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TheraMind 2.0: A Multi-LLM Ensemble System for Accelerating Drug Repurposing in Non-Small Cell Lung Cancer



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Abstract: Published clinical case reports, review articles, and clinical trials represent valuable yet underutilized sources of evidence for drug repurposing in cancer therapy. In this talk, I will present TheraMind 2.0, an AI-powered system I developed that leverages multiple large language models to automate the identification and analysis of relevant literature supporting potential drug repurposing for non-small cell lung cancer (NSCLC). My enhanced pipeline integrates three parallel data streams, research articles, clinical trials, and case reports, scraped from PubMed and ClinicalTrials.gov. Using coordinated data extraction and standardized prompts, I deployed an ensemble of GPT-4o-mini, Gemini-2.0-Flash, and Mixtral models in three complementary classification strategies: rule-based decision trees, individual model validators, and majority-vote consensus. TheraMind 2.0 also produces structured outputs including patient demographics, therapeutic responses, and concise summaries with complete audit trails. This scalable, transparent framework bridges the gap between computational drug discovery and clinical adoption by transforming unstructured biomedical literature into actionable, clinician-ready evidence for therapeutic decision-making.

Bio: Vrushket is a graduate student in the School of Computing at Binghamton University's Watson College of Engineering & Applied Science. His research focuses on applying artificial intelligence and large language models to biomedical text mining and drug repurposing, particularly for cancer therapy. Working under Dr. Nancy L. Guo, they have developed TheraMind, an innovative multi-LLM ensemble system for mining clinical evidence from published case reports, review articles, and clinical trials. Vrushket's work aims to accelerate the translation of computational drug discovery findings into clinical practice by providing oncologists with structured, evidence-based therapeutic options for patients with limited treatment alternatives.