AI-based White-matter Abnormality Detection in Multi-protocol Brain Magnetic Resonance Images

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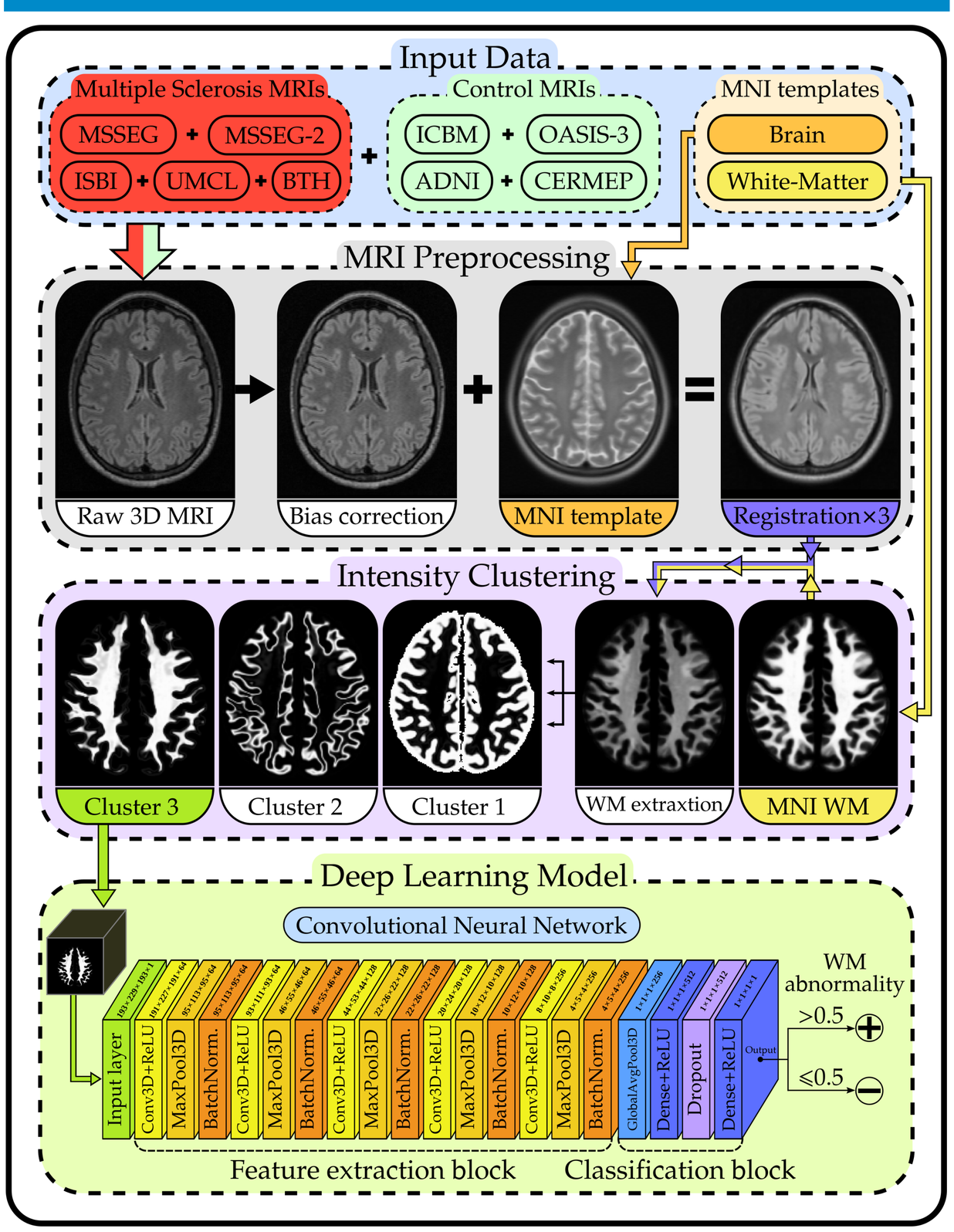
Background

- Magnetic Resonance Imaging (MRI) of brain:
  - → Widely used for diagnosing neurological diseases
  - → FLAIR: excellent contrast for white matter abnormalities
  - → Numerous MRIs produced daily → multi-protocol data
- Artificial Intelligence (AI):
  - → Automates certain aspects of medical image analysis
  - → Usually requires images from similar scanner and protocol
- Our contribution
  - → An analysis approach independent of scanner and protocol
  - → MRI classification for white matter abnormality presence
  - → Evaluation in limited data scenarios

Methods

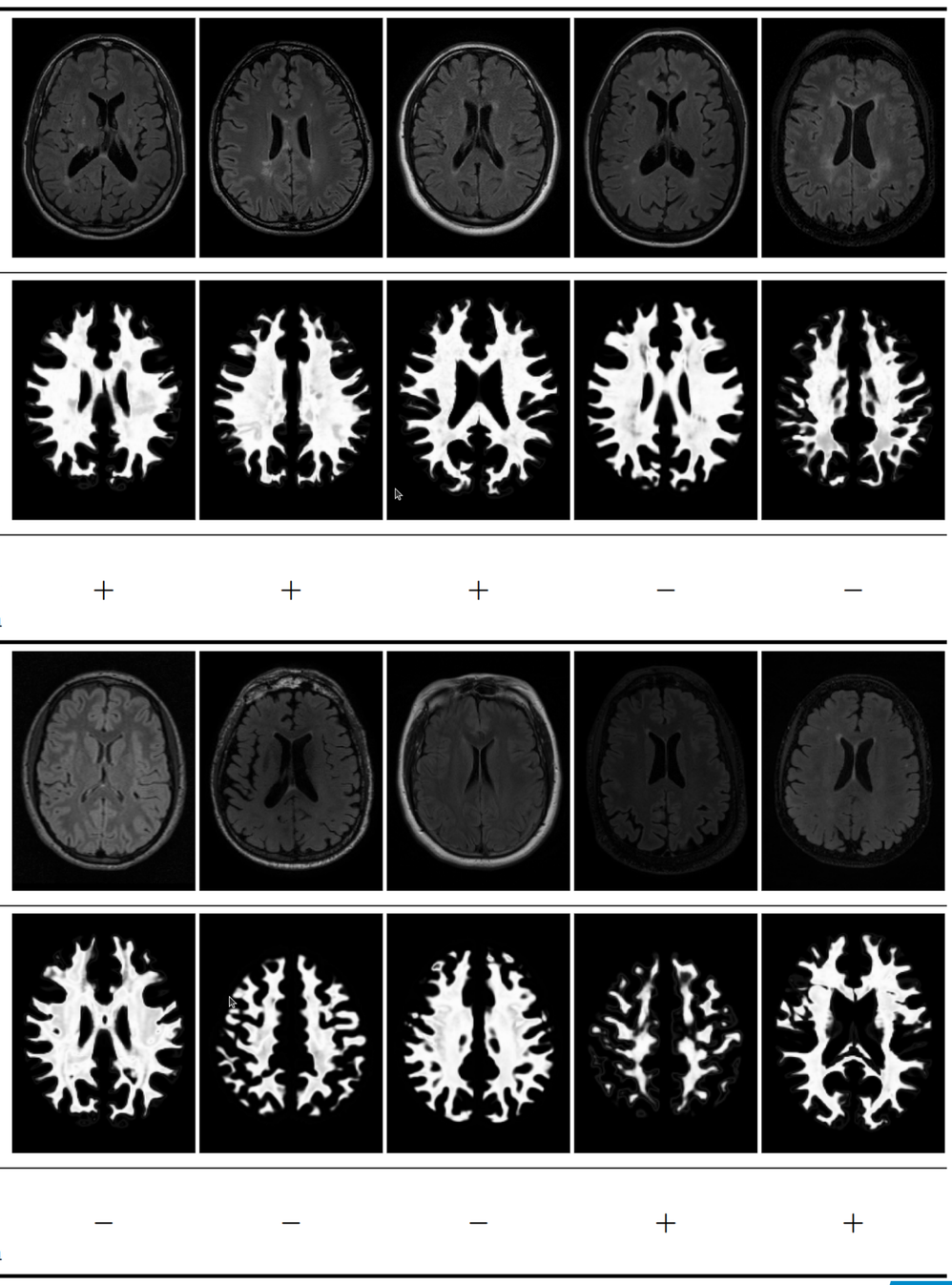


Results

- Experimental Settings
  - → *A*: 204 MRIs for training (blend of 34 MR protocols)
  - → *E*: 80 MRIs for training (5 MRIs per 16 MR protocols)
  - → In each Setting#, training data is reduced by 10%

Setting	Training	Protocols	Accuracy(%)	Sensitivity(%)	Specificity(%)	F1 Score(%)
A00	204	34	90.43	92.80	88.07	90.42
A08	66	24.0 (1.9)*	75.03	93.67	56.40	80.23
A10	46	20.7 (2.6)*	62.03	89.53	34.53	69.23
E00	80	16	81.63	88.00	75.25	82.52
E01	64	16	70.50	88.00	53.00	74.59
E02	48	16	64.00	90.25	37.75	70.75

* Mean (standard deviation) value over 10 different data shuffles



Discussion

- The method proves to be independent of MRI protocol
  - → Classification accuracy: more than 90%
  - → Despite existance of mislabeling in the data
  - → The model could detect the mislabeled data
- Future work
  - → Employing a similar approach for disease classification

Reference
Masoud Abedi, Navid Shekarchizadeh, Pierre-Louis Bazin, Nico Scherf, Julia Lier, Christa-Caroline Bergner, Wolfgang Köhler, and Toralf Kirsten, Deep learning-based classification of multi-protocol brain magnetic resonance images for white matter abnormality presence, In Submission.