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Explainable Multimodal AI for Decision Support Under High-Dimensional Heterogeneous Data

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Xiaofeng Song is a Professor of Biomedical Engineering at Nanjing University of Aeronautics and Astronautics (China), the Vice Dean for the College of Automation Engineering, and the Deputy Vice-President of the Jiangsu Bioinformatics Society. His research focuses on Bioinformatics and AI in biology, with a particular emphasis in recent years on non-coding RNA and the development of original bioinformatics algorithms, tools, and databases within the frontier field of circular RNA (circRNA). He has presided over five National Natural Science Foundation of China projects (including one Key project), one Key R&D project of Jiangsu Province, one “Six Talent Peaks” project of Jiangsu Province, and multiple other provincial or ministry-level projects. As a first or corresponding author, he has published more than 80 papers in internationally renowned SCI-indexed academic journals, such as Nucleic Acids Research, Briefings in Bioinformatics, Genomics, Proteomics & Bioinformatics (GPB), Computational Biology and Medicine, BMC Genomics, and BMC Bioinformatics.

Decision support systems in high-stakes domains must simultaneously achieve predictive accuracy and interpretability, yet these two objectives are often in tension when data are high-dimensional, heterogeneous, and partially labeled. We propose an explainable multimodal AI framework that fuses structured tabular features, sequence embeddings, and graph-based relational representations through an attention-guided fusion module. Shapley-value-based attribution and attention rollout mechanisms are incorporated to provide instance-level explanations aligned with domain knowledge. The framework is designed to be domain-agnostic and is evaluated on biomedical, fault-diagnosis, and financial risk prediction benchmarks, demonstrating consistent gains in both prediction performance and explanation faithfulness over existing baselines. Our work provides a practical blueprint for deploying interpretable AI in complex real-world decision pipelines.

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All are welcome