Introduction to image processing tools

Data is the most valuable resource businesses have in today's digital age, and a large portion of this data is made up of images. Data scientists can process these images and feed them into machine learning (ML) models to gain deep insights for a business.

Image processing is the process of transforming images into digital forms before performing special operations on them, which yields valuable information.

1.OpenCV

Topping our list is OpenCV, which is an open-source library that was developed and released by Intel in 2000. OpenCV is often deployed for computer vision tasks like face detection, object detection, face recognition, image segmentation, and much more.

Written in C++, OpenCV also comes with a Python wrapper and can be used alongside NumPy, SciPy, and Matplotlib. One of the best aspects of OpenCV is that the computer vision library is constantly evolving thanks to its many contributors on Github.

The image processing library provides access to over 2,500 state-of-the-art and classic algorithms. Users can use OpenCV to perform several specific tasks like removing red eyes and following eye movements.

Here are some of the main highlights of OpenCV:

- Used by major companies like IBM, Google, and Toyota
- Algorithmic efficiency
- Vast access to algorithms
- Multiple interfaces

2. Scikit-Image

Another top image processing library on the market is Scikit-Image, which is used for nearly every computer vision task. Scikit-Image is partly written in Cython, which is a programming language that is a superset of Python. This unique structure helps it achieve good performance.

Scikit-Image, which uses NumPy arrays as image objects, offers many different algorithms for segmentation, color space manipulation, geometric transformation, analysis, morphology, feature detection, and much more.

Here are some of the main highlights of Scikit-Image:

- Open source and easy to use
- Free with minimum legal and licensing restrictions
- Versatile

- Real-world applications like consumer behavior prediction

3. SciPy

Originally designed for mathematical and scientific computations, SciPy is also a top library for performing multi-dimensional image processing by importing the submodule scipy.ndimage. SciPy provides functions to operate on n-dimensional Numpy arrays.

This image processing library is another great option if you're looking for a wide range of applications like image segmentation, convolution, reading images, face detection, feature extraction, and more.

Here are some of the main highlights of Scipy:

- High-level commands and classes for visualizing and manipulating data
- Open source
- Interactive sessions with Python
- Classes, web and database routines for parallel programming

4. Mahotas

One more top image processing library in Python is Mahotas, which was originally designed for bioimage informatics. Mahotas enables developers to take advantage of advanced features like local binary patterns and haralick. It can compute 2D and 3D images through its mahotas.features.haralick module, and it extracts information from pictures to perform advanced image processing.

Mahotas has many popular functions such as Watershed, Convex points calculations, morphological processing, and template matching. There are over 100 functionalities for computer vision capabilities.

Here are some of the main highlights of Mahotas:

- Over 100 functionalities for computer vision
- Advanced features
- Computes 2D and 3D images
- Constantly adding new functionalities

5. Pillow/PIL

Another open-source library for image processing tasks, Pillow is an advanced version of PIL (Python Imaging Library). With Pillow, you can carry out many processes in image processing like point operations, filtering, and manipulating.

Pillow is one of the top libraries for handling images thanks to its support for a wide range of image formats. The image processing library is easy to use, making it one of the most common tools for data scientists who work with images.

Here are some of the main highlights of Pillow:

- Support for various image formats like JPEG and PNG
- Easy to use
- Various image processing methods

6. SimpleITK

SimpleITK works a little differently than the other image processing libraries on this list. Instead of considering images as arrays, SimpleITK considers them as a set of points on a physical region in space. In other words, it defines the region occupied by images as origin, size, spacing, and direction cosine matrix. This enables SimpleITK to effectively process images and support 2D, 3D, and 4D dimensions.

SimpleITK is often used for image segmentation and image registration, which is the process of overlaying two or more images.

Here are some of the main highlights of SimpleITK:

- Support for 2D and 3D images
- Advanced programming features that deliver performance, flexibility, and efficiency

- Image segmentation and image registration
- Considers images as set of points on physical region in space

7. Matplotlib

Matplotlib is another great option for an image processing library. It is especially useful as an image module for working with images in Python, and it includes two specific methods for reading and displaying images. Matplotlib is specialized in 2D plots of arrays as a multi-platform data visualization library on Numpy arrays.

The image processing library is usually used for 2D visualizations like scatter plots, histograms, and bar graphs, but it has proven to be useful for image processing by effectively pulling information out of an image. It's important to note that Matplotlib doesn't support all file formats.

Here are some of the main highlights of Matplotlib:

- Simple and easy to use
- Provides high-quality images and plots in various formats

- Open source
- Highly customizable

8. NumPy

While NumPy is an open-source Python library used for numerical analysis, it can also be used for image processing tasks like image cropping, manipulating pixels, masking of pixel values, and more. NumPy contains a matrix and multi-dimensional arrays as data structures.

NumPy can also be used to help with color reduction, binarization, paste with slice, positive or negative inversion, and many other functionalities. Images can also be considered as made up of arrays, which is what enables NumPy to perform different image processing tasks.

Here are some of the main highlights of NumPy:

- Compact data storage
- High-speed processing of arrays
- Helps with many functionalities

- Data compatibility with other libraries

9. Pgmagick

Nearing the end of our list is Pgmagick, which is another top Python library for image processing for the GraphicMagick library. The image processing tool has an impressive collection of tools and libraries that provide assistance in image editing and image manipulation.

Here are some of the main highlights of Pgmagick:

- Large collection of tools and libraries
- Image editing and image manipulation
- Supports many image formats
- Open source

10. SimpleCV

The last image processing library in Python on our list is SimpleCV, which is a popular open-source framework for creating computer vision applications with image processing.

SimpleCV has a readable interface for cameras, format conversion, image manipulation, feature extraction, and more.

The image processing library is popular among those looking to easily create computer vision tasks. It enables users to get access to high-powered computer vision libraries like OpenCV without needing to learn about file formats, bit depths, color spaces, buffer management, and more.

Here are some of the main highlights of SimpleCV:

- Open source
- Readable interface
- Easily create computer vision tasks
- Access to high-powered computer vision libraries