GRACE Explainability Report: adni

Interpretability Report for Patient Instance: 901

1. Patient Summary

Prediction: Mild Cognitive Impairment
Confidence: 95.32%

Key Feature Contributions according to LIME:

LIME values are between -1 and 1, where positive values support the prediction, and negative values oppose it.
Only contributions with absolute value > 0.01 are shown.

Ensemble Model:

- Neurodegeneration and Brain Atrophy: 0.2058
- Cognitive Function and Memory Systems: -0.0185
- Neuroimaging Biomarkers: 0.0117

Node Models (Contributions to Intermediate Nodes):

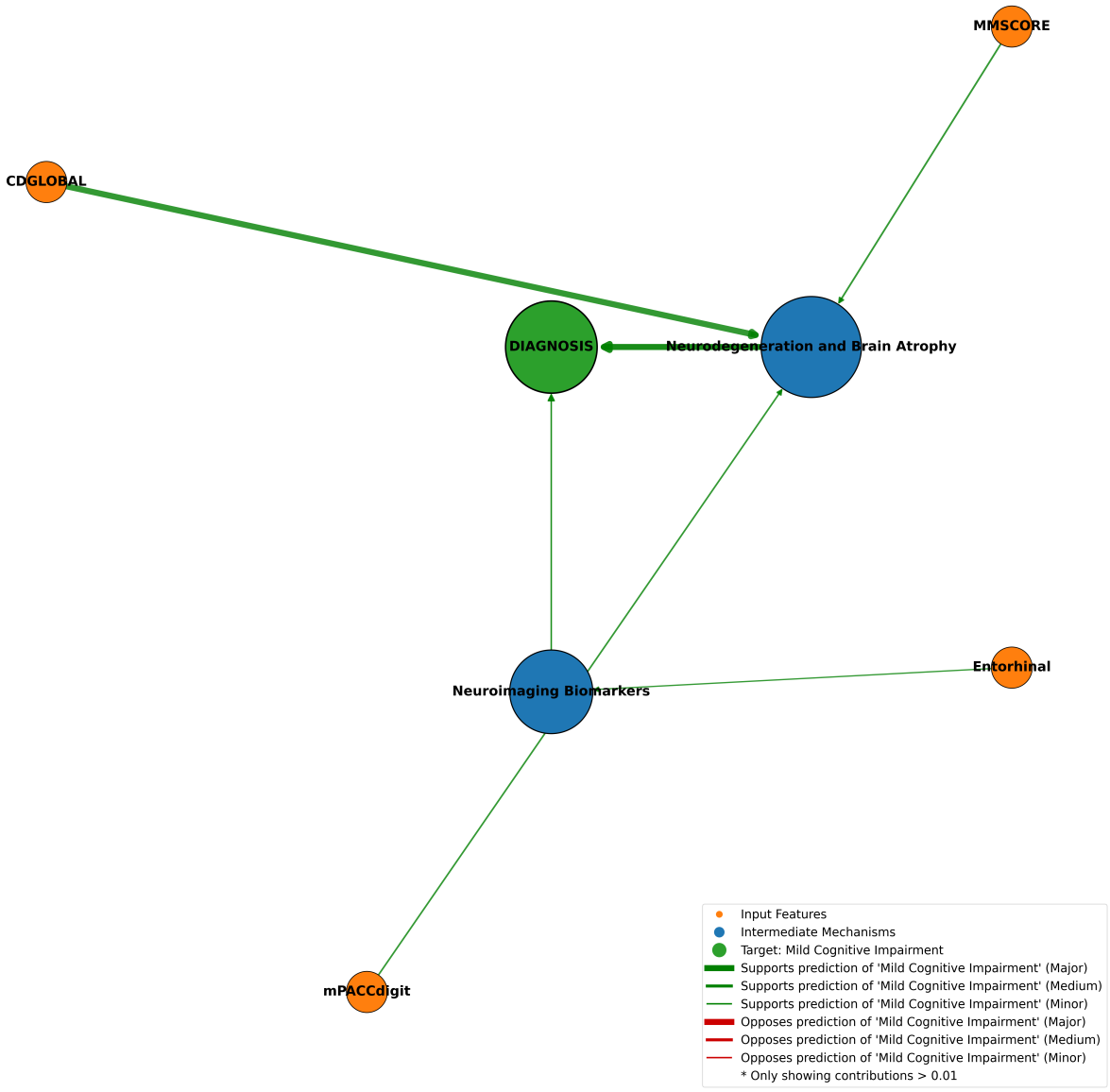
Node - Neurodegeneration and Brain Atrophy:

-- CDGLOBAL: 0.2599
-- MMSCORE: 0.0251
-- mPACCdigit: 0.0209

Node - Cognitive Function and Memory Systems:

-- EcogPtLang: 0.0680
-- mPACCdigit: -0.0650
-- FAQ: 0.0609
-- EcogSPOrgan: 0.0232

LIME-Informed Knowledge Graph Visualization


MMSCORE
CDGLOBAL
DIAGNOSIS
Neurodegeneration and Brain Atrophy
Entorhinal
Neuroimaging Biomarkers
mPACCdigit
Input Features
Intermediate Mechanisms
Target: Mild Cognitive Impairment
Supports prediction of 'Mild Cognitive Impairment' (Major)
Supports prediction of 'Mild Cognitive Impairment' (Medium)
Supports prediction of 'Mild Cognitive Impairment' (Minor)
Opposes prediction of 'Mild Cognitive Impairment' (Major)
Opposes prediction of 'Mild Cognitive Impairment' (Medium)
Opposes prediction of 'Mild Cognitive Impairment' (Minor)
* Only showing contributions > 0.01

2. Contextual Explanation

This patient's predicted diagnosis is Mild Cognitive Impairment (MCI) with high probability (0.9532), reflecting early cognitive decline that is not yet dementia. The LIME analysis highlights two main intermediate nodes influencing this prediction: 'Neurodegeneration and Brain Atrophy' (positive contribution) and 'Cognitive Function and Memory Systems' (slightly negative contribution). Within 'Neurodegeneration and Brain Atrophy', the Clinical Dementia Rating global score (CDGLOBAL) at 0.5 strongly contributes positively, indicating mild but notable functional impairment consistent with MCI. The MMSE score of 26, slightly below normal, also supports mild cognitive deficits. The zero value for AVDEL30MIN (delayed verbal recall) and zero for category fluency interference (CATANINTR) suggest impaired memory retention and executive function, common in early AD pathology. The negative LIME weight for CATANINTR indicates that absence of interference might slightly reduce predicted impairment, but the overall profile still points to decline. The 'Cognitive Function and Memory Systems' node shows mixed contributions: elevated EcogPtLang (1.44) and FAQ (5.0) scores indicate perceived language difficulties and functional challenges in daily activities, supporting cognitive decline. The negative contribution of mPACCdigit (-5.5) suggests better-than-expected processing speed, which may slightly offset impairment signals. The graph structure shows these features cluster under neurodegeneration and cognitive function, consistent with known AD progression pathways involving hippocampal and cortical atrophy leading to memory and executive dysfunction. Overall, the patient's profile reflects early neurodegenerative changes with mild cognitive and functional impairment, typical of MCI stage in the AD continuum.

3. Personalized Insights and Considerations

Given the retrospective nature of the ADNI dataset and this analysis, direct clinical interventions cannot be prescribed. However, general recommendations for individuals with MCI include regular cognitive assessments to monitor progression, engagement in cognitive stimulation activities, and management of vascular risk factors to potentially slow decline. Lifestyle factors such as physical exercise, social engagement, and a balanced diet (e.g., Mediterranean diet) may support brain health. The patient's elevated Clinical Dementia Rating and functional questionnaire scores highlight the importance of supportive measures for daily living activities. The interplay of impaired delayed recall, mild global cognitive deficits, and functional challenges suggests underlying neurodegeneration affecting memory circuits and executive networks. This profile underscores the need for continued research into biomarkers and interventions targeting early AD pathology, including amyloid and tau deposition, neuroinflammation, and synaptic dysfunction. Clinicians and researchers should consider multimodal approaches integrating cognitive, functional, and biomarker data to refine risk stratification and therapeutic strategies for MCI patients.