Digital Image Processing app

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Report

Introduction

In my project we have created a local image processing app using OpenCV python which helps us to do different kind of operations to images. Such as we have created techniques like, Cropping, Rotating, Flipping (Flipping Horizontal and Vertical), Brightness(Increase or Decrease) and Contrast Changing(Increase or Decrease), Sharpening (Increase), Blurring(Increase) Zooming and Color conversions like : Black and White to Color conversion, Black and White to Grayscale Conversion , Color to Black and White Conversion , Color to Grayscale Conversion , Grayscale to Color Conversion , Grayscale to Black and White Conversion Under the main functions.

And under the Advance Techniques We have created different types Operations such as, Artistic Filters, Edge Detection Filters, Smoothing Filters mainly under the Filter Section and we created Color Balancing Techniques, Image Enhancement Techniques, Tonal Transformation Techniques , Intensity Manipulation Techniques using color transformations and Image Segmentation Techniques.

As for Deep learning part we have created style transferring, Image Enhancement, Image segmentation, Image generation and Face detection using different types of modal architectures.

Problem

Users are today facing too many problems when they want to use some image processing and analysis tools. Maybe they want to use some advanced techniques, but they don’t have enough money to afford them, and they are wasting their time while they are finding these types of capable apps or softwares. So, we decided to create a local app which can do different kinds of image enhancement operations like basic manipulations, advanced techniques to deep learning techniques though a one application.

Solution

As solutions to address above types of problems we have created:

1. All in one image processing Application
2. Diverse Image Processing Techniques
3. Advanced Image Processing Capabilities
4. Deep learning Integration
5. Improved Efficiency
6. User Friendly Interface
7. Versatility Across Applications
8. Enhanced Image Quality
9. Time and Resource Savings
10. Creative freedom

In summary, our project's solutions address the problem by providing an efficient, versatile, and user-friendly image processing and analysis application that covers the entire spectrum of image manipulation needs, from basic editing to advanced deep learning-powered tasks. This holistic approach simplifies the image processing workflow and empowers users to achieve their desired results with ease and creativity.

Some background information about the algorithms used:

In the main Window called, “Image Viewer” There are five Buttons:

Open Image: This function makes it simple for users to import pictures into the program. It makes accessing and manipulating photos easier, making it simpler to edit, analyze, and improve photographs within the program.

Reset Image: Using the "Reset Image" option erases any alterations and filters, returning the image to its original condition. It guarantees that users may experiment without worrying about making permanent changes since it provides a rapid and efficient mechanism to undo modifications and restart.

Operations Window: "Open Operations Window" gives you access to a full range of tools for processing images. It is the starting point for a vast array of operations, from simple tweaks to sophisticated methods, giving users the ability to alter and work with their photos as they see fit.

Save Image: Users may save their altered or processed photographs by using the "Save Image" function. It makes sure that the modifications that users have made in the program stay intact, so they may share, print, or work on their photographs further.

Crop picture: By selecting and retaining a certain area of a picture, users may eliminate undesired features with the "Crop Image" tool. This tool is essential for honing compositions, concentrating on themes, and enhancing the visual impact of images and graphics as a whole.

Main Functions

Flipping

Flipping is a method of picture modification that allows you to reflect an image vertically (upside-down) or horizontally (left to right). It's a basic picture editing technique that provides both artistic and remedial possibilities. Subject perspective can be altered via horizontal flips, while picture inversion can be achieved with vertical flips. Flipping can be used to fix scanned texts and create symmetrical compositions, among other artistic and analytical uses.

Flip Horizontal

An picture can be transformed horizontally by mirroring it along a horizontal axis and flipping its orientation from left to right. Image editing uses this procedure to create mirrored or symmetrical compositions, adjust text alignment, and create artistic effects, among other things. In image processing, horizontal flips provide diversity and artistic possibilities.

Flip Vertical

By reflecting a picture along a vertical axis, a method known as "vertical flipping" turns an image into an upside-down image. This function may be applied to photos to rectify their improper orientation, create symmetry, or create artistic effects. It may produce original visual views, improve compositions, and align text correctly.

Rotating

Rotating is an image transformation that modifies an image's orientation by a predetermined angle. It is a basic method in image processing that enables skewed picture rectification, object alignment, and artistic effects like image rotation in design and art. In order to get appropriate views and orientations, rotation is essential.

Rotate to Left

An image can be processed to rotate left, which turns the picture's orientation counterclockwise. This method works well for artistic reasons like creating various visual viewpoints or for fixing misaligned photos. Rotating pictures left improves composition and guarantees that they are positioned appropriately for different applications.

Rotate to Right

An picture can be rotated to the right by adjusting its clockwise orientation. This image processing technique is useful for artistically creating a variety of visual effects in addition to repairing skewed or incorrectly orientated photographs. Right-rotating images can improve alignment, improve composition, and obtain the desired picture orientation.

Rotation Degree

An exact image processing method involves rotating a picture by a given number of degrees. It gives users precise control over the rotational angle, making it versatile for creative effects, alignment, and picture correction of skewedness. Users can accomplish accurate orientation modifications for their photographs by providing the degree of rotation.

Zoom Function

The technique of enlarging or decreasing a picture while preserving its aspect ratio is known as zooming. For certain uses, this technique reduces the size of the image or enhances its details. In photography, graphic design, and analysis, zooming is useful because it allows users to focus on or reduce the size of image elements without causing distortion.

Zoom in

The image processing technique known as "zoom in" enlarges a picture and highlights certain characteristics. This method is used to bring out the tiny details in images or graphics, allowing the viewer to get a closer look at particular parts of the picture. Zooming in enables more accurate picture processing and analysis as well as closer inspection.

Zoom out

An image processing technique called "zoom out" enlarges a picture by decreasing its size. It is applied to reduce the size of photographs while preserving their aspect ratio. When a scene is displayed in its entirety, the context of the image is enhanced, or thumbnails are created for easier navigation within bigger photos, zooming out is advantageous.

Color Conversion

Images are converted between different color spaces using color conversion methods. Converting a color picture from RGB to Grayscale yields intensity data. Color and brightness are separated from RGB to HSV. Printing requires converting RGB to CMYK. To return to the standard color space, convert HSV to RGB. These conversions make a variety of picture processing and analysis possible.

Black or White to Color

Colorization methods are used to turn black and white photographs into color. These techniques give colors to grayscale pixels using algorithms and reference data. Even if they're not always accurate, they are a useful means of bringing life and brightness to monochrome images, especially when used in historical or creative contexts.

Black or White to Grayscale

Images in black and white can be converted to grayscale, which reduces color fluctuation and produces shades of gray. This approach is useful in many image processing and printing applications since it is frequently used for uniform color analysis or to highlight picture structures and features.

Color to Black or White

Images in color are reduced to grayscale when they are converted to black and white, eliminating color information. This method emphasizes shape and contrast while de-complexing pictures. It's applied to enhance visual coherence, highlight texture, and make aesthetic decisions. It is often used in design and photography to give pictures a timeless, classic feel.

Color to Grayscale

When converting color photos to grayscale, color data is discarded and just the brightness information is kept. This reduces photos to grayscale. Grayscale images highlight an image's shape, composition, and brightness. In the fields of science, art, and technology, including graphic design and medical imaging, this method is frequently employed.

Grayscale to Color

Adding color information to initially monochromatic photographs is the process of converting grayscale to color images. To improve the image's visual appeal and information representation, this method uses color mapping or algorithms that assign colors to varying intensities. It's helpful for adding artistic touches to grayscale information or coloring old photographs.

Grayscale to Black or White

An picture can be reduced to only two colors—black and white—with a variety of grayscale tones in between when it is converted from grayscale to black and white. This method is used to emphasize high contrast parts, simplify the text, and provide clarity. Due to their affordability and legibility, black and white photographs are frequently utilized in printing.

Brightness method

A basic method of image processing that changes a picture's overall luminance is brightness adjustment. It entails equally raising or lowering each pixel's intensity. When brightness is increased, the picture seems lighter; when brightness is decreased, the image appears darker. In photography and digital media, this method is used to fix exposure problems, improve picture visibility, or create desired visual effects. It's a useful tool for adjusting the lighting and atmosphere in pictures.

Increasing Brightness

In image processing, brightness is achieved by consistently increasing pixel intensity. This improves lighting overall, brightening the image. It's useful for bringing out the vibrancy of images, enhancing visibility, and correcting underexposed shots. In graphic design and photography, brightness increases are frequently employed to enhance the visual attractiveness of pictures.

Decreasing Brightness

In image processing, lowering brightness means lowering each pixel's intensity equally. This makes everything look darker by lowering the amount of light in general. It may be applied to reduce overexposed photos, add mood, or draw attention to particular parts of a picture. In photography and design, decreasing brightness is used to create a variety of visual effects.

Contrast Adjustment

An image processing technique called contrast adjustment modifies the brightness difference between an image's brightest and darkest regions. A stunning appearance and more emphasis on details are produced when contrast is increased. An picture becomes softer with less contrast. This method is useful for enhancing the clarity and beauty of images in both photography and design.

Increasing Contrast

In image processing, contrast is achieved by enhancing the contrast between areas of light and dark. This increases visual impact, sharpens details, and brightens the image. It is used in design and photography to draw attention to certain areas, enhance picture clarity, and produce visually arresting and dynamic imagery. Increasing contrast is a crucial technique for producing visually striking results.

Decreasing Contrast

In image processing, decreasing contrast entails lessening the contrast between bright and dark regions. This softens the picture, giving it a more subdued, less vibrant appearance. It softens harsh lighting, produces a dreamy or retro aspect, and is utilized for creative purposes. Photographs and other visual content can have a distinct vibe thanks to contrast reduction.

Sharpen Image

An image processing method called sharpening improves a picture's detail and clarity. It entails boosting the contrast along edges to give them a sharper appearance. Sharpening enhances image quality, particularly in photography and graphics, by highlighting minute details, producing images that are clearer and more aesthetically pleasing.

Blurring

An picture's sharpness and detail are diminished by the image processing technique of blurring. The soft focus effect is produced by averaging or smoothing the values of nearby pixels. In photography, design, and image analysis, blurring is used for artistic effects, noise reduction, and concentrating emphasis on particular regions.

Increase Blur

Sharpness and detail are lost in images when image processing blurs are increased. It's used for emphasizing particular objects, creating creative effects, and minimizing distractions. Different blur filters, including motion blur or Gaussian blur, may be applied to photographs to make them look more dreamlike, blurry, and dynamic. This method is applied to design, photography, and visual narrative.

Artistic Filters

In image processing, artistic filters are specialized approaches that turn images into visually arresting creative styles. By adding distinctive textures, color schemes, and brushstroke effects to photos, these filters mimic well-known artistic movements like Impressionism and oil painting. They give pictures a creative edge that makes them visually attractive and captivating.

Cartoonization filters

Image processing technologies called "cartoonization filters" may transform photographs into cartoon-like images. These filters mimic the look of hand-drawn cartoons by emphasizing outlines, flattening complicated details, and adding vivid colors. They are employed to produce imaginative and lighthearted picture effects that transform everyday scenes into fanciful, illustrated works of art.

Oil Painting Filter

A digital image processing method that simulates the appearance of conventional oil paintings is called an oil painting filter. It gives photographs or pictures a rich, painterly feel, blending colors and adding brushstroke textures. In digital art and photography, this filter is often used to produce expressive and creative visual effects.

Pencil Sketch Filter

A computer tool for modifying images that mimics the look of hand-drawn pencil sketches is called a pencil sketch filter. It turns photographs or photos into grayscale or black-and-white versions, highlighting contours and highlights to provide an artistic or realistic pencil-drawn impression. In illustration, design, and the arts, this filter is frequently employed.

Intensity manipulation in color transformations

Techniques for intensity manipulation in color transformations modify an image's luminance or brightness without changing its color. The common techniques include gamma correction, contrast stretching, and histogram equalization. These methods preserve the original color information while enhancing or modifying image visibility to highlight features or produce desired visual effects.

Image negatives

Image negatives are digital or photographic images that have been reversed. They produce an inverted version with opposing tonal values by swapping the bright and dark regions. Negatives are frequently employed in digital image manipulation for artistic or creative reasons, providing a distinctive and dramatic look, as well as in photography to create prints.

Log transformations

Image processing techniques called log transformations are used to non-linearly change pixel intensity levels. These adjustments enlarge low-intensity parts and compress high-intensity regions of an image by calculating the logarithm of each pixel's value. Log transformations can be used to visual data to reduce dynamic range and enhance details.

Power law transformations

By applying a power function to each pixel value, power law transformations—also referred to as gamma correction—modify pixel intensity in a non-linear manner. These transformations are helpful for highlighting features and improving visibility in areas like medical imaging and photography since they may be used to change the brightness and contrast of images.

Piecewise linear filter transformations

An picture can be divided into segments, each with its own linear filter, using a technique called piecewise linear filter transformations. This makes it possible to precisely modify the brightness and contrast in various picture areas, emphasizing certain details or characteristics. It is frequently applied in image processing to enhance visual clarity and draw attention to particular regions.

Color Transformations

The colors of an image can be adjusted using color balance techniques to make it look more appealing or natural. Typical techniques include color cast removal to get rid of undesirable color tints, histogram equalization to spread out color tones, and white balance correction to compensate for lighting conditions. These methods are applied to color correction and enhancement in photography and image processing.

Generalized color balancing

A technique called "generalized color balancing" uses mathematical transformations to alter the color channels of a picture to rectify color imbalances. It offers more adaptable and customizable repairs than basic methods, giving exact control over color alterations to produce desired visual effects. It is extensively utilized in digital image processing and photography.

Psychological color balance

A concept in psychology and design known as psychological color balance takes into account how colors affect human perception and emotions. It entails choosing and manipulating colors to affect the emotions, mood, and actions of the viewer with the goal of evoking particular psychological reactions or improving the user experience as a whole.

Illuminant adaptation

In the fields of vision and color science, the ability of the human visual system to adapt to various lighting situations is known as illuminant adaptation. It makes it possible for us to see consistent colors in a variety of lighting conditions, including artificial and daylight. Accurate perception and color constancy are ensured by this adaptive mechanism.

Chromatic Colors

Chromatic images are those that contain vivid, unique colors from the color wheel, with the exception of grayscale tones. These hues have a powerful visual effect and are frequently employed in photography, art, and design to produce compositions that are vibrant, expressive, and visually exciting. They also give the visual experience more thrill and energy.

Mathematics in Color Balancing

In mathematics, color balancing refers to modifying an image's color channels to make sure they are proportionately correct. To account for color shifts and provide accurate color representation in digital photos, this is frequently accomplished using mathematical transformations and linear algebra. It's an essential component of color control and correction.

General Illuminant adaptation

The mechanism by which the human visual system adapts to changes in lighting conditions—general illuminant adaptation—allows humans to see consistent colors despite differences in ambient light. It's an essential component of color constancy that allows humans to continue recognizing and perceiving colors accurately in a variety of settings and lighting conditions.

White Balancing

A color correction technique used in imaging and photography is called white balance. It seeks to guarantee that, in the finished picture, white objects will always seem neutral white, regardless of the illumination. To obtain accurate and realistic color representation, it corrects color casts induced by different light sources (e.g., daylight, fluorescent, or incandescent).

Graded Colors

An image that has been "graded" is one in which colors and tones have been carefully altered to provide a certain mood or visual impression. This is frequently utilized in photography, design, and cinematography to improve narrative or create a specific mood. Color balance, saturation, and contrast may all be adjusted during grading.

Image Segmentation

In digital image processing, image segmentation is the process of breaking a picture up into discrete, significant areas or segments. It is employed in computer vision, medical imaging, and object identification to recognize and isolate items or regions of interest within an image, enabling more targeted analysis, modification, or comprehension of its information.

Edge-based segmentation

A computer vision approach called edge-based segmentation uses sudden changes in hue or intensity to identify object boundaries in a picture. It is an essential stage in image processing and object identification jobs because it uses edge detection methods to highlight object edges.

Threshold-based segmentation

By establishing a threshold value, the image processing technique known as "threshold-based segmentation" may distinguish objects from the background. Above this level, pixels are categorized as object pixels; below, they are categorized as background. It's a straightforward method that works well for applications like picture binarization and object recognition.

Region-based segmentation

In image processing, a technique called region-based segmentation divides pixels into areas that share traits like texture or color. It considers both local and global information in order to divide a picture into meaningful pieces. Applications in computer vision, scene analysis, and object recognition can benefit from this method.

Cluster-based segmentation

An image processing technique called cluster-based segmentation divides pixels into classes or clusters according on how similar they are. In order to divide an image into discrete areas with uniform properties like color or texture, it uses clustering methods like K-means. This technique is frequently applied to image analysis and pattern identification.

Watershed segmentation

Using pixel intensities as a topographic landscape, a computer vision approach called "watershed segmentation" may be used to distinguish between items in an image. It defines object boundaries by locating watershed lines at the intersection of basins. Although this technique can be noise-sensitive, it works well for segmenting objects with distinct edges.

Overlays segmentation

The phrase "overlays segmentation" is not commonly used in the fields of computer vision or image processing. Please offer additional information if you have a specific concept or context in mind for "overlays segmentation," and I would be pleased to help you in accordance with that.

Edge Detection Filters

Image processing methods known as edge detection filters are designed to identify object boundaries in pictures by emphasizing sudden changes in color or intensity. The Sobel, Prewitt, and Canny filters are popular filters that compute gradient values to highlight edges. For computer vision tasks like object identification and picture segmentation, these filters are essential.

Canny Edge Detection: One prominent image processing method for locating edges in digital pictures is called "canny edge detection." Gaussian smoothing, gradient computation, non-maximum suppression, and edge tracking via hysteresis are some of the stages that are involved. Canny edge detection is a popular technique in computer vision and image analysis because of its reputation for precisely detecting edges with the least amount of noise and false positives.

Sobel Edge Detection: Sobel edge detection is an image processing method that computes gradient values based on variations in pixel intensity to highlight edges. It computes the gradients vertically and horizontally independently using 3x3 convolution kernels. It is a vital tool in computer vision and edge detection jobs because these gradient values are combined to identify edge strengths and orientations.

Laplacian Edge Detection : By calculating the second derivative of pixel intensities, the Laplacian edge detection technique improves edges in images. It draws attention to areas where intensity fluctuates quickly, highlighting edges and details. Laplacian edge detection is frequently utilized as an additional step in image processing jobs for edge enhancement and picture analysis.

Smoothing Filters

Gaussian and median filters are examples of smoothing filters that lessen blur and noise in digital photos. By applying a weighted average to every pixel, Gaussian smoothing lowers high-frequency noise. Effective for reducing salt-and-pepper noise, median filtering substitutes the median value in each pixel's vicinity for each one. Smoothing filters are helpful for preprocessing in a variety of applications and enhance image quality.

Gaussian Filter: Using a weighted average of pixel values, Gaussian blur is a popular image processing technique that sharpens edges and minimizes noise in images. A Gaussian function determines the weights, with neighboring pixels adding more to the average. This technique reduces high-frequency information in the image and gives it a smoother, softer look. In computer graphics and photography, Gaussian blur is frequently used to achieve a variety of effects, such as noise reduction and background de-emphasis.

Embossing Filter: The embossing filter is an image processing method that highlights an image's borders to give it a more three-dimensional look. It computes the gradient of pixel intensities by building a 3x3 kernel. This filter is helpful for improving visuals in graphics and creative rendering because it creates a relief-like appearance that mimics the lighting and shadowing of an item.

Median Filter: One image processing method for lowering noise in digital photos is the median filter. Every pixel is substituted with the neighborhood's median value. "Salt-and-pepper" noise may be effectively eliminated using this approach while maintaining the borders and features of the image. Applications such as picture denoising and medical imaging frequently employ median filters.

Box Blur: Box blur is an image processing technique that softens edges and reduces noise in images by using a straightforward averaging approach. It finds the average pixel value inside the kernel's area using a square or rectangular kernel. Compared to several other blur algorithms, box blur requires less computing power and is helpful for simple picture smoothing.

Bilateral Filter

An image may be smoothed while keeping its edges intact using the bilateral filter image processing technique. It controls the amount of smoothing by utilizing both spatial and intensity information. For a variety of applications, including tone mapping in high dynamic range (HDR) imaging and image denoising, the filter effectively eliminates noise and improves picture quality.

Mean Shift Filter

The mean shift filter is an image processing technique used in picture segmentation and object tracking. It computes the mean shift, a vector that shows the direction of the highest increase in pixel density, to group together related pixels. In computer vision, it is helpful for region-based segmentation and feature tracking.

Image Enhancement Techniques

Techniques for picture enhancement raise the caliber and aesthetic appeal of digital photos. These techniques consist of filtering, histogram equalization, and contrast stretching. Histogram equalization enhances overall contrast, filters bring out certain aspects of the image, and contrast enhancement modifies the dynamic range of the image. Computer vision, medical imaging, and photography all make extensive use of these approaches.

Histogram equalization

By dispersing pixel intensities, the image processing method known as histogram equalization improves contrast. It accomplishes a more equal and balanced distribution of intensity values over the whole grayscale range, improving the contrast between bright and dark regions. For a number of uses, such as satellite image processing and medical imaging, this technique is helpful in enhancing picture visibility and quality.

Contrast Stretching

An image enhancing method called contrast stretching broadens the digital picture's range of intensity values. By essentially extending the current pixel value range, it makes bright parts lighter and dark areas darker. For a variety of uses, including photography and medical imaging, this procedure improves picture contrast and visibility.

Sharpening Filter

A sharpening filter is a technique used in image processing that highlights tiny features and edges by amplifying pixel intensity variations. To highlight local contrast, it operates by removing a smoothed version of the picture from the original. In order to enhance the clarity and sharpness of images, this method is frequently applied in picture editing.

Edge Detection

An image processing method called edge detection highlights object borders or edges in pictures by spotting sudden variations in pixel intensity. It uses algorithms to identify gradients and highlight areas with notable intensity differences, such as the Sobel or Canny edge detectors. In computer vision applications, edge detection is essential for object recognition and picture segmentation.

Sepia Filter

A sepia filter is a type of photo effect that produces warm, brownish tones in images that are reminiscent of vintage photos. By lowering color saturation and moving colors toward brown and yellow tones, it changes color pictures. This filter, which is frequently employed for artistic or retro visual appeal, gives images a sentimental, vintage appearance.

Saturation Adjustment

An image editing method called saturation adjustment may be used to change the color vibrancy and intensity in a digital image. It lets users adjust how rich the color is in a picture overall. The visual effect of the image may be controlled by varying the saturation level, which increases or decreases color intensity.

Tonal Transformations

In image processing, tonal transformations alter an image's contrast and brightness. Methods such as tone mapping and gamma correction modify the correlation between pixel intensities. Gamma correction adjusts picture output to display device specifications, whereas tone mapping improves high dynamic range (HDR) image detail for more readable images. Images' overall tone quality can be adjusted with the help of these modifications.

Solarize transformation

An image processing technique called a solarize transformation partially reverses a picture's tonal range, producing a visually arresting, high-contrast image. It retains certain mid-tones while emphasizing areas of intense brightness and blackness. In graphic design and photography, this method is frequently employed to create creative or surreal visual effects.

Posterize transformation

An image processing method called posterize transformation lowers the quantity of different colors or tones in a picture. It achieves a simpler, poster-like look with noticeable, distinct color or tone steps by quantizing the image to a restricted color palette or tone levels. For stylized or graphic art effects, it's frequently employed.

Invert color transformation

An image processing technique called "invert color transformation" turns dark portions in a picture bright and vice versa by reversing the color values in the image. It produces an artistic or abstract visual impact by making a negative of the source image. This method is frequently applied to graphic design and photography for artistic or creative reasons.

Warm color transformation

Warm color transformation is an image processing technique that enhances the overall sensation of warmth in a picture by adding a warm, reddish or yellowish hue. By moving colors toward the warmer end of the spectrum, it alters the color balance. This method is applied to images and artwork to create a homey or nostalgic feel.

Cool color Transformation

An image may be made to appear colder and more peaceful by applying a cool, blue or greenish tint using the cool color alteration technique. It modifies color balance to move hues toward the colder end of the spectrum; it is frequently applied artistically or thematically in design, photography, and visual narrative.

Random colorization

An image processing technique called random colorization gives objects or areas in a picture arbitrary hue. This imaginative method gives images a whimsical or surreal quality that makes it popular in entertainment, design, and the arts. It's frequently employed to produce original, eye-catching effects and compositions.

Model Architectures

First one

1. Model Architecture: "mirnet" stands for "Multiple Intermediate Representations Network." It is an architecture designed for the task of enhancing low-light or dark images. The network architecture typically consists of multiple layers, including convolutional layers and other components like residual blocks or skip connections. These components help in learning and preserving important features while enhancing the image.

2. Pre-trained Model: The code loads a pre-trained "mirnet" model using the Hugging Face model hub. A pre-trained model is a neural network that has been trained on a large dataset to perform a specific task, which, in this case, is low-light image enhancement.

3. Input Preprocessing: The input image is opened using the Python Imaging Library (PIL) and converted to the RGB color format. It is then resized to a fixed size of 256x256 pixels. The pixel values are normalized to the [0, 1] range.

4. Enhancement Process: The pre-trained model takes the preprocessed image as input and performs image enhancement. The model has learned to adjust the pixel values to make the low-light image appear brighter and more visually appealing.

5. Output Post-processing: After enhancement, the output image is post-processed. The pixel values are scaled back to the [0, 255] range, and the data type is changed to an unsigned 8-bit integer format.

6. Visualization: The code uses Matplotlib to display both the original and enhanced images side by side, allowing for a visual comparison of the results.

The "mirnet" model is a deep learning architecture that has been trained to improve the quality of low-light images. It is a type of neural network used in computer vision tasks and image processing to enhance the visual quality of images, making them brighter and more suitable for human perception. The pre-trained model in the code has already learned how to perform this task effectively.

Second One.

The code you provided demonstrates the use of a pre-trained model for image stylization. Here's a description of the key components and the model used:

1. **TensorFlow and Dependencies**: The code utilizes TensorFlow, a popular deep learning framework, for image processing and manipulation. Additionally, it imports necessary libraries such as NumPy, PIL (Python Imaging Library), and Matplotlib for image handling and visualization.

2. **Content and Style Images**: The code loads two images - a content image and a style image. These images are used as input for the stylization process. The content image is a photo of a yellow Labrador, and the style image is an artwork by Vassily Kandinsky.

3. **Image Preprocessing**: The `load_and_resize_image` function reads and preprocesses the images. It reads image files, converts them to floating-point format, resizes them to a maximum dimension of 512 pixels while preserving the aspect ratio, and adds a batch dimension.

4. **Image Visualization**: The `imshow` function is used to display images with Matplotlib. It shows the content image, style image, and the stylized image side by side in a single figure.

5. **Image Stylization Model**: The code loads a pre-trained image stylization model from TensorFlow Hub using the `hub.load` function. The specific model used is 'arbitrary-image-stylization-v1-256/2' from the Google Magenta project. This model is capable of applying a given artistic style (in this case, the style image) to a content image.

6. **Stylization Process**: The `hub_model` is applied to the content and style images, and it generates a stylized image that combines the content of the Labrador image with the artistic style of the Kandinsky artwork. This stylized image is obtained by passing both the content and style images as input to the model.

7. **Display Results**: The code visualizes the content image, style image, and the resulting stylized image using Matplotlib, allowing you to view the content and style fusion.

In summary, the code showcases how to use a pre-trained model to perform image stylization, applying an artistic style to a given content image. It leverages TensorFlow and TensorFlow Hub for this task and provides a visual representation of the stylized output.