

Artificial Intelligence-Driven Multi-Agent System for Enhanced Radiology Workflow and Decision Support

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Abstract

Medical imaging is one of the fields that are critical in diagnosing and monitoring different diseases. This requires hospital resource management and intelligent decision-making processes. This article examined a multi-agent system that can be used to schedule patients, allocate resources, and improve the overall accuracy of diagnosis in radiology services. The proposed system comprises a network of intelligent agents that dynamically collaborate with each other to improve workflow, enhance medical decision-making, and improve patient care advancement. The system comprises the Patient Agent (PA) which acts as the initial source of interaction between the patient and the system of the hospital. This agent gathers personal and medical information from the patient and facilitate contact with other agents. Other agents include the Intelligent Diagnosis Agent (IDA) which it use to associate patients with possible known symptoms and historical data using artificial intelligence (AI) tools to suggest correct diagnostic procedures. The Hospital Scheduler Agent (SA) would assign a time slot allocated for radiological examinations, while the Hospital Resource Agent (RA) guarantees the availability of appropriate imaging equipment and medical personnel. During the whole process of diagnosis, the Radiology Monitoring Agent (RMA) captures imaging data for analysis, identifies those data that have real-time potential anomalies, and optimizes imaging protocols. The scans will then be reviewed by the Medical Specialist Agent (MPA-Radiology), who will also validate findings with and tie in with the Decision Support and Referral Agent (DSRA) to produce a personalized treatment plan. If the diagnosis requires medication, the Medication Management Agent (MMA) will coordinate with the Pharmacy Agent (PHA) to ensure the availability of prescribed drugs. In the case of emergencies, the Emergency Schedule Management Agent (SMA) constantly reschedules appointments for urgent imaging procedures and instructs medical personnel through the Notifying Agent (NA) post-diagnosis. The Rehabilitation Monitoring Agent (ReMA) keeps an eye on the recovery progress of the patient after diagnosis, while the Patient Follow-up Agent (PFA) will ensure treatment compliance and appointment maintenance. Additional analyzers such as Association Rule Extraction Agent (ARA) and Machine Learning Agent (MLA) will be analyzing huge datasets from imaging results, identifying patterns that improve predictive diagnostics, and thus clinical outcomes of future patients. The Data Preprocessing Agent (DPA) also ensures the consistency and correctness of data before they are stored securely by the Database Agent (DBA) for future calling and analysis.

Keywords: Multi-Agent Systems (MAS); Hospital Management Simulation; Patient Scheduling; Radiology Workflow Optimization; Medical Resource Allocation.

