Chapter 61
Advanced Object Detection in Bio-Medical X-Ray Images for Anomaly Detection and Recognition

Garv Modwel
https://orcid.org/0000-0001-6370-1670
Amity University, India

Anu Mehra
Amity University, India

Nitin Rakesh
Sharda University, India

K. K. Mishra
MNNIT Allhabad, India

ABSTRACT

The human vision system is mimicked in the format of videos and images in the area of computer vision. As humans can process their memories, likewise video and images can be processed and perceptive with the help of computer vision technology. There is a broad range of fields that have great speculation and concepts building in the area of application of computer vision, which includes automobile, biomedical, space research, etc. The case study in this manuscript enlightens one about the innovation and future scope possibilities that can start a new era in the biomedical image-processing sector. A pre-surgical investigation can be perused with the help of the proposed technology that will enable the doctors to analyses the situations with deeper insight. There are different types of biomedical imaging such as magnetic resonance imaging (MRI), computerized tomographic (CT) scan, x-ray imaging. The focused arena of the proposed research is x-ray imaging in this subset. As it is always error-prone to do an eyeball check for a human when it comes to the detailing. The same applied to doctors. Subsequently, they need different equipment for related technologies. The methodology proposed in this manuscript analyses the details that may be missed by an expert doctor. The input to the algorithm is the image in the format of x-ray imaging; eventually, the output of the process is a label on the corresponding objects in the test image. The tool used in the process also mimics the human brain neuron system. The proposed method uses a convolutional neural network to decide on the labels on the objects for which it interprets the image. After some pre-processing the x-ray images, the neural network receives the input to achieve an efficient performance. The result analysis is done that gives a considerable performance in terms of confusion factor that is represented in terms of percentage. At the end of the narration of the manuscript, future possibilities are being traces out to the limelight to conduct further research.

DOI: 10.4018/978-1-6684-7544-7.ch061

INTRODUCTION AND LITERATURE REVIEW

Medical technology is growing with improved technological advancement, driving to an advanced level of treatment and diagnostic in the twenty-first century. Day to day our food behavior is changing. The human body meets an enormous amount of chemical substances. This is resulting in different categories of infections, diseases, and syndromes. The current era demands to develop treatments that are efficient enough. However, efficiency is not only the key when it comes to the time constraints for the treatment. When technology fits properly into the medical sector, it can lead to an optimal solution for medical treatment.

In ancient days' technology was not much developed to detect different happenings in the human body with the improvement of technology now a day we are capable enough to reproduce an imagery system in different patterns. There are different types of imagery system that are MRI imaging, CT scan, X-Ray imaging, ultra-sonic imaging. The proposed methodology deals with the development of object detection techniques in X-Ray imaging.

X-ray is the light spectrums that has wavelength ranging from 0.01 to 10 nanometer and corresponding frequency range varies from $3*10^{16}$ to $3*10^{19}$ HZ. The property of the light is such that it passes through less dense material and obstructed through highly dense materials. The dense material from which the X-Ray is being reflected is captured in the sensors to form the corresponding image of the object. This principle of an X-Ray is the feature that drives this research in this manuscript. When patience is subject to the X-ray bone reflects the light that is sensed by the sensor. In the same way if the body contains a metallic part or any tumor that is, growing inside the body also shows the same characteristics as these are also dense objects. The denser the object the more it will reflect the X-Ray beam. The objects that are reflecting the X-Ray is represented as a light spot in the X-Ray imaging. Object through which the light passes is represented as a dark spot.

CT scan is also a 3-dimensional extension of X-Ray imaging. The patience is allowed to lay down on a bed and the complete body is scanned 360 degrees to generate the 3-dimensional image. These three-dimensional images are generated through digital geometry processing which combines the angle at which the images are taken and the corresponding images to form a 3-dimensional imaging.

When it comes to X-Ray image, it is very difficult to detect small objects with an eyeball check. Sometimes doctors need to attain many patients so they have very little time for a particular patience. The focus of the research in this manuscript is to detect important anomaly in X-Ray imaging. This will result in less time consumption in the detection of metallic objects and tumors in the human body. This will also enable the doctors to cure and advise many patients compared to an eyeball check on the X-Ray imaging alone. A small mistake in the detection of these objects may cause a serious issue to the patience's body we cannot rely on the doctor eyeball check. In some cases, it is hard to detect minor abnormalities. As the computer, vision technique uses pixel variation technique it can go to the pixel level of the image and analyze it. This is very difficult for an experienced doctor even. Suppose there is more than one part of the body that is infected by, a metal then even a minor variation is being detected a highlighted. Subsequently, different doctors to do a root cause analysis of the anomaly can analyze these highlighted areas.

When body cells start growing at a faster rate compared to their usual metabolic performance the density of cells increases. This is the main reason behind the tumor. The early stage of cancer starts with tumors. If somehow we able to detect there is a tumor present in a patience body at this stage it can be detected and can be cured. About X-Ray as tumors are very dense rays cannot pass through. This results