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# Medical image processing using python and open cv

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**Abstract.** This paper presents the implementation of the Python programming language and the Open CV library in medical image processing. Medical images play an important role in identifying diseases and detecting whether organs are functioning properly. Image processing related to medical images is an active research field where various techniques are used to facilitate diagnosis and various image processing techniques can be used. In this study, image processing was performed including image preprocessing, histogram equalization, smoothening, erosion, and dilation. The use of python was chosen because this programming language is open source with a lot of available resources. The open CV library is also available free of charge and provides tons of image processing functions. The software can also be installed in a small Raspberry Pi computer and low electrical power usage making it very suitable as an efficient resource of the medical image processing system.

## 1. Introduction

Image processing is image processing that aims to improve the quality of the image so that it is easily interpreted by humans or machines. Image processing techniques transform images into other images. So, the input is the image and the output is also an image, but the output image has better quality than the input image. There are two kinds of images namely continuous images and discrete images. Continuous images are generated from optical systems that receive analog signals, for example, the human eye and analog cameras. Discrete images are generated through the process of digitizing continuous images. Some optical systems are equipped with digitization functions so that they are able to produce discrete images, for example, digital cameras and scanners.

Medical image processing is similar in concept to biomedical signal processing in various dimensions. This includes analysis, improvement, and appearance [1,2,3]. Images captured through x-ray, ultrasound, MRI, nuclear medicine, and optical imaging technology. The purpose of this research is to do medical image processing with the help of the Open CV Python programming language Open CV library [4,5]. Medical imaging concentrates on taking pictures for diagnostic and therapeutic purposes. Snapshots of physiological and physiological processes in vivo can be collected through sophisticated sensors and computer technology. Medical imaging technology uses X-rays (CT scans), sounds (ultrasound), magnetism (MRI), radioactive drugs (nuclear medicine: SPECT, PET) or light (endoscopy, OCT) to assess the current condition of organs or tissues. and can monitor patients from time to time for diagnostic evaluations and treatments [6].

Python is a programming language that has an efficient high-level data structure and a simple but effective approach to object-oriented programming. High-level language means that the python programming language is close to or similar to everyday language, unlike machine language which is a series of binary codes. Python has advantages compared to other languages that already exist, including in terms of ease, ability, development, interaction with users, and the programming paradigm. Another advantage of python is that the python program can run on Windows and Linux operating systems without making changes. Python is claimed to be a language that



combines capabilities, capabilities, with very clear code syntax, and is equipped with large and comprehensive standard library functionality [4,5].

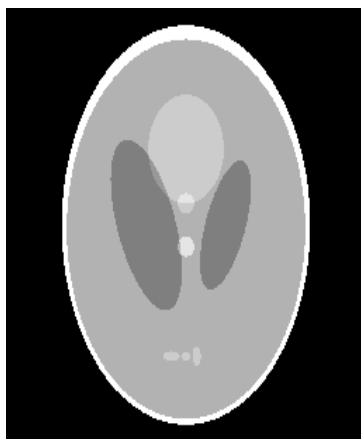
The open CV stands for Open Source Computer Vision Library which consists of more than 300 C functions [7]. An open CV can operate on Windows or Linux-based computers. Open CV-Library is a way of applying for the open-source vision community which is very helpful in the opportunity to update the application of computer vision in line with the growth of Personal Computer that continues to grow. This software provides a number of image processing functions, as well as image and pattern analysis functions. Some examples of applications from OpenCV are Object Identification, Segmentation, and Recognition such as detecting and recognize faces, identify objects, classify human actions in the video, track camera movements, track moving objects (Irianto, 2010). OpenCV is a library that is very well known in processing computer vision images. OpenCV is designed for real-time applications and has good functions for image/video. OpenCV is highly recommended for programmers who will dwell on the field of computer vision, because this library is able to create applications that are reliable, strong in the field of digital vision, and have capabilities similar to visual processing in humans.

## 2. Methods

In this project, we use an open computer vision library, OpenCV. OpenCV (Open Source Computer Vision Library) is an open-source computer library and machine learning software library. OpenCV was built to provide general infrastructure for computer vision applications and to accelerate the use of machine perception in commercial products. Being a BSD licensed product, OpenCV makes it easy for businesses to utilize and modify code. OpenCV has more than 2500 optimized algorithms, which include a comprehensive set of computer vision and advanced machine learning and machine algorithms. This algorithm can be used to detect and recognize faces, identify objects, classify human actions in video, track camera movements, track moving objects, extract 3D object models, generate 3D point clouds from stereo cameras, stitch images together to produce high-resolution images of entire scenes, find similar images from the image database, delete red eyes from pictures taken using flash, follow eye movements, recognize scenes and create markers to add them with augmented reality, etc. OpenCV has more than 47 thousand community users and the estimated number of downloads exceeds 7 million. Libraries are widely used in companies, research groups, and government agencies. In this project, we utilize OpenCV for medical image processing which includes operations on pixel intensity, filtering, side detection, and segmentation.

## 3. Result and Discussion

In this project, the image used as input to be processed is the Shepp-Logan phantom image. Shepp-Logan Phantom is a standard test image created by Larry Shepp and Benjamin F. Logan. This phantom functions as a human head model in the development and testing of image reconstruction algorithms. In taking the image, often underexposed or overexposed. The system we have developed can do the addition or reduction of the pixel intensity values so that it can turn a normal image into overexposed or underexposed and vice versa as in Figures 1.2 and 3.



**Figure 1.** Original Image



**Figure 2.** Over Exposed



**Figure 3.** Under Exposed

In taking images with the camera, noise always occurs which results in the image becoming not smooth. The system that we developed can filter so that the image becomes smooth as in Figure 4. A smooth image has a weakness that is a blur at the edges. So, it is necessary to sharpen the edge boundaries with a high-frequency filter as in Figure 5.

Edge detection is a medical image processing technique that is widely used for example to find out the contours of a network and to estimate tissue area. This system can do side detection as well as in Figure 6.



Figure 4. Smooth Image



Figure 5. Sharpen Image

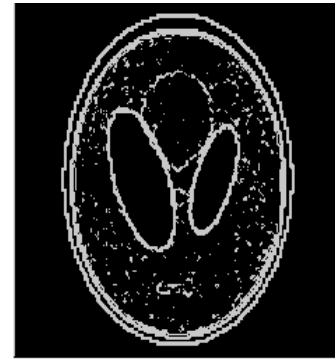


Figure 6. Edge Detection

Image segmentation is a process aimed at obtaining objects contained in images such as tumors in the brain. With multiple thresholding, it can be an object that has a certain gray level. Figure 7 is the result of segmentation on objects that have intensities between 150 to 200. Due to the effect of noise, the segmentation objects have holes and areas that are not objects have spots. This incident can be overcome by performing a dilation operation to patch holes and erosion surgery to remove spots as in Figures 8, 9 and 10.

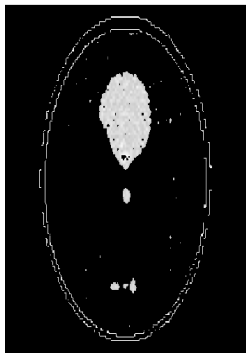


Figure 7. Segmentation



Figure 8. Binarization

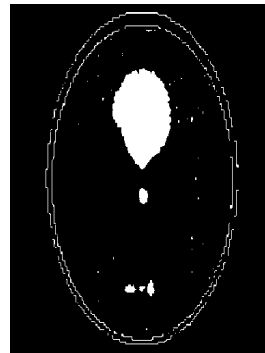


Figure 9. Dilation



Figure 10. Erosion

#### 4. Conclusion

From the project we are working on it can be concluded that the Python programming language and the OpenCV library can be used for medical image processing with very good results. Image processing operations such as image enhancement, noise removal, side detection, contouring, and segmentation can be done well. With its open-source nature, medical image processing can be done at a cheap price using Python and OpenCV.

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