Automatic reporting of Lumbar Magnetic Resonance Imaging in patients with low back pain

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Introduction: Chronic Lower Back Pain (CLBP) is one of the major types of pain that is affecting many people around the world. It is estimated that 28.1% of US adults suffer from this illness and 2.5 million of UK population experience this type of pain every day. Currently the diagnostic imaging of the lower back pain is mainly done by a visual observation and analysis of the lumbar spine MRI images by radiologists and clinicians and this process could take up much of their time and effort. In addition, not all clinicians who see these images could interpret them, these facts, therefore, rationalize the need for a new approach to increase the efficiency and effectiveness of the diagnostic imaging reporting.

Material and Methods: We are proposing to develop a new methodology to automatically aid clinicians in performing diagnosis of CLBP. Our approach will be based on the current accepted medical practice of manual inspection the MRI scans of patients' lumbar spine. The latter is done through visual observation and analysis of specific slices in both axial and sagittal views of the lumbar spine MRI. To detect lumbar spinal stenosis and disc herniation, the clinicians locate the boundaries of the different parts of the lumbar spine on the MRI image. They then identify the distances between them.

Our proposed methodology will capture and model these processes as algorithms. It starts with identifying slices in a lumbar spine MRI that are useful and necessary for the detection process. These slices are 2D at certain locations and orientations. The images will be then divided spatially into separate regions, each related to a specific organ by performing image segmentation.

We developed a patch-based classification neural network consisting of convolutional and fully connected layers to classify and label pixels in the selected MRI slices. The classifier is trained using overlapping patches of axial-view T2-weighted MRI images of the bottom three intervertebral discs.

Results: The results of the computer-aided MRI reporting are highly sensitive and correlate very well with the human radiologist reporting of the images.

Conclusion: Computer-aided reporting of lumbar spine MRI scans is a reliable method and could well reduce the cost and time needed to report these images.

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