AUTOMATIC SEGMENTATION OF LUMBAR INTERVERTEBRAL DISCS FROM THE AXIAL VIEW

Yuwin Amantha Siriwardhane

A dissertation submitted in partial fulfilment of the requirements for the
Bachelor of Science (Honours) degree in Computer Science

Department of Computing

Informatics Institute of Technology, Sri Lanka
in collaboration with
University of Westminster, UK

2021

Abstract

Statistics have stated out that more than 60% of people have experienced a lower back pain at some point in their life. Disc herniation is one of the greatest contributors towards lower back pain and more than 95% herniated discs occurs in the lumbar spine. During clinical process the radiologists have to examine the MRI to diagnose a disc herniation and it is not just one case where the radiologists have to deal with, there might be multiple cases to be examined and the doctors are left with cogitating and envisaging. Segmentation of medical images will be really useful for the diagnosis process of spine pathologies, studies of anatomical structures, for surgical intervention and for evaluation of various therapies but manual segmentation of medical images by the experts will cost a lot of time, effort and discipline.

This dissertation is a result of the project on building an automatic semantic segmentation system. These models are built and embedded into computer aided systems to automate the process of segmentation without the human intervention and to identify minor alterations through pixel level where the human eye is not capable of detecting. The utilized dataset for this project contains 1545 slices of MRI images of the intervertebral disc from the axial view along with the annotated labels by the expert radiologists. A series of 2D convolutional neural network was used with the UNet architecture to achieve the semantic segmentation process. The segmentations are evaluated using the dice coefficient and the Jaccard index.

This system works only for the intervertebral discs from the axial view and its results are up to the standards. When compared to existing systems, the segmentation process is performed equally or better and the user interaction of this system is facilitated through a web application embedded with other features.

Keywords: Image Segmentation, Semantic Segmentation, Edge Detection, Convolutional Neural Networks, Lumbar Disc Herniation, MRI