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Swin Transformer Enhanced with OOD Detection for Robust and Reliable Diagnosis of Ischemic Stroke from CT Image

Authors

- **Nurmisba Nurmisba**Departement of Informatics, Universitas Muhammadiyah Makassar, Indonesia
- **Desi Anggreani**Departement of Informatics, Universitas Muhammadiyah Makassar, Indonesia
- **Muhyiddin A M Hayat**Departement of Informatics, Universitas Muhammadiyah Makassar, Indonesia
- **Aedah Abd Rahman**School Science and Technology, Asia E University, Malaysia

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ABSTRACT

Diagnosing ischemic stroke from CT scan images presents significant challenges in achieving the speed and accuracy essential for clinical decision-making, where conventional CNN-based methods show limitations. This study addresses these gaps by developing an automated diagnostic system using a Swin Transformer model integrated with an Out-of-Distribution (OOD) detection mechanism to enhance diagnostic reliability. The model was trained and validated on a dataset of 583 brain CT images from 341 patients at a regional hospital in Makassar. This dataset, labeled by two expert radiologists (κ=0.94), was categorized into ischemic stroke (206), normal (228), and non-brain CT scans (149) as the OOD class. The Swin Transformer achieved an exceptional validation accuracy of 99.15% after 10 epochs, with a highly efficient total training time of approximately 24 minutes. The model's superiority was further confirmed by high weighted averages for precision (0.99), recall (0.99), and F1-score (0.99). Critically, the OOD detection module demonstrated perfect performance, achieving 100% accuracy in identifying irrelevant images with a 0% false positive rate, thereby preventing erroneous diagnoses from non-brain scans. Robustness testing under varied lighting conditions also showed a 100% success rate. Real-time viability was confirmed through external validation using a live camera, yielding a rapid inference time of 0.3 seconds per image. This study concludes that the

developed system offers a highly accurate, robust, and safe solution, proving its readiness for clinical implementation to support ischemic stroke diagnosis in Indonesia.