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Research talk at APU: Future Trends in parallel processing

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Future Parallel Processing talk in APU, Feb2025.

Future Trends of Parallel Processing Talk @APU 2025

– By Uzair Iqbal

The trends that are set to be there in future parallel processing in healthcare are all set to define the industry by enhancing computational efficiency, enabling real-time analytics, and inspiring innovations in diverse fields. Here are the critical trends predicted:

Accelerated AI and Machine Learning in Diagnostics

Application: Training complex models on very large datasets-such as those from medical images and electronic health records-with the aim of early disease detection.

Real-Time Monitoring and Analytics of Patients

Application: Predicting a decline in health through the analysis of data streams coming from wearables and sensors in the ICU. Impact: Real-time alerts reducing response time, improving outcomes in critical care. Self-sustaining, "air-cast" treatments are ailing techniques of health using real-time monitoring, personalized medicines, and innovative data-driven solutions. By analyzing live data streams from wearables with ICU sensors, AI-powered systems can predict health declines, leading to timely interventions and improved critical care outcomes. The latest genomic high-throughput processing enables low-cost rapid sequencing, which brings about therapies for precision oncology treatments tailored to individual genetic profiles. Improved parallelized algorithms and AI accelerate medical imaging workflows for fast MRI/CT reconstruction as well as immersive 3D surgical planning with VR/AR incorporation. With respect to drug discovery, these developments entail the use of GPU acceleration in molecular dynamics simulations which shortens the development cycle and finds new applications for existing drugs through virtual screening. Such decentralized frameworks for federated learning provide solutions to privacy and cross-institutional cooperation challenges since federated learning supports secure AI training across institutions while improving model accuracy in the process but keeping sensitive patient information confidential. Together, these innovations drive a paradigm shift toward proactive, personalized, and interconnected healthcare.

Presentation session by Dr Uzair.

Edge Computing for IoT and Wearables

Impact: Access to specialist care without leaving remote areas. Emerging technologies are enhancing healthcare delivery and management through the concepts of decentralized computing, ethical governance, and accessible infrastructure. Edge computing adds to the functionality of IoT and wearable devices through on-device data processing, thus achieving near-real-time health insights by minimizing data exchange with cloud resources. Strong ethics and regulatory framework dealing with AI bias and other parameters, including compliance with HIPAA and GDPR, design systems with equity, transparency, and patient-centricity while respecting the principles of privacy and fairness. Cloud democratization democratizes the processing capacity, operating in a parallel fashion for the benefit of small institutions with scalable solutions and to fill the resource-access divide so that world-class tools can reach underserved populations. Telemedicine and remote surgery are taking advantage of low-latency networks to facilitate robotic procedures and virtual consultations, shattering geographical barriers and enabling remote communities to access specialized care. These innovations synergistically lead to a more responsive, inclusive, and ethically empowered healthcare ecosystem that prioritizes technological efficiency and human dignity.

Challenges: Energy use, data consistency, and infrastructure costs will be some of the challenges that will have to be overcome to fully gain these trends. Application of skills learnt by technologists working alongside clinicians and policymakers will be key in overcoming such hurdles.

Dr Uzair emphasized the related issue in Healthcare Data Systems.

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