ECE 9202 - Advanced Image Processing Project Proposal

Amina Tabassum - 251390976
atabass4@uwo.ca

Thisali - 251469334
tsenarat@uwo.ca

Xiang Li - 251130633
xli2824@uwo.ca

Jan 31st, 2025

1 Bone Abnormality Detection Using Deep Learning

Musculoskeletal (MSK) disorders affect more than 1.7 billion people worldwide and are one of the leading causes of chronic pain and disability [1]. The detection and diagnosis of MSK disorders are important parts of orthopedic practice. However, traditional practices rely on manual interpretation that not only requires expert intervention but is also time-consuming and subject to variability among radiologists. To address this limitation, we propose a unique approach to automate the process by employing deep learning algorithms. Our project will focus on identifying bone abnormalities from MSK radiographs.

The Musculoskeletal Radiograph (MURA) dataset (Stanford AIMI MURA dataset) will be used in this project. It is a large collection of radiographic images used for detecting bone abnormalities. It includes 40,561 images from 14,863 studies, each labeled as either normal or abnormal by radiologists. The dataset includes images of seven upper extremities: wrist, shoulder, hand, finger, forearm, elbow, and humerus.

In order to develop a robust algorithm for detecting bone abnormalities, the dataset will be pre-processed using normalization, noise reduction, and image enhancement techniques. Key points will be extracted using algorithms such as SIFT or ORB for both normal and abnormal images [2]. This will be followed by matching key points and estimating the transformation matrix to align the normal image with the abnormal image. The differences between aligned images will be used to identify and label regions of abnormality. The registration accuracy will be evaluated using metrics such as mean squared error. After annotating the abnormal regions, we will augment the dataset to avoid under-fitting. This will be followed by using transfer learning techniques such as ResNet, AlexNet, and contrastive learning to train models and test these models on a validation set.

The proposed study aims to automate the detection of bone abnormalities and hence assist radiologists in making more accurate diagnoses.

References

[1] L. M. Waddell *et al.*, "Responsiveness of subjective and objective measures of pain and function following operative interventions for musculoskeletal conditions: A narrative review," *Arthritis care & research*, vol. 76, no. 6, pp. 882–888, 2024.

[2] P. Rajpurkar *et al.*, "Mura: Large dataset for abnormality detection in musculoskeletal radiographs," 2017.