

Artificial Intelligence based detection of Parkinson's disease in Magnetic Resonance Imaging brain scans

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Background

- There is a need for diagnostic tests for early PD detection.
- A subset of AI known as deep learning (DL) has shown great promise in diagnostic medical imaging, sometimes matching or even exceeding the performance of radiologists by detecting patterns invisible to the human eye.
- Using DL, we explored whether such changes are detectable on routine MRI scans.

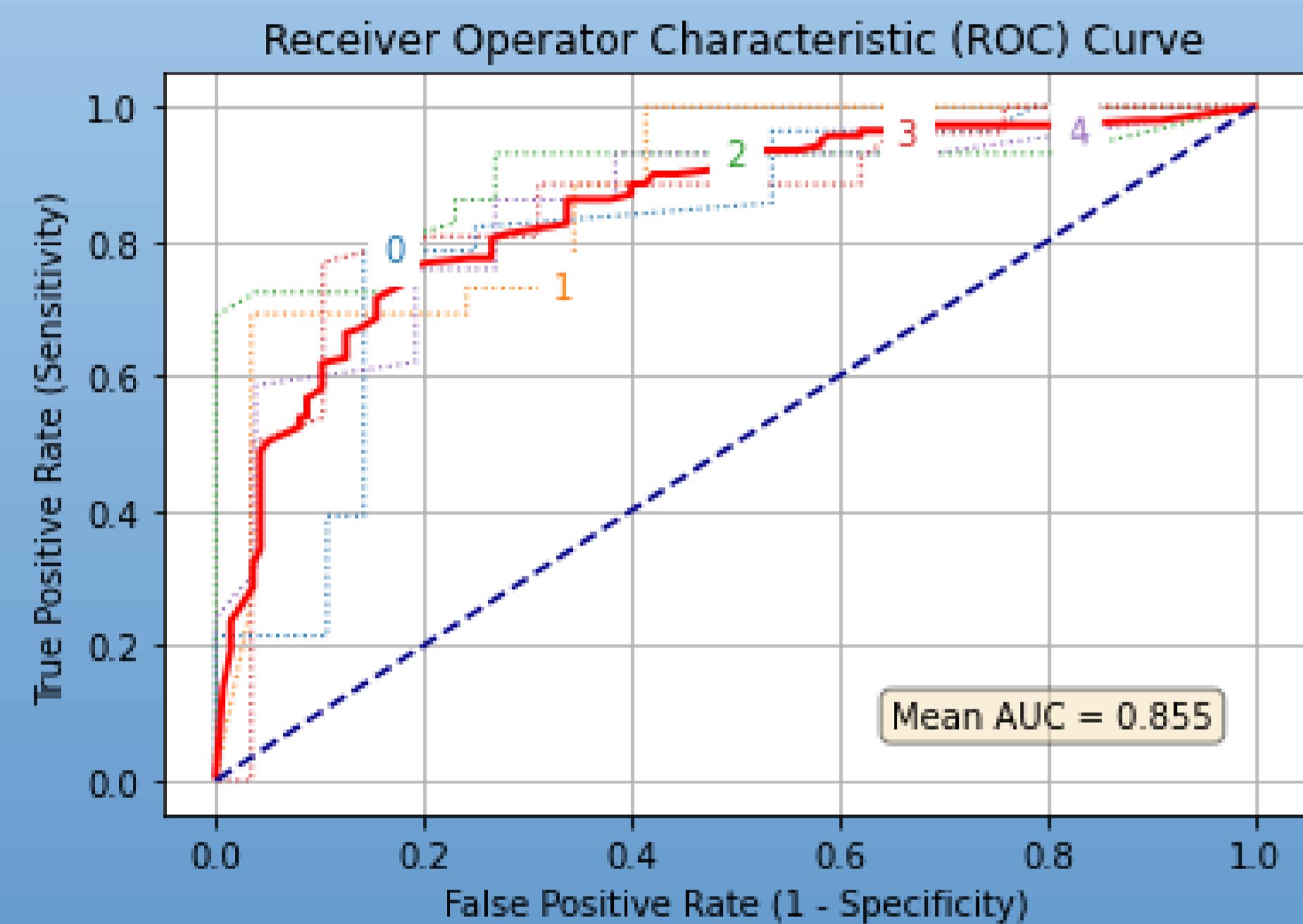
Methods

- We trained a convolutional neural network to classify 138 PD and 60 control brain MRI images acquired from the Parkinson's Progression Marker Initiative database.
- Models were assessed using 5-fold cross-validation.
- We used Deep SHapley Additive exPlanations (DeepSHAP) to visualize the contribution of individual pixels to the model's prediction.

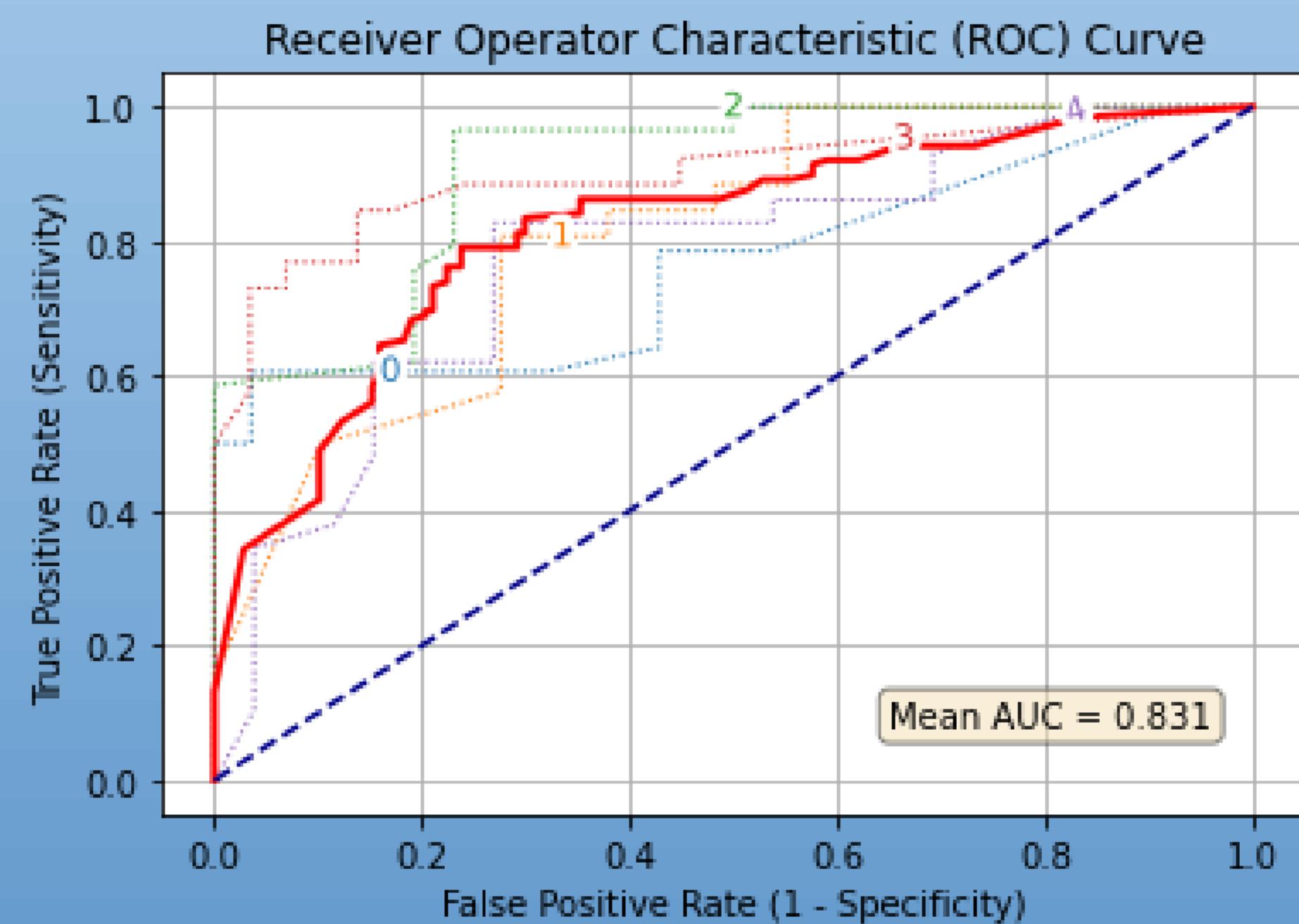
Results

- A combined dataset of axial T2 and proton density MRI images was classified with 79% accuracy and a Receiver Operating Characteristic (ROC) area under the curve (AUC) of 0.86.
- A dataset of axial T2 MRI images was classified with 81% accuracy and ROC AUC of 0.83.
- A dataset of proton density axial MRI images was classified with 84% accuracy and ROC AUC of 0.89.
- DeepSHAP heat maps demonstrated predominant interest in midbrain slices.

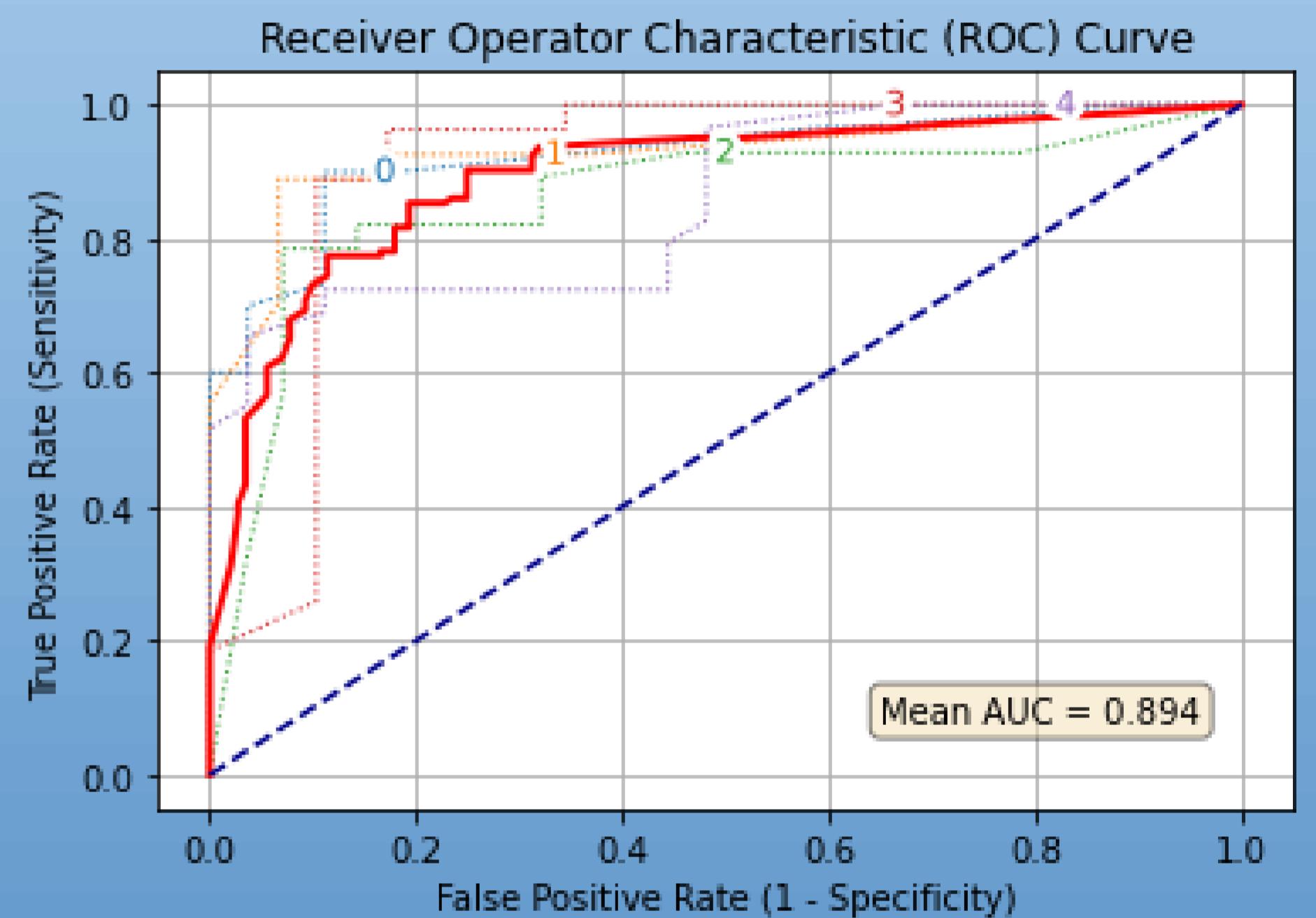
① Combined axial dataset



② T2 axial dataset

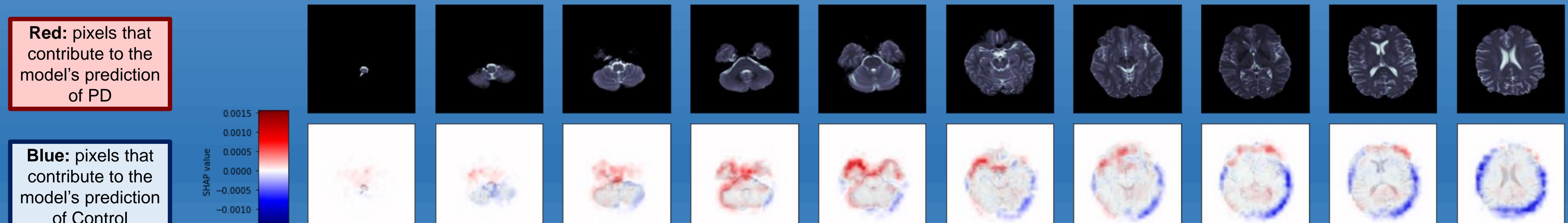


③ Proton density axial dataset

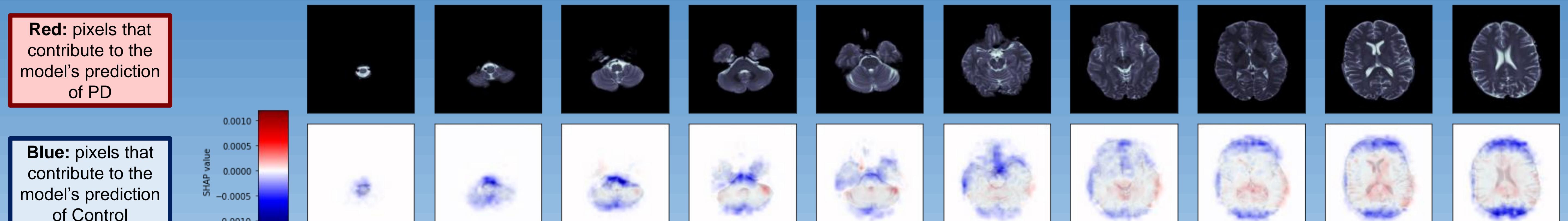


Average T2 axial DeepSHAP maps:

① PD prediction



② Control prediction



Conclusion

- Our models exhibited good diagnostic performance and demonstrated interest in PD relevant brain regions.
- We will validate this model in a large dataset of routinely collected NHS MRI scans, many of which pre-date onset of motor symptoms.