Chapter 3
Deep Learning Techniques for Biomedical Image Analysis in Healthcare

Sivakami A.
https://orcid.org/0000-0001-5075-6365
Bharat Institute of Engineering and Technology, India

Balamurugan K. S.
Bharat Institute of Engineering and Technology, India

Bagyalakshmi Shanmugam
Sri Ramakrishna Institute of Technology, India

Sudhagar Pitchaimuthu
Swansea University, UK

ABSTRACT

Biomedical image analysis is very relevant to public health and welfare. Deep learning is quickly growing and has shown enhanced performance in medical applications. It has also been widely extended in academia and industry. The utilization of various deep learning methods on medical imaging endeavours to create systems that can help in the identification of disease and the automation of interpreting biomedical images to help treatment planning. New advancements in machine learning are primarily about deep learning employed for identifying, classifying, and quantifying patterns in images in the medical field. Deep learning, a more precise convolutional neural network has given excellent performance over machine learning in solving visual problems. This chapter summarizes a review of different deep learning techniques used and how they are applied in medical image interpretation and future directions.

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INTRODUCTION

In modern years, Deep Learning (DL) (LeCun et al, 2015) has become a large influence on many fields in science and technology. It leads with advances and breakthroughs in audio recognition (Dahl etal,2012) and image recognition (Krishzvesky et al, 2012), it can prepare artificial agents that defeat human players in Go (Silver metal, 2016) and ATARI games (Mnih etal, 2015), and it produces artistic new images (Mordvintsev et al., 2015; Tan etal.,2017) and music (Briot etal.,2017). The final goal is to produce systems that can help in the diagnosis of disease, to automate the difficult and time-consuming tasks of reading and examining medical images, and to promote treatment planning. We require to be capable to employ machine learning methods to automatically distribute medical images (for example, breast x-ray or biopsy images) as healthy (non-cancerous) or not healthy (cancerous). (M H Hesamian et al, 2019). The diagnosis and treatment decisions can be made based on what is learned about the unhealthy images. The goal is that automatic classification and segmentation can be accomplished using distinct and innovative deep learning techniques, and extraordinary levels of accuracy can be accomplished (Shen et al., 2017). The diagnosis of particular image depends on both image acquisition and image interpretation. Image acquisition devices have been developed upto certain extent over the recent few years for getting the high resolution radiological images (X-Ray, CT and MRI scans, etc.) . However, we started to attain the more benefits for automated image interpretation (L B Curial et al, 2019). Computer vision activates the machine learning techniques to detect the image pattern as input and gives the effect in the form of size, colour size etc.Due to the extensive variety of different patient data, conventional learning methods are not guaranteed in the future. Now deep learning has much attention in all the fields especially in medicine. It is supposed to hold a $300 million medical imaging market in future. In 2021, deep learning will show rapid deveolpment in medicine than the other industry. It is the most powerful complex method of supervised learning. DL is particularly used for investigating the psychiatric and neurological disorders noncompulsory of manual feature selection.

DL technology implemented in medical imaging may enhance and increase innovative technology that has observed because of the digital imaging arrived. Over 15 years, most researchers understand that the applications of DL will bring over humans, and not only the diagnosis will be done by intelligent machines but will also help to prognosticate disease, command medicine and control of the disease treatment. The deep learning is transformed in several sectors such as ophthalmology, pathology, cancer detection, radiology etc. Ophthalmology is the first area to be transformed in health care, however, other sectors such as pathology and a cancer diagnosis has gained recognition and sufficient application with proper efficiency at present.

Medical image segmentation, recognizing and resolution of organs from different medical images produced by modern image techniques such as X-ray, ultrasound, CT or MRI. The images produced by imaging techniques has to give critical information about the shapes and volumes of the human organs. Several researchers have been reported (Suzuki etal., 2017; Lakhani et al., 2018; Kim etal., 2018) that the huge automated segmentation systems been developed by utilizing of existing DL methods. More advanced systems were built on common methods like mathematical methods and edge detection filters . Machine learning approaches towards image features have become more influential technique over others for a longer period of time. Due to hardware development, DL methods came into the picture and begun for giving the practical exhibition of image processing tasks in the field of academia and industry. The ability of deep learning procedures has started to good opportunity for image segmentation, and inappropriate for medical image segmentation. DL techniques have earned much attention in