IMPROVING 3D LESION SEGMENTATION ROBUSTNESS AGAINST IMAGE COMPRESSION IN MULTIPLE SCLEROSIS

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#1436

▸ CONTEXT

- Accurate segmentation of white matter lesions (WMLs) in MRI is crucial for the diagnosis and prognosis of multiple sclerosis (MS).
  - ↪ *Manual segmentation is laborious, leading to the development of deep learning (DL)-based methods to automate the process[1].*
- Data transfer and storage are key for DL methods, making lossy image compression (IC) a powerful tool to enhance data management.
  - ↪ *Lossy IC can impact image quality, affecting the accuracy of DL tasks.*
- Related works have studied the effect of IC on DL-based tasks in medical imaging[2-4].
  - ↪ *No work has studied the impact of IC on DL-based segmentation of WMLs yet.*

▸ CONTRIBUTION

We propose an **iterative fine-tuning approach** to improve the robustness of 3D U-Net segmentation of WMLs in MS against IC. The proposed approach can handle compression ratios (CRs) **up to 64:1**.

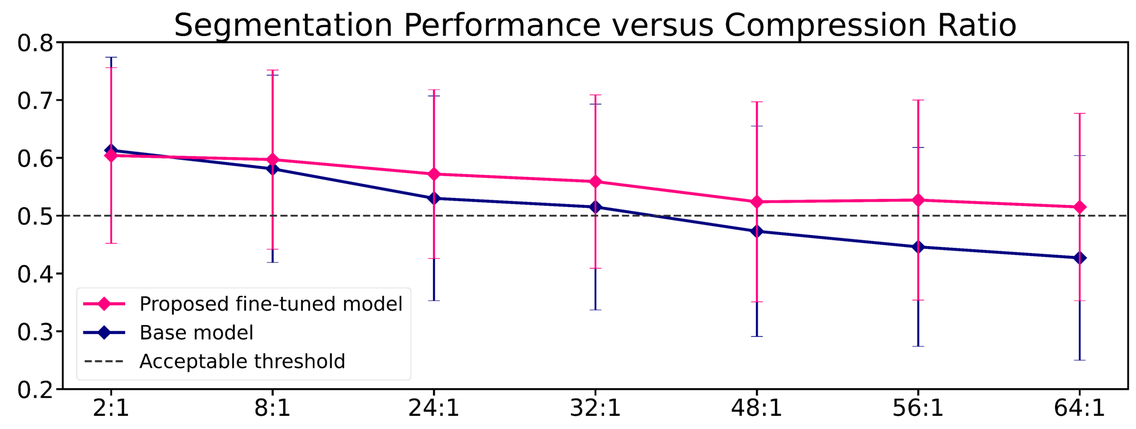
▸ MATERIALS

- 3D MRI FLAIR images from **63 MS patients** were acquired at Saint-Luc Hospital in Belgium.
- **WML annotations** were performed by two experts upon consensus.
- The **JPEG 2000** algorithm is used to achieve lossless IC. The 3D MRI scans were compressed as individual 2D slices before reassembly.

▸ METHODS

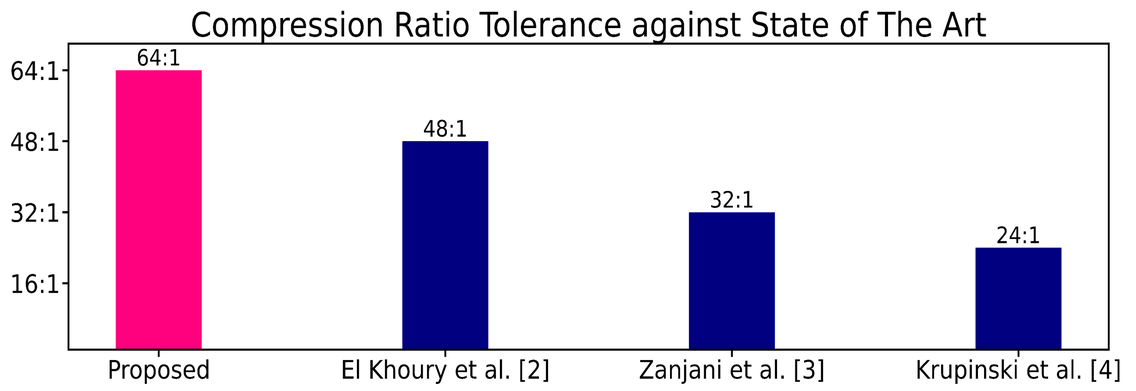
- The **base model** uses a 3D patch-based U-Net for semantic segmentation of WMLs[5-6] and is trained exclusively on uncompressed images.
- The **proposed model** extends the base model by taking its weights and performing seven fine-tuning iterations on the same training set compressed at CRs ranging from 2:1 to 64:1.
  - ↪ *Iterative fine-tuning helps the model learn and filter IC artifacts at higher CRs.*

▸ RESULTS



For equivalent segmentation performance, measured using Dice Score, the proposed model handles CRs **up to 64:1** compared to 32:1 for the base model.

▸ COMPARISON TO STATE OF THE ART



The proposed model achieves **higher compression ratio tolerance** than related works[2-4] that have studied the robustness of DL-based tasks to IC.

▸ REFERENCES

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