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(57) Abstract :
The present invention provides a reinforcement learning-based multimodal medical imaging report generation system (100). It includes an image acquisition and preprocessing module (110) with DICOM parsing (112) and quality assessment (113), and a vision-language encoder (120) for visual feature extraction (121) and clinical context embedding (122). A hardware-accelerated fusion engine (130) performs cross-modal attention and domain-invariant learning. An adaptive reward optimization engine (140) applies group relative policy optimization with dynamic weighting. A temporal reasoning module (150) retrieves prior studies and detects changes. The system also includes an edge-cloud synchronization engine (160), a secure communication layer (170) with federated privacy control, and a real-time feedback loop (180). It reduces clinical errors, improves cross-institutional generalization, and lowers report generation latency.

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