

```
cv2.imwrite('sharpened_image.jpg', sharpened_image)
```

#Plot the sharpened image

```
plt.subplot(1, 2, 2)
plt.title("Sharpening")
plt.imshow(sharpened_image)
plt.show()
```

Out put

In this example, a 3×3 sharpening kernel is used to enhance the edges in the image.

#Import the necessary libraries

```
import cv2
import matplotlib.pyplot as plt
import numpy as np
```

Load the image

```
image = cv2.imread('GFG.jpeg')
```

#Plot the original image

```
plt.subplot(1, 2, 1)
plt.title("Original")
plt.imshow(image)
```

Remove noise using a median filter

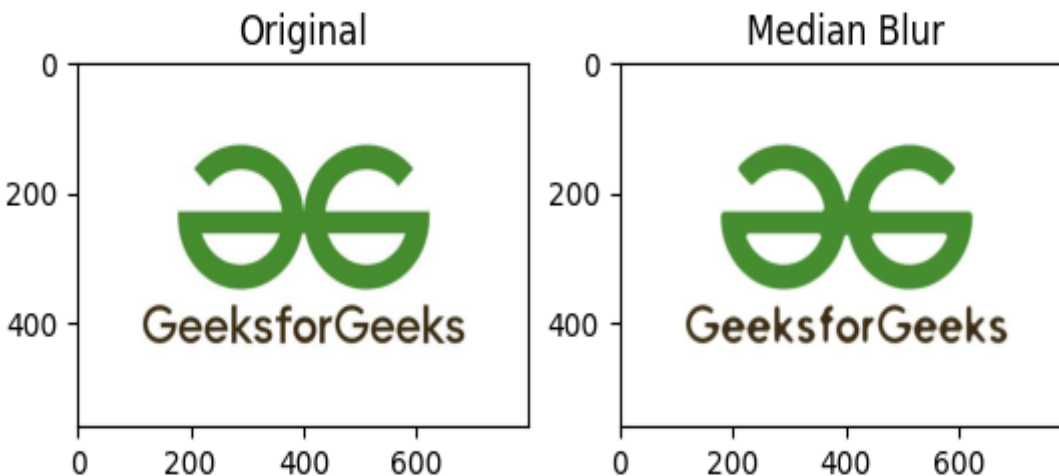
```
filtered_image = cv2.medianBlur(image, 11)
```

#Save the image

```
cv2.imwrite('Median Blur.jpg', filtered_image)
```

#Plot the blurred image

```
plt.subplot(1, 2, 2)
plt.title("Median Blur")
plt.imshow(filtered_image)
plt.show()
```

Output

In this example, the `cv2.medianBlur()` function is used to apply a median filter to the image.

Chapter-7

Video Enhancement

AI video enhancement refers to the use of artificial intelligence algorithms to improve the quality of video content. This can involve a range of techniques and technologies aimed at increasing resolution, enhancing colors, reducing noise, stabilizing footage, and more. Here are some key areas where AI is applied for video enhancement:

1. Upscaling and Super-Resolution

Introduction

Upscaling involves increasing the resolution of a video, while super-resolution is a technique to generate high-resolution images from low-resolution ones. Traditional methods often lead to blurry results, but AI offers more sophisticated solutions.

AI Techniques

AI-based upscaling employs deep learning models, such as Convolutional Neural Networks (CNNs) and Generative Adversarial Networks (GANs), to predict high-resolution details. Models are trained on large datasets of low- and high-resolution image pairs to learn the mapping between them.

Applications

- **Entertainment Industry:** Upscaling old movies to modern 4K resolutions.
- **Surveillance:** Enhancing the clarity of footage for better identification.
- **Medical Imaging:** Improving the resolution of medical scans for accurate diagnosis.

Benefits

- **Improved Visual Quality:** AI upscaling produces sharper, more detailed images.
- **Cost-Effective:** Enhances existing footage without the need for expensive re-shoots.

2. Noise Reduction

Introduction

Noise, often present in low-light or old footage, can degrade video quality. AI-based noise reduction techniques are designed to distinguish and remove unwanted noise while preserving important details.

AI Techniques

AI models, such as Denoising Autoencoders and CNNs, are trained to separate noise from actual video content. They learn to identify patterns of noise and reduce it without blurring the underlying details.

Applications

- **Film Restoration:** Cleaning up old, noisy footage.
- **Security Cameras:** Improving the clarity of low-light surveillance videos.
- **Consumer Video:** Enhancing amateur videos shot in challenging lighting conditions.

Benefits

- **Enhanced Clarity:** Significantly reduces noise, improving the visual quality of videos.
- **Preservation of Details:** Maintains the integrity of important video content.

3. Color Enhancement and Correction

Introduction

Color enhancement involves adjusting and improving the colors in a video to make them more vibrant and accurate. AI can automatically correct color imbalances and enhance visual appeal.

AI Techniques

AI techniques use deep learning models trained on large datasets to understand color patterns. These models can perform tasks such as white balance correction, saturation adjustment, and dynamic range enhancement.

Applications

- **Film and TV Production:** Enhancing the visual appeal of scenes.
- **Marketing and Advertising:** Creating visually striking promotional videos.
- **Social Media Content:** Improving the quality of user-generated content.

Benefits

- **Automatic Adjustments:** Saves time and effort compared to manual color correction.
- **Consistent Quality:** Ensures a consistent and professional look across video content.

4. Frame Interpolation

Introduction

Frame interpolation involves generating intermediate frames between existing ones to increase the frame rate of a video. This results in smoother motion, especially for high-action scenes.

AI Techniques

AI-based frame interpolation uses deep learning models to predict the appearance of intermediate frames. Techniques such as Optical Flow and CNNs analyze motion between frames and create smooth transitions.

Applications

- **Sports Broadcasting:** Enhancing the smoothness of fast-paced action.
- **Gaming:** Improving the visual experience in games with higher frame rates.
- **Virtual Reality:** Creating immersive experiences with fluid motion.

Benefits

- **Smoother Motion:** Reduces choppiness in videos, providing a more enjoyable viewing experience.
- **Enhanced Realism:** Makes fast-moving scenes appear more natural.

5. Video Stabilization

Introduction

Shaky footage can be a major issue in video production. AI-based video stabilization techniques help to correct and smooth out unsteady videos, resulting in professional-quality output.

AI Techniques

AI stabilization algorithms analyze video frames to detect and correct shake. Techniques include CNNs and RNNs (Recurrent Neural Networks) which predict and adjust for camera movements.

Applications

- **Action Cameras:** Stabilizing footage from devices like GoPros.
- **Drone Footage:** Smoothing out videos captured from drones.
- **Mobile Phones:** Enhancing amateur videos shot on smartphones.

Benefits

- **Professional Quality:** Turns shaky footage into smooth, watchable content.
- **User-Friendly:** Makes it easier for non-professionals to produce high-quality videos.

6. Detail Enhancement

Introduction

Detail enhancement focuses on improving the sharpness and clarity of specific details within a video. This can involve enhancing textures, edges, and fine features that might be lost in standard processing.

AI Techniques

Deep learning models such as CNNs are used to identify and enhance details within video frames. These models can be trained on datasets to recognize and amplify specific types of details.

Applications

- **Architectural Visualization:** Enhancing the details in visual presentations.
- **Wildlife Documentaries:** Bringing out fine details in animal footage.
- **Scientific Visualization:** Improving the clarity of detailed scientific videos.

Benefits

- **Increased Sharpness:** Makes videos appear more detailed and professional.
- **Highlighting Features:** Emphasizes important aspects of the video content.

7. Artifact Removal

Introduction

Artifacts, such as compression artifacts or scanning lines, can degrade video quality. AI-based artifact removal techniques help to clean up these imperfections.

AI Techniques

AI models are trained to identify and remove various types of artifacts. Techniques include GANs and CNNs, which can effectively clean up video content without losing important details.

Applications

- **Video Streaming:** Improving the quality of compressed streaming content.
- **Old Film Restoration:** Removing artifacts from digitized old films.
- **Broadcasting:** Enhancing the quality of live broadcast footage.

Benefits

- **Cleaner Videos:** Removes distracting artifacts, improving viewer experience.
- **Preservation of Quality:** Maintains the integrity of original content while cleaning up imperfections.

8. Object Removal and Inpainting

Introduction

Object removal and inpainting involve identifying and removing unwanted objects from a video and filling in the missing parts seamlessly. This is useful in scenarios where certain elements need to be edited out.

AI Techniques

Deep learning models, particularly GANs and CNNs, are trained to recognize unwanted objects and predict the appearance of the background. These models can then seamlessly fill in the gaps left by removed objects.

Applications

- **Film Editing:** Removing unwanted elements from scenes.
- **News Broadcasting:** Editing out sensitive or distracting content.
- **Personal Videos:** Removing unwanted objects from personal recordings.

Benefits

- **Seamless Editing:** Allows for clean removal of objects without noticeable gaps.
- **Versatility:** Can be used in a wide range of video editing scenarios.

9. Style Transfer

Introduction

Style transfer involves applying artistic styles to videos, transforming them to look as though they were painted or created in a specific artistic style. AI can make these transformations seamlessly and realistically.

AI Techniques

Neural style transfer uses deep learning models to separate and apply the content and style of images to video frames. Techniques like CNNs are used to achieve this effect.

Applications

- **Creative Projects:** Producing visually unique videos for art and advertising.
- **Film and Animation:** Creating distinctive visual styles for movies and animations.
- **Social Media:** Enhancing personal videos with artistic effects.

Benefits

- **Creative Flexibility:** Allows for endless creative possibilities in video production.
- **Easy Implementation:** AI makes it easier to apply complex artistic styles.

10. Motion Deblurring

Introduction

Motion deblurring aims to reduce the blur caused by movement in videos, making moving objects and scenes appear clearer. This is particularly useful in high-motion footage.

AI Techniques

AI models like CNNs are trained to recognize and reduce motion blur by analyzing video frames and predicting the sharp version of the blurred content.

Applications

- **Sports and Action:** Clarifying fast-moving scenes in sports and action footage.
- **Surveillance:** Improving the clarity of moving objects in security footage.
- **Amateur Videos:** Enhancing the quality of personal recordings with motion blur.

Benefits

- **Clearer Images:** Significantly improves the visibility of moving objects.
- **Enhanced Viewing Experience:** Makes high-motion videos more enjoyable to watch.

Conclusion

AI has revolutionized video enhancement, offering powerful tools to improve video quality across various applications. From upscaling and noise reduction to color enhancement and motion deblurring, AI techniques provide significant benefits, making video content sharper, clearer, and more visually appealing. As technology advances, AI's role in video enhancement is set to grow, offering even more sophisticated and accessible solutions for both professionals and amateurs.

Chapter-7

SUMMARY AND CONCLUSION

To summarize about the internship period, during my educational internship at YBI Foundations, I had the opportunity to learn and explore various topics related to data science and Artificial Intelligence. The internship covered a wide range of subjects, including the scope of data science and artificial intelligence, Image enhancement, Image deblurring, Video enhancement. I also gained knowledge about essential Python libraries for data science and machine learning, and learned how to work with Data Frames for data manipulation and analysis.

Furthermore, the internship provided an introduction to Kaggle, a popular platform for data science competitions and projects. I learned about the machine learning prediction flow, which involves steps like train-test split to evaluate model performance. I also gained practical experience in implementing coding for image enhancement and image deblurring .

Overall, my internship at YBI Foundations equipped me with a solid foundation in data science and artificial intelligence concepts and practical skills, enabling me to apply my knowledge in real-world scenarios.

Chapter-8

References

The following websites are referred in order to complete the internship program.

https://github.com/Dinesh-Goli/ybi_project/tree/main

[https://colab.research.google.com/drive/13QW3UaePIR9ieSF6aYZcII-](https://colab.research.google.com/drive/13QW3UaePIR9ieSF6aYZcII-5rTsgPUWG#scrollTo=BqlxbXNno4K1)

[5rTsgPUWG#scrollTo=BqlxbXNno4K1](https://colab.research.google.com/drive/13QW3UaePIR9ieSF6aYZcII-5rTsgPUWG#scrollTo=BqlxbXNno4K1) <https://www.ybifoundation.org/#/home>

<https://www.youtube.com/>

<https://www.ybifoundation.org/certificate-validation?credentialId=DWT1Z0O9AI93C>