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(54) Title of the invention : A HARDWARE-INTEGRATED MULTIMODAL CLINICAL REASONING SYSTEM WITH DYNAMIC HYPERGRAPH CONSTRUCTION AND REINFORCEMENT LEARNING-BASED DIAGNOSTIC PATH-OPTIMIZATION

(51) International classification	:G16H 50/20, G06N 5/04, G16H 10/60, G16H 30/20, G16H 30/40	(71)Name of Applicant : <b>1)Noida Institute of Engineering and Technology (NIET)</b> Address of Applicant :19, Institutional Area, Knowledge Park II, Greater Noida, Uttar Pradesh 201310 Uttar Pradesh India
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(57) Abstract :

The present invention relates to a hardware-integrated multimodal clinical reasoning system for automated medical diagnosis. It processes electronic health records and medical imaging using dynamic hypergraph construction and reinforcement learning-based path optimization. The system includes a multimodal node projection module, a hierarchical indexing engine using HNSW structures for efficient nearest-neighbor retrieval, and an implicit hyperedge processor to model complex clinical relationships. A reinforcement learning-based diagnostic engine navigates the hypergraph using multi-objective rewards for accuracy, diversity, and efficiency. An orthogonal multi-hop retrieval mechanism prevents biased evidence accumulation, while a test-time training module enables case-specific parameter adaptation. A hardware-accelerated multimodal fusion processor with parallel encoding significantly improves performance, achieving over three hundred percent higher throughput and more than ninety percent reduction in inference latency compared to conventional systems.

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