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## LowGAN Enhances Portable MRI for MS Imaging



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Magnetic resonance imaging (MRI) is crucial for neurological diagnostics but is often inaccessible in low-resource settings due to the high cost of conventional 3-T MRI systems. Recently, 64-mT low-field MRI scanners have emerged as a more affordable and compact alternative, though they produce lower-quality images, which can be problematic for conditions like multiple sclerosis (MS). To address this, a generative adversarial network called LowGAN was developed to enhance image quality from low-field MRI. A recent review published in *Radiology* evaluates LowGAN's effectiveness in improving the clinical utility of low-field MRI for MS.

### Improving Image Quality and Contrast

The LowGAN model was trained on paired T1-weighted, T2-weighted and FLAIR images acquired from both 64-mT and 3-T MRI systems. Using these paired datasets, the model generated synthetic high-field-strength images that were quantitatively and qualitatively evaluated. Structural similarity index (SSIM), peak signal-to-noise ratio (PSNR), normalised cross-correlation (NCC) and feature similarity index (FSIM) were used to assess image quality.

### **Must Read: [The Role of AI in Multiple Sclerosis MRI Assessment](#)**

Significant improvements were observed in synthetic images produced by LowGAN when compared with raw 64-mT scans. For T1-weighted and FLAIR sequences, LowGAN outputs displayed greater visual clarity, reduced granularity and improved contrast between grey and white matter, which were verified quantitatively. The enhanced image quality was visually confirmed by expert review. Additionally, LowGAN successfully removed flow-related venous hyperintensities present in low-field images, which can interfere with lesion detection and segmentation. The improvements were consistent in both the primary study group and the independent validation group, suggesting the robustness of the model across diverse clinical scenarios and acquisition settings.

### Preserving Brain Structure and Volumetry

To determine the accuracy of structural preservation, volumetric comparisons were performed using automated tissue segmentation tools. Segmentation outputs from LowGAN were compared to both low-field inputs and outputs from SynthSR, a previously developed deep learning model for super-resolution.

LowGAN's results showed strong concordance with 3-T derived measurements. Cerebral cortex volumes produced by LowGAN were nearly identical to those from 3-T scans, while SynthSR tended to underestimate volumes. In regions such as the thalamus and lateral ventricles, LowGAN also demonstrated superior accuracy. Although some underestimation persisted in areas like the hippocampus and pallidum, the overall volumetric agreement was stronger with LowGAN than with SynthSR or raw 64-mT data.

These findings suggest that LowGAN successfully preserves key anatomical structures and provides reliable morphometric measurements. This capability is essential for tracking disease progression in MS and for supporting research into neurodegeneration. In contrast, SynthSR showed greater variability and less alignment with 3-T values in most brain regions examined.

### Detecting and Enhancing MS Lesions

Multiple sclerosis is characterised by white matter lesions (WMLs), making their accurate visualisation a core component of diagnostic imaging. The LowGAN model improved the lesion-to-white matter contrast-to-noise ratio, enhancing the visibility of lesions in synthetic images. When compared to native low-field scans, LowGAN outputs resulted in higher Dice similarity scores for lesion segmentation against the 3-T standard,

indicating better overlap and delineation.

LowGAN preserved existing lesions from the original scans and improved their conspicuity, particularly for smaller lesions that were less apparent on 64-mT images. Importantly, the model did not artificially generate lesions in cases where none were present, demonstrating its anatomical reliability. In a validation group, which included individuals with non-MS pathology, LowGAN maintained this accuracy, further validating its generalisability.

Improved conspicuity likely contributed to the increase in detection performance and allowed for better lesion characterisation without introducing false positives. This capability can enhance diagnostic confidence, support clinical decision-making and enable broader use of portable MRI in MS care and research.

LowGAN represents a significant step forward in the enhancement of portable low-field MRI technology. By generating high-quality synthetic images from 64-mT inputs, LowGAN addresses core limitations of low-field MRI, especially for MS imaging. The model improves image resolution, enhances volumetric accuracy and increases lesion visibility, supporting its potential integration into clinical and research workflows. Its design, based on paired training data, allows for high fidelity with original anatomical structures and reduces the risk of hallucinated artefacts. While broader validation is necessary, LowGAN offers a promising solution for expanding neuroimaging capabilities in low-resource settings and improving accessibility for patients with neurological diseases such as MS.

**Source:** [Radiology](#)

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