CHAPTER 1

INTRODUCTION

The production of crystals in the urine induced by genetic predisposition distinguishes renal calculus, also known as kidney stone formation. Even though many people, including children, are impacted by kidney stones, the vast majority of cases go unnoticed unless there is severe abdominal pain an irregular urine colour, Furthermore, persons with kidney stones exhibit common symptoms such as fever, discomfort, and nausea, which might be mistaken for other illnesses. Kidney stone identification is critical, especially early on, In order to receive adequate medical treatment.

The presence of stones in the kidney reduces renal functionality and can potentially cause dilatation. People who have never been diagnosed with this ailment will be affected by the severity of chronic kidney disease(CKD) chronic renal failure(CRF).Because of its asymptomatic character, it is frequently detected during medical examinations for other diseases such as cardiovascular disease(CVD), diabetes and other medical problems that predispose to the urogenital apparatus. Days, computer-assisted tools like ultrasound imaging, computed tomography (CT) and X rays gives the most accurate diagnostic tools for kidney stone screening and diagnosis. The main objective of this project is to detect the kidney stone from a digital ultrasound image of the kidney by performing various image processing techniques. But the image produced by the ultrasound techniques is not suitable for further processing due to low contrast and the presence of speckle noise. Hence, the study also examined the effectiveness of various diagnosis techniques on the ultrasound image to enhance the quality of the image Further, enhanced ultrasound image will be used to locate the exact position of the stone. The main motive of this project was to develop an elementary and straightforward technique to find the stone in the kidney This detection can be done in any available PC's and hence any normal being can check an ultrasound for a kidney stone and dissolve it in the stone.

1.1 Image Processing

Image processing is the field of study and application that deals with modifying and analyzing digital images using computer algorithms. The goal of image processing is to enhance the visual quality of images, extract useful information, and make images suitable for further analysis or interpretation. Image processing is a way to convert an image to a digital aspect and perform certain functions on it, in order to get an enhanced image or extract other useful information from it. It is a type of signal time when the input is an image, such as a video frame or image and output can be an image or features associated with that image. Usually, the AWS Image Processing system includes treating images as two equal symbols while using the set methods used. It is one of the fastest growing technologies today, with its use in various business sectors. Graphic Design forms the core of the research space within the engineering and computer science industry as well.

1.2 OpenCV Concept

OpenCV (Open-Source Computer Vision) is a powerful and widely-used library for image processing and computer vision tasks. It provides a comprehensive set of functions and tools that facilitate the development of applications dealing with images and videos. OpenCV is a huge open-source library for computer vision, machine learning, and image processing. Now, it plays a major role in real-time operation which is very important in today's systems. By using it, one can process images and videos to identify objects, faces, or even the handwriting of a human. While taking photographs is as simple as pressing a button, processing and improving those images sometimes takes more than a few lines of code. That's where image processing libraries like OpenCV come into play. OpenCV is a popular open-source package that covers a wide range of image processing and computer vision capabilities and methods. It supports multiple programming languages including Python, C++, and Java. OpenCV is highly tuned for real-time applications and has a wide range of capabilities. When it is integrated with various libraries, such as NumPy, python is capable of processing the OpenCV array structure for analysis. To Identify an image pattern and its various features we use vector space and perform mathematical operations on these features.

1.3 Problem Statement

Kidney-stones can be a life-threatening situation. Therefore, timely diagnosis is very essential. To ensure the efficacy of surgical operations, it is necessary to precisely diagnose kidney stones. Speckle noise and poor contrast in ultrasound pictures of the kidney make it difficult to detect stones. As a result, doctors may find it tough and confusing to recognize tiny kidney stones and their nature. To solve this problem, an image processing-based detection technique is proposed to determine the exact location of the stones.

1.4 Objective of the Project

Kidney stones is difficult to track early because of hidden symptoms. There is a huge burden on patients and the resilience system due to delays in diagnosis. The problem of kidney stone detection has encouraged researchers to expand their research in order to track and detect this problem at an early stage for the people with kidney stones and medical treatment should be given on time to avoid any further complications. We have used Ultrasound images to detect the kidney stones and applied techniques to predict accurate results. The reason why we collected the dataset of ultrasound images rather than CT scan images(which is widely used in the healthcare domain to predict results) is that we want to create an user friendly project which can be further implemented and can be used in the daily life by the healthcare system to generate and track the accuracy of the results within the short spare of time and further creating an ease to both healthcare system and to the common people with the disease.

CHAPTER 2

LITERATURE SURVEY

Sharma et al., 2021: Proposed a deep learning-based model using CT scan images for kidney stone detection. The system employed CNNs for feature extraction and classification, achieving high detection accuracy and Kaur and Singh, 2020: Developed an image processing pipeline for stone detection using ultrasound images. Preprocessing included noise removal using median filtering, followed by segmentation using active contour models.

Patel et al., 2019: Focused on reducing false positives in ultrasound images using machine learning. The study combined edge detection with morphological operations for improved precision and Ahmed et al., 2018: Suggested a hybrid model that integrates CT and ultrasound data. Feature fusion improved the sensitivity and specificity of kidney stone detection.

Huang et al., 2017: Applied 3D image processing on CT images to detect and measure kidney stones. The method included surface rendering and volume estimation for precise diagnosis.

Kidney stone detection in a human body is tedious task, as if wrongly detected this can lead to life threat. So in order to eliminate or reduce inaccurate detection of kidney stones many of the researchers have given their contribution by providing efficient kidney stone detection algorithms. This section provides a detailed overview of various existing kidney stone detection techniques using various images The automation of kidney stone detection can reduce or approximately eliminate manual erroneous detection.

This help in better and accurate cure of the problem and can save human lives. Thus it has a direct impact on the society. Malala et al. [6] investigated a c-arm tomographic technique in their paper to develop three dimensional structure of kidney, The result of their experiments showed the ability to develop volume information for kidney stone detection but computerized Tomography (CT) scans of the kidney have greater exposure to radiations than the regular x-ray radiations.

The result of their paper shows almost 90% of urethral stones as dark and obscure. Therefore, the disadvantage is that precise and accurate detection is limited. Furthermore, uric acid stones could not be observed and smaller stones are out of the field of view. Hence kidney stone detection is done in an improved method by using Doppler imaging sequence by Cunitz et al.

This paper quotes that ultrasound is much better than computed Tomography . Sun et al. designed a rotational sono-probe that could take sonographic images of four equally separated angles with respect to an axis that is fixed and rotating. Calculation of renal volume manually time consuming and unreliable. Their method is performed by minimizing some energy functions. Therefore, their automated method of calculating renal stone is precise and accurate as compared to that done manually. This three dimensional analysis is further used by Marsousi et al. [10] to improve kidney stone detection using automated methods.

CHAPTER 3

SYSTEM MODEL

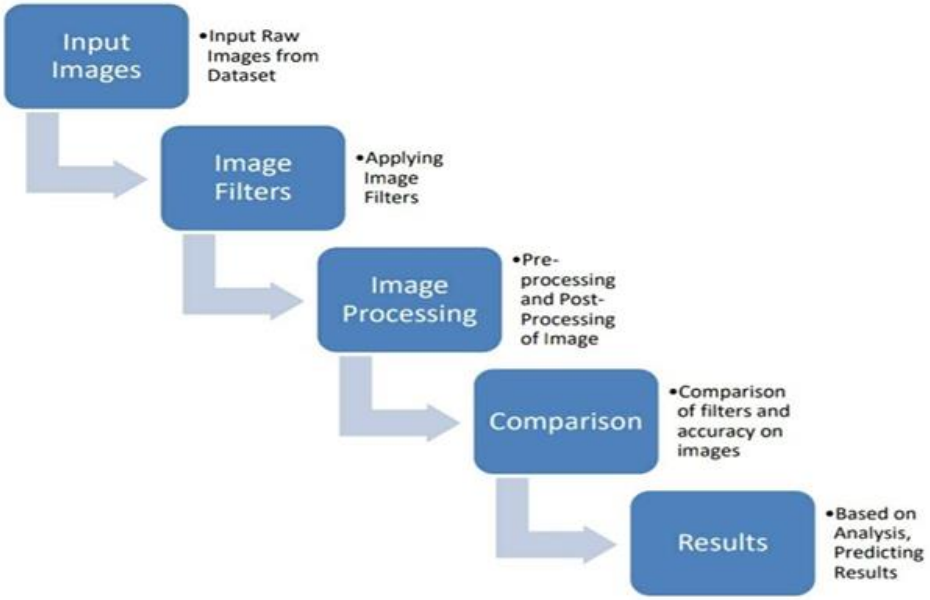

Figure 3.1: Process of image processing

The above fig 3.1 shows, the An image processor does the functions of image acquisition, storage, preprocessing, segmentation, representation, recognition and interpretation and finally displays or records the resulting image. The following block diagram gives the fundamental sequence involved in an image processing system. As detailed in the diagram, the first step in the process is inputing the images and input ram images from Dataset. The next step is the preprocessing step image filters by applying image filters to it . Image processing typically deals with enhancing an image into its constituent parts or objects. Then their will be comparison of filters and accuracy on images tales place at last result should be based on analysis, predicting results.

CHAPTER 4

REQUIREMENT SPECIFICATION

The Matlab has been programmed in C or C++. It makes use of OpenCV library package for Detection of Kidney Stone. This is a subroutine library for Detection of Kidney Stone.

4.1 Software Requirements

- Software : Matlab
- OpenCV Package : OpenCV
- Editor : Matlab
- Language : C++

4.2 Hardware Requirements

- Ram : 8GB or above
- Hard Disk : 2GB free space
- Display : Desktop
- Processor : ISP,DSP
- Input Device : Keyboard & Mouse
- Output Device : Monitor

CHAPTER 5

SYSTEM DESIGN

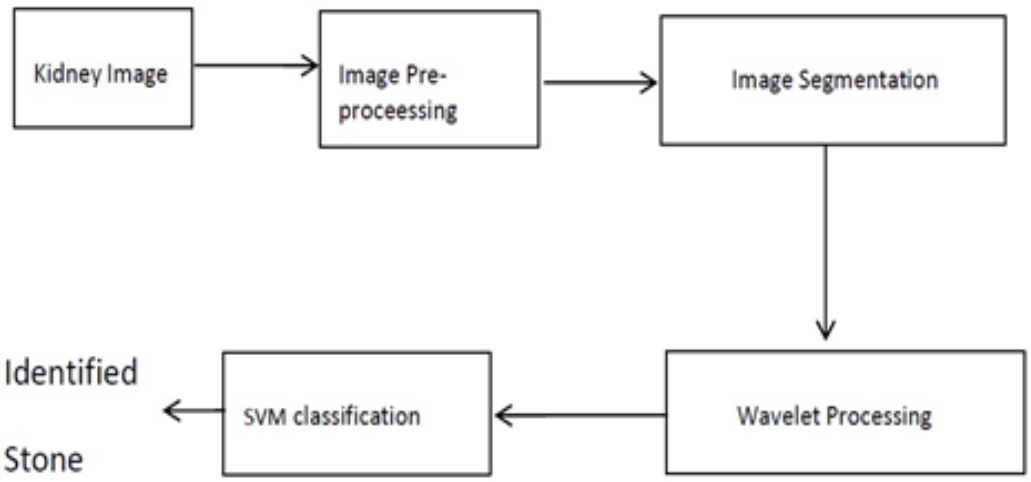

Figure 5.1: Process of Finding stone

Image Preprocessing: Before detecting kidney stones, the images obtained from various scanning methods need preprocessing to enhance their quality and reduce noise. MATLAB offers a range of preprocessing techniques such as noise reduction filters, contrast enhancement, and image sharpening. These methods help in improving the clarity and visibility of kidney stones in the images.

Segmentation: Segmentation is a crucial step where MATLAB algorithms delineate the regions of interest (kidney stones) from the surrounding tissues or structures in the image Various segmentation techniques like thresholding, edge detection, and region-based methods are employed to isolate and highlight potential stone formations accurately.

Wavelet Processing: Once the stones are segmented, MATLAB algorithms extract specific features such as size, shape, texture, and density of the stones. These features aid in characterizing the stones and differentiating them from normal anatomical structures or artifacts present in the image.

Classification and Detection: Utilizing machine learning and pattern recognition algorithms within MATLAB, the extracted features are used to classify and detect the presence of kidney stones. Supervised learning techniques like support vector machines (SVM), neural networkor decision trees can be trained on labeled data to create robust models capable of accurately identifying stones.

Visualization and Reporting: MATLAB provides tools for visualizing the detected kidney stones, displaying their location, size, and other relevant information. This visualization aids healthcare professionals in better understanding the results and making informed decisions regarding the patient's treatment plan

CHAPTER 6

IMPLEMENTATION

Built-In-Functions

Matlab is an interactive system whose basic data element is an array that does not require dimensioning. This allows you solve many technical computing problems, especially those with matrix and vector formulations, in a fraction of the time it would take to write a program in a scalar noninteractive language such as C. The name MATLAB stands for matrix laboratory. MATLAB was originally written to provide easy access to matrix software developed by the LINPACK and EISPACK projects, which together represent the state-of-the-art in software for matrix computation. MATLAB has evolved over a period of years with input from many users. In university environments, it is the standard instructional tool for introductory and advanced courses in mathematics, engineering, and science. In industry. MATLAB is the tool of choice for high-productivity research, development, and analysis.

OpenCV

OpenCV (Open Source Computer Vision Library) is one of the most widely used libraries in computer programming. OpenCV-Python is an OpenCV Python API. OpenCV-Python is not only running, because the background has a code written in C / C ++, but it is also easy to extract and distribute (due to Python folding in the front). This makes it a good decision to make computer vision programs more robust. response to a specific type of event.

CHAPTER 7

RESULTS

7.1 Kidney with Stone

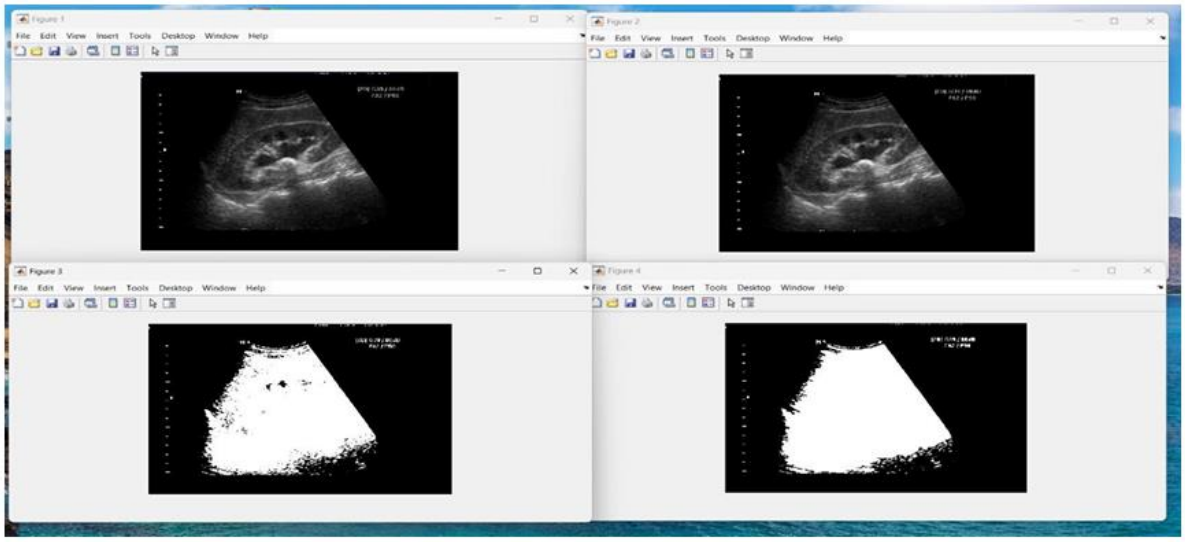

Figure 7.1: Starting stage of kidney stone

- In this fig 7.1 will shows Starting Stage of Kidney.

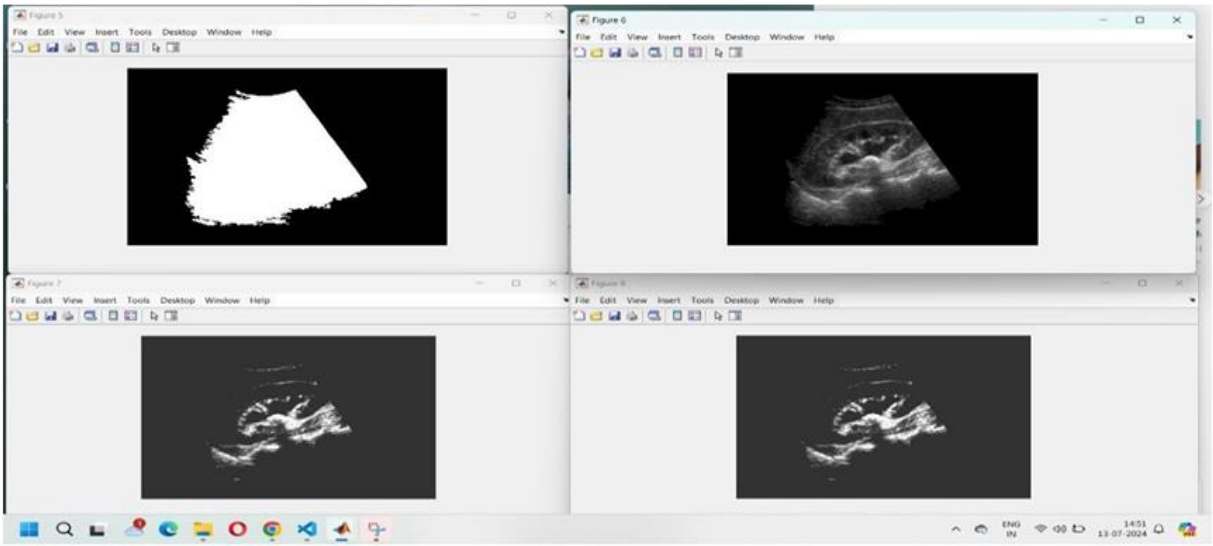

Figure 7.2: Scanning of Kidney Stone

- In this fig 7.2 will show Segmentation of Kidney Stone.

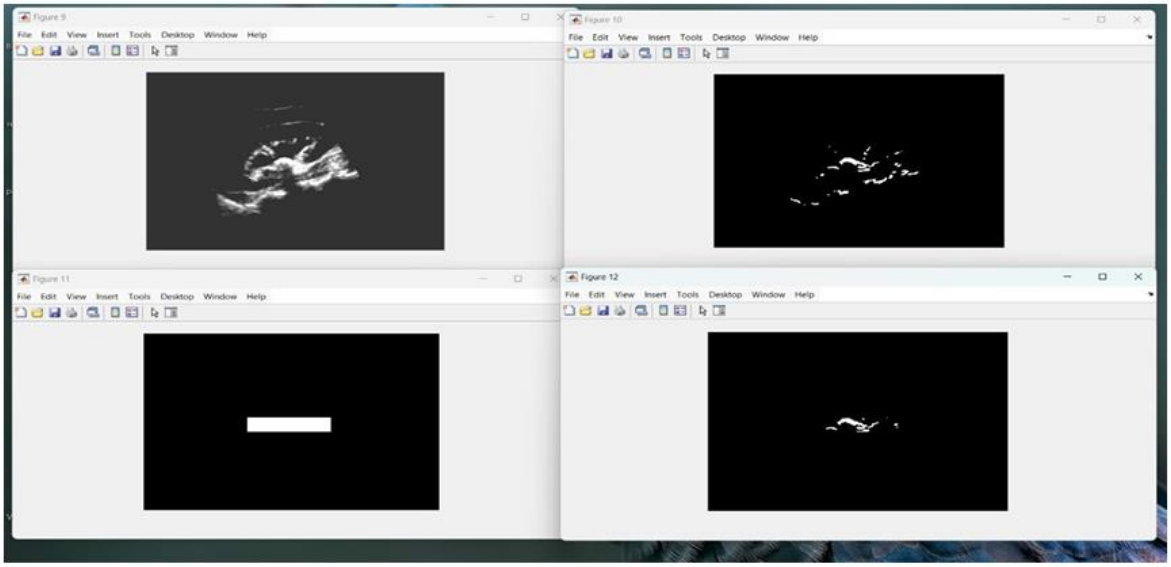

Figure 7.3: Detection of Kidney with Stone

- In this fig 7.3 it will detect the kidney with stone.

7.2 Kidney without Stone

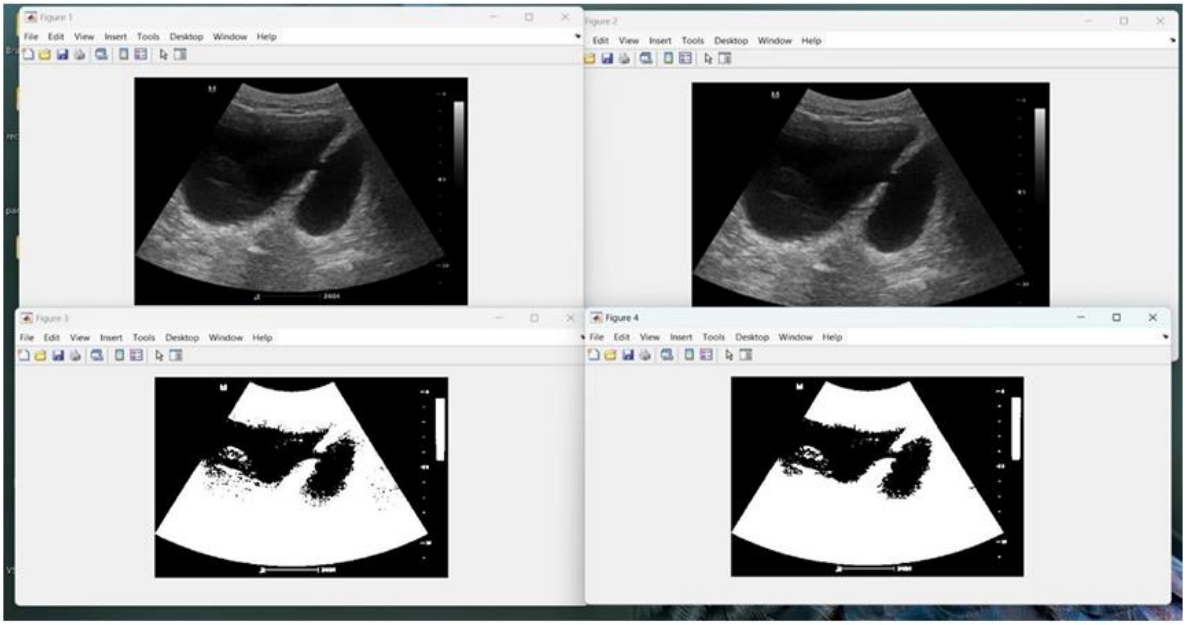

Figure 7.4: Starting Stage of Kidney

- In this fig 7.4 it will show the Starting stage of Kidney.

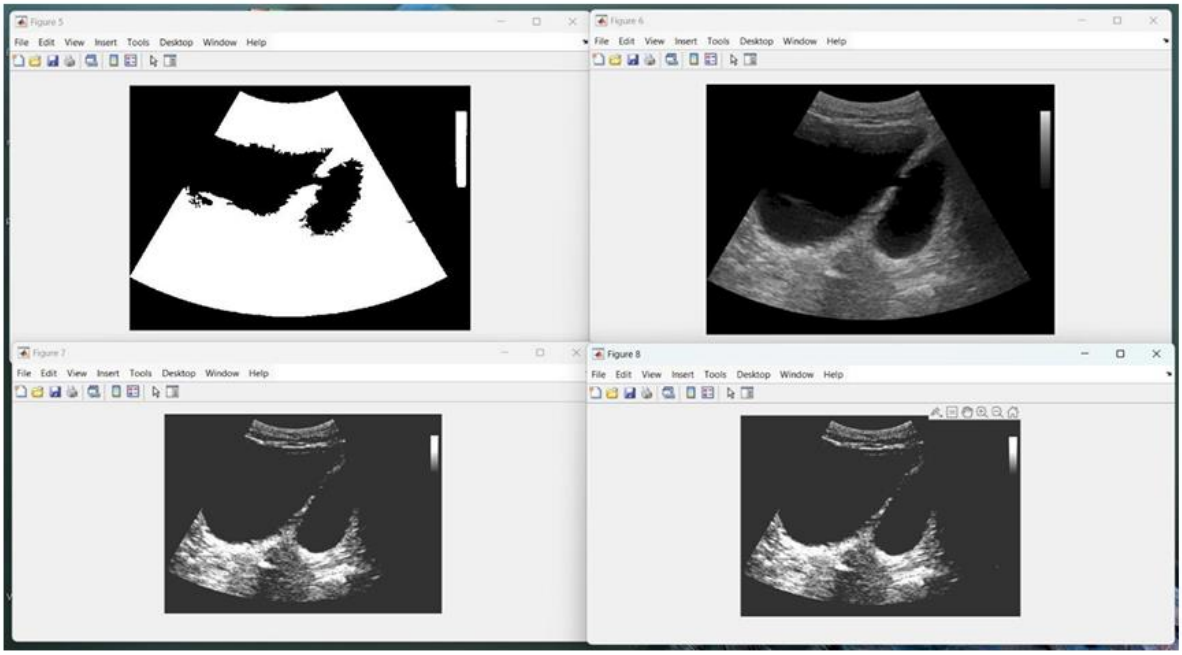

Figure 7.5: Recognition of Kidney Stone

- In this fig 7.5 it will show recognition of Kidney Stone.

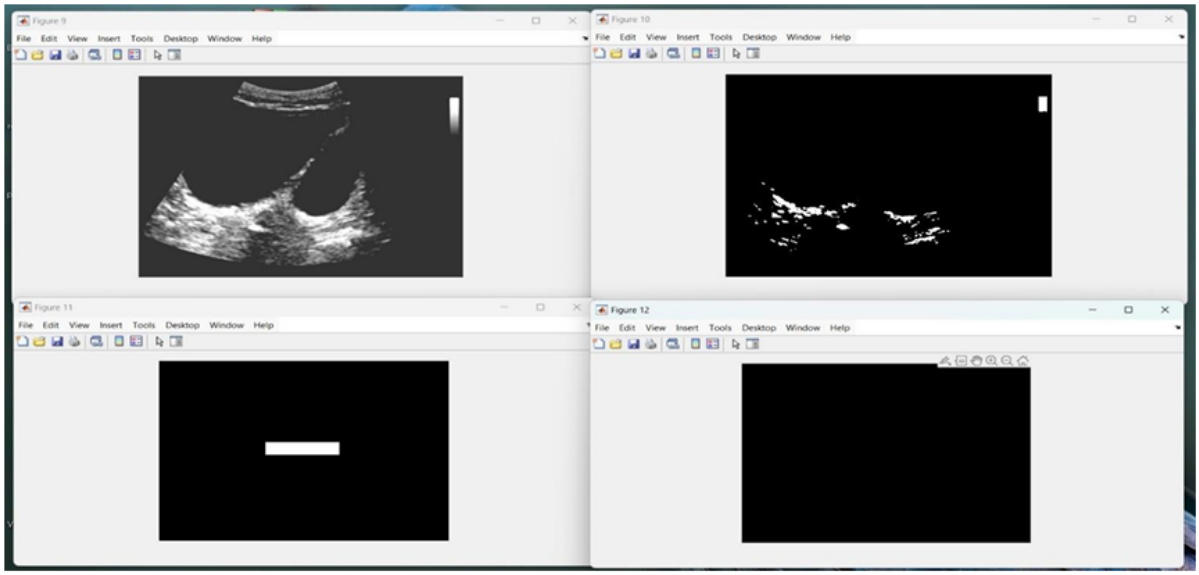

Figure 7.6: Detection of Kidney without Stone

- In this fig 7.6 it will show detection of Kidney without Stone.