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AI IN BIOMEDICAL TRACK ENSEMBLE DEEP LEARNING APPROACHES FOR MULTICLASS CLASSIFICATION OF HIP REGION FRACTURES IN X-RAY IMAGES

Hip region fractures, including pelvic, femoral neck, intertrochanteric, and subtrochanteric fractures, are critical medical conditions, especially when diagnosed early. These fractures impair mobility, increase risks, and cause complications. Early diagnosis using X-ray imaging is vital for effective treatment. Recent advances in computer vision, particularly ensemble deep learning models, have revolutionized fracture detection by combining various models to improve classification accuracy and stability. The proposed research will develop and evaluate ensemble deep learning methods for multiclass classification of hip fractures on X-ray images. The dataset consists of 1000 X-ray images from Sri Lankan hospitals (2022-2023), categorized into five types: non-fracture, femoral neck, intertrochanteric, subtrochanteric, and combined fractures. Preprocessing and data augmentation techniques are used to increase dataset diversity. The data was split into 70% for training, 15% for validation, and 15% for testing to evaluate performance. The model architectures include ResNet-101, ResNet-50, EfficientNetB0, and EfficientNetV2, with ResNet-101 achieving the highest test accuracy of 0.8000, followed by ResNet-50 (0.7786), EfficientNetB0 (0.7286), and EfficientNetV2 (0.7500). Ensemble learning can enhance multiclass hip fracture classification, yielding more accurate results. This approach has potential clinical applications, aiding early and reliable diagnosis. Future research will explore more advanced ensemble methods, incorporating multi-model evidence and sophisticated data augmentation techniques such as generative adversarial networks (GANs) to address class imbalance. Further hyperparameter tuning could improve performance and generalization in practical clinical settings.

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Keywords: Ensemble deep learning, Hip region fracture, Multiclass classification, Restnet101, X-ray images