Supplementary Information

TreatmentFormer: Multimodal Transformer Modeling and Biomarker Prioritization Following Rapamycin Treatment in Cognitively Normal Adults with Alzheimer's Disease Risk

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Supplementary Table S1: Feature Selection Frequency from the 10 aggregate experimental runs. Only features selected by the Random Forest filter at least once across the runs are listed.

Feature	Selection_Count	Selection_Frequency (%)
Biomarker_B_MIP-1α	10	100.00
Biomarker_C_RDW CV %	10	100.00
Biomarker_B_IFN-γ	9	90.00
Biomarker_B_MIP-1β	9	90.00
Biomarker_B_Tie-2	9	90.00
Biomarker_C_RDW SD fL	8	80.00
Biomarker_A_Indoleacetate	7	70.00
Biomarker_A_Inositol	7	70.00
Biomarker_A_Dihydroxyphenylalanine (DOPA)	6	60.00
Biomarker_A_Glycerol-3-phosphate	6	60.00
Biomarker_A_Ribose	6	60.00
Biomarker_A_Stearate	6	60.00
Biomarker_B_IL-10	6	60.00
Biomarker_B_IL-6	6	60.00
Biomarker_A_Mannose	5	50.00
Biomarker_A_Pentadecanoate	5	50.00
Biomarker_A_Uracil	5	50.00
Biomarker_A_Linoleate	4	40.00
Biomarker_A_N-Acetylmethionine	4	40.00
Biomarker_B_MCP-4	4	40.00
Biomarker_B_SAA	4	40.00
Biomarker_B_TNF-β	4	40.00
Biomarker_C_Calcium (mg/dL)	4	40.00
Brain_CBF_Imaging_Putamen	4	40.00
Biomarker_A_Asparagine	3	30.00
Biomarker_A_Erythrose	3	30.00
Biomarker_A_Fructose 6-phosphate	3	30.00
Biomarker_A_Glucose	3	30.00
Biomarker_A_Glutamine	3	30.00
Biomarker_A_Glycine	3	30.00

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Feature	Selection_Count	Selection_Frequency (%)
Biomarker_A_Lactate	3	30.00
Biomarker_A_N-Acetylaspartate	3	30.00
Biomarker_A_Pyridoxal (PL)	3	30.00
Biomarker_B_TNF-α	3	30.00
Biomarker_B_VEGF-C	3	30.00
Biomarker_A_2-Hydroxyglutarate	2	20.00
Biomarker_A_Adonitol	2	20.00
Biomarker_A_Cadaverine	2	20.00
Biomarker_A_Gamma-aminobutyrate (GABA)	2	20.00
Biomarker_A_Glyceraldehyde-3-Phosphate	2	20.00
Biomarker_A_Heptadecanoate	2	20.00
Biomarker_A_Hypoxanthine	2	20.00
Biomarker_A_Malate	2	20.00
Biomarker_A_Nicotinurate	2	20.00
Biomarker_A_O-Phosphoethanolamine	2	20.00
Biomarker_A_Taurine	2	20.00
Biomarker_A_Thymine	2	20.00
Biomarker_A_Xanthine	2	20.00
Biomarker_A_Xylose	2	20.00
Biomarker_A_beta-Hydroxybutyrate (3-Hydroxybutyrate)	2	20.00
Biomarker_B_IL-1β	2	20.00
Biomarker_B_MDC	2	20.00
Biomarker_C_% Lymphocytes	2	20.00
Biomarker_C_Estimated Average Glucose	2	20.00
Biomarker_C_Hemoglobin A1c %	2	20.00
Brain_CBF_Imaging_Caudate	2	20.00
Biomarker_A_3-Hydroxypropionate	1	10.00
Biomarker_A_Aminoadipate	1	10.00
Biomarker_A_Arachidate	1	10.00
Biomarker_A_Aspartate	1	10.00
Biomarker_A_Cholesterol	1	10.00
Biomarker_A_Cinnamate	1	10.00
Biomarker_A_Citrate	1	10.00
Biomarker_A_Citrulline	1	10.00
Biomarker_A_Creatinine	1	10.00
Biomarker_A_Cysteine	1	10.00
Biomarker_A_Cytosine	1	10.00
Biomarker_A_Kynurenine	1	10.00
Biomarker_A_Laurate	1	10.00
Biomarker_A_Methylmalonate	1	10.00
Biomarker_A_Mevalonate	1	10.00

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Feature	Selection_Count	Selection_Frequency (%)
Biomarker_A_Ornithine	1	10.00
Biomarker_A_Orotate	1	10.00
Biomarker_A_Palmitate	1	10.00
Biomarker_A_Pyridoxine (PN)	1	10.00
Biomarker_A_Pyruvate	1	10.00
Biomarker_A_Ribose 5-phosphate	1	10.00
Biomarker_A_Succinate	1	10.00
Biomarker_A_Tryptophol	1	10.00
Biomarker_A_Valine	1	10.00
Biomarker_A_alpha-Keto-beta-Methylvalerate (KMV)	1	10.00
Biomarker_A_alpha-Ketoisocaproate (KIC)	1	10.00
Biomarker_A_alpha-Ketoisovalerate (KIV)	1	10.00
Biomarker_A_beta-Hydroxy beta-Methylbutyrate (HMB)	1	10.00
Biomarker_B_Eotaxin-3	1	10.00
Biomarker_B_GM-CSF	1	10.00
Biomarker_B_IL-8	1	10.00
Biomarker_B_MCP-1	1	10.00
Biomarker_B_bFGF	1	10.00
Biomarker_C_% Basophils	1	10.00
Biomarker_C_Abs Granulocytes x19(9)/L	1	10.00
Biomarker_C_Anion gap (mmol/L)	1	10.00
Biomarker_C_CO2 (mmol/L)	1	10.00
Biomarker_C_GFR	1	10.00
Biomarker_C_MPV	1	10.00
Biomarker_C_Total Bilirubin (mg/dL)	1	10.00
Brain_CBF_Imaging_Entorhinal	1	10.00
Brain_CBF_Imaging_GM_mask_frontal	1	10.00
Brain_CBF_Imaging_GM_mask_temporal	1	10.00
Brain_CBF_Imaging_Lateraloccipital	1	10.00
Brain_CBF_Imaging_Postcentral	1	10.00
Brain_CBF_Imaging_Precentral	1	10.00
Brain_CBF_Imaging_WM_mask	1	10.00

Supplementary Table S2: Mean absolute SHAP values across repeated runs. Values are reported as mean ± SD.

Modality	**Mean** |SHAP| ± **SD**
Blood Metabolites	0.000117 ± 0.000048
Complete Blood Count	0.000114 ± 0.000051
Inflammatory	0.000092 ± 0.000022
Brain CBF Imaging	0.000047 ± 0.000022
Structural MRI	0.000044 ± 0.000025
Microbiome	0.000040 ± 0.000019
Perfusion Image	0.000033 ± 0.000031
Other	0.000002 ± 0.000001