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Distributed Database Architectures for Federated Medical Training

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Abstract: *Federated Learning (FL) has emerged as a promising approach for collaborative medical model training while preserving patient privacy. This research proposes the integration of FL with distributed database architectures to enable secure and efficient medical model training across diverse healthcare institutions. The approach addresses challenges such as real-time data synchronization, data heterogeneity, and low-latency model updates. Key innovations include hybrid SQL/NoSQL databases for structured and unstructured data, dynamic partitioning for improved data locality, and adaptive indexing for optimized query performance. The system incorporates secure data handling mechanisms like encryption and differential privacy, ensuring compliance with healthcare regulations. Scalability is achieved through decentralized database management, enabling broad healthcare node participation. The framework's effectiveness is evaluated in real-world smart healthcare networks, focusing on model accuracy, query latency, scalability, and energy efficiency, with potential impacts on personalized medicine and collaborative healthcare analytics.*

Keywords: Federated Learning (FL), Distributed Database Architectures, Hybrid Database Systems (SQL + NoSQL), Healthcare Privacy (HIPAA, GDPR), Adaptive Indexing, Real-Time Model Training

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