23CSE362

TOPIC:-"Evaluating Challenges and Performance Metrics in Edge Computing for Healthcare|"

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Q1: Interoperability and Cybersecurity Challenges in Healthcare Edge Deployment Interoperability Challenges

ANS:- Interoperability and cybersecurity are two major challenges when deploying edge computing systems in healthcare. Interoperability ensures that different devices, like wearables, medical imaging systems, patient monitoring tools, and hospital databases, can work together smoothly. Without standard communication and data-sharing protocols, coordinating tasks across edge servers and cloud systems becomes very difficult. This leads to inefficient scheduling, underuse of devices, and inconsistent service delivery.

Cybersecurity adds another layer of complexity. Sensitive patient data must be protected at every stage, from collection to processing and transmission. This requires secure resource allocation models to defend against threats like data leakage, man-in-the-middle attacks, or denial of service. These challenges force edge networks to use stronger encryption, authentication, and access control measures, which consume more computing, communication, and storage resources.

Therefore, the edge deployment strategy in healthcare must focus on secure and interoperable resource allocation frameworks to ensure both operational efficiency and data integrity.

Q2: Most Important Healthcare Edge Computing Performance Metrics Latency Measures

ANS:- The quality of edge computing-based healthcare services is assessed using latency and accuracy. Latency is especially critical in real-time decision scenarios like ICU monitoring, remote surgeries, or diagnostics during ambulance transport. The PDF shows that effective management of resources like communications bandwidth and computer power can reduce latency by minimizing the time taken for data processing and mitigating data traffic congestion.

In contrast, accuracy reflects performance benchmarks for the AI models and frameworks that support medical decisions powered by edge devices. Achieving high accuracy demands that edge systems are well configuration, incorporating high-speed CPUs, adequate storage, and real-time retrieval capabilities from medical databases. The survey paper further posits that allocation of both computing and communication resources enables sensitive allocation of latency and accuracy. Smart allocation of resources within edge networks allows prioritization of essential medical operations, minimized bandwidth expenditure, and faster

submission of precise outputs, offering potential for improved outcomes like patient safety risks and diminished clinical efficiency.

Q3: Edge AI Algorithm Reliability Benchmarks for Patient Diagnostics Availability and Uptime Metrics

ANS:- Reliability in patient diagnostics using Edge AI is not purely based on accuracy. It is checking that every result is always correctly detected, even during varied operational conditions, and there is always minimal latency. The survey from the PDF highlights the role of resource scheduling and allocation in achieving such reliability. As an example, failure or delays in task execution may occur due to improperly configured provisioning leading to underrloaded or overburdened edge devices which in turn adversely impedes the diagnostics. Some of the benchmarks that have been cited to measure reliability include: response time under load, uptime percentage, fault tolerance, energy consumption, and success rate of task completion. The document also explains how resource allocation, in particular computing, storage, and communication, is controlled with joint allocation models (CCS) to enhance system resilience. Efficient and dynamic resource allocation allows distributed running of AI models even during peak demand, thereby improving accuracy. Also, offloadable or migratable tasks across edge nodes due to distributed resource scheduling guarantee reliability even when a node fails. Real-time healthcare diagnostics aided by edge AI systems become more trustworthy with the integration of smart resource management and the above-mentioned benchmarks.

Q4: Most critical measures in healthcare edge computing Latency and Real-time Processing

ANS:- Evaluating the effectiveness of edge computing in healthcare requires considering such real-world metrics as latency, throughput, accuracy diagnostics, uptime, system reliability, operational completeness, and cost-effectiveness. The paper highlights that the edge system resource allocation greatly impacts meeting these metrics. For example, throughput, or the volume of data processed within a time frame, increases with stringent bandwidth and CPU resource allocation. Ensuring real-time data access and appropriate data source retrieval guarantees accuracy of diagnosis, whilst uptime and reliability benefit from optimized schedule task execution and redundancy strategies. The survey highlights computing, communication, and storage (CCS) as the three core types of resources that must be allocated intelligently to meet the performance goals. Furthermore, enhanced cost-effectiveness is achieved through the selective activation of edge nodes and the offloading of non-critical tasks to cloud centers or other edge devices. In conclusion, strategically monitoring and optimizing the described metrics through resource allocation makes it possible to harness the full potential of edge computing in advancing the efficiency, speed, and access to healthcare services.