AI-DRIVEN DETECTION OF HIP AND PELVIC FRACTURES IN X-RAY IMAGING

Hip and pelvic fractures involving the neck of the femur, intertrochanteric region, and pelvic ring are significant health issues. Such fractures cause severe pain, limited mobility, and complications like non-union or avascular necrosis, requiring prompt and precise diagnosis for effective treatment. The application of AI, especially deep learning models, shows promise in automating fracture detection, improving diagnostic accuracy, and streamlining workflows. This study aims to develop and evaluate AI solutions based on deep learning to automate the detection and classification of hip and pelvis fractures in X-ray images, using transfer learning to provide fast, accurate diagnoses and support treatment planning. Nearly 1000 X-ray images from Sri Lankan hospitals (2022-2023) were labelled into five categories: non-fractures, non-displaced incomplete fractures, non-displaced complete fractures, completely displaced complete fractures, and incompletely displaced complete fractures. Preprocessing and augmentation techniques were applied to diversify the datasets. The data was split into training (70%), testing (15%), and validation (15%) sets, with pre-trained deep learning models including CNN, InceptionV3, ResNet50, ResNet101, MobileNet, EfficientNetB0, EfficientNetV2, and Xception. ResNet101 performed the best, achieving an accuracy of 0.8000 and precision of 0.8179, followed by ResNet50 (0.7786, 0.7298) and EfficientNetV2 (0.7500, 0.6678). The results indicate that these deep learning models are capable of classifying complex fracture patterns. The AI-based algorithms enhance hip and pelvic fracture detection and classification, with a testing accuracy of 0.8000 in ResNet101, marking significant progress toward clinical application. Future research may include multi-modality imaging (e.g., CT or MRI), generative adversarial networks (GANs) for data augmentation, and advanced ensemble techniques.

Keywords: Deep learning models, Hip and pelvic fractures, RestNet101, Sri Lanka dataset, X-ray images