SciFetch Report

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Request: I’m looking for the latest advancements in quantum machine learning applications for medical diagnostics

Summary

Quantum machine learning (QML) is emerging as a transformative approach in medical diagnostics, leveraging the computational power of quantum computing to enhance data processing and analysis. Recent advancements highlight the potential of QML in various aspects of medical diagnostics, from biomarker discovery to nanoparticle identification. 1. **ResQ: A Novel Framework to Implement Residual Neural Networks on Analog Rydberg Atom Quantum Computers** - This paper explores the implementation of residual neural networks (ResNets) on analog Rydberg atom quantum computers. The study suggests that quantum computing can accelerate machine learning processes, potentially improving the effectiveness of neural networks in medical diagnostics by leveraging quantum principles. 2. **How Quantum Computing Can Enhance Biomarker Discovery** - This perspective article discusses the role of quantum computing in advancing biomarker discovery, which is crucial for early diagnosis and personalized medicine. Quantum algorithms can process complex biological data and detect intricate correlations, offering significant improvements over classical methods. 3. **Quantum Machine Learning-Based Electrokinetic Mining for the Identification of Nanoparticles and Exosomes with Minimal Training Data** - This research introduces a QML approach for identifying nanoparticles and exosomes, which are vital in drug

delivery and cancer diagnostics. The method utilizes electrokinetic attributes, providing a cost-effective and efficient alternative to traditional identification techniques. 4. **The Potential Role of Quantum Computing in Biomedicine and Healthcare: The Next Frontier Beyond Artificial Intelligence** - This paper outlines the broader implications of quantum computing in healthcare, emphasizing its potential to surpass classical AI in processing complex biological data. Quantum-enhanced machine learning could revolutionize genomic analysis, diagnostics, and therapeutic interventions. 5. **Deep Genomics: Deep Learning-Based Analysis of Genome-Sequenced Data for Identification of Gene Alterations** - Although not exclusively focused on quantum computing, this paper highlights the integration of advanced computational methods, including QML, in genomic analysis. The convergence of these technologies enables the detection and interpretation of complex gene alterations, crucial for precision medicine. These papers collectively underscore the transformative potential of quantum machine learning in medical diagnostics, offering new avenues for early detection, personalized treatment, and efficient data processing. As QML continues to evolve, its integration into healthcare promises to enhance diagnostic accuracy and patient outcomes significantly.

Relevant Articles

1. Whole-Body Conditioned Egocentric Video Prediction

Date: 2025-06-26

Source: arXiv

URL: http://arxiv.org/abs/2506.21552v1

Abstract: We train models to Predict Ego-centric Video from human Actions (PEVA), given the past video and an action represented by the relative 3D body pose. By conditioning on kinematic pose trajectories, structured by the joint hierarchy of the body, our model learns to simulate how physical human actions shape the environment from a first-person point of view. We train an auto-regressive conditional diffusion transformer on Nymeria, a large-scale dataset of real-world egocentric video and body pose ca...

2. mTSBench: Benchmarking Multivariate Time Series Anomaly Detection and Model Selection at Scale

Date: 2025-06-26

Source: arXiv

URL: http://arxiv.org/abs/2506.21550v1

Abstract: Multivariate time series anomaly detection (MTS-AD) is critical in domains like healthcare, cybersecurity, and industrial monitoring, yet remains challenging due to complex inter-variable dependencies, temporal dynamics, and sparse anomaly labels. We introduce mTSBench, the largest benchmark to date for MTS-AD and unsupervised model selection, spanning 344 labeled time series across 19 datasets and 12 diverse application domains. mTSBench evaluates 24 anomaly detection methods, including large l...

3. Where to find Grokking in LLM Pretraining? Monitor Memorization-to-Generalization without Test

Date: 2025-06-26

Source: arXiv

URL: http://arxiv.org/abs/2506.21551v1

Abstract: Grokking, i.e., test performance keeps improving long after training loss converged, has been recently witnessed in neural network training, making the mechanism of generalization and other emerging capabilities such as reasoning mysterious. While prior studies usually train small models on a few toy or highly-specific tasks for thousands of epochs, we conduct the first study of grokking on checkpoints during one-pass pretraining of a 7B large language model (LLM), i.e., OLMoE. We compute the tr...

4. HalluSegBench: Counterfactual Visual Reasoning for Segmentation Hallucination Evaluation

Date: 2025-06-26

Source: arXiv

URL: http://arxiv.org/abs/2506.21546v1

Abstract: Recent progress in vision-language segmentation has significantly advanced grounded visual understanding. However, these models often exhibit hallucinations by

producing segmentation masks for objects not grounded in the image content or by incorrectly labeling irrelevant regions. Existing evaluation protocols for segmentation hallucination primarily focus on label or textual hallucinations without manipulating the visual context, limiting their capacity to diagnose critical failures. In respons...

5. DeOcc-1-to-3: 3D De-Occlusion from a Single Image via Self-Supervised Multi-View Diffusion

Date: 2025-06-26

Source: arXiv

URL: http://arxiv.org/abs/2506.21544v1

Abstract: Reconstructing 3D objects from a single image is a long-standing challenge, especially under real-world occlusions. While recent diffusion-based view synthesis models can generate consistent novel views from a single RGB image, they generally assume fully visible inputs and fail when parts of the object are occluded. This leads to inconsistent views and degraded 3D reconstruction quality. To overcome this limitation, we propose an end-to-end framework for occlusion-aware multi-view generation. O...

6. StruMamba3D: Exploring Structural Mamba for Self-supervised Point Cloud Representation Learning

Date: 2025-06-26

Source: arXiv

URL: http://arxiv.org/abs/2506.21541v1

Abstract: Recently, Mamba-based methods have demonstrated impressive performance in point cloud representation learning by leveraging State Space Model (SSM) with the efficient context modeling ability and linear complexity. However, these methods still face two key issues that limit the potential of SSM: Destroying the adjacency of 3D points during SSM processing and failing to retain long-sequence memory as the input length increases in downstream tasks. To address these issues, we propose StruMamba3D, ...

7. Continuous symmetry breaking in 1D spin chains and 1+1D field theory

Date: 2025-06-26

Source: arXiv

URL: http://arxiv.org/abs/2506.21540v1

Abstract: We argue that ground states of 1D spin chains can spontaneously break U(1) ``easy-plane'' spin rotation symmetry, via true long-range order of (S^x, S^y), at the phase transition between two quasi-long-range-ordered

phases. The critical point can be reached by tuning a single parameter in a Hamiltonian with the same symmetry as the XXZ model, without further fine-tuning. Equivalently, it can arise in systems of bosons with particle-hole symmetry, as a long-range-ordered transition point betwee...

8. WorldVLA: Towards Autoregressive Action World Model

Date: 2025-06-26

Source: arXiv

URL: http://arxiv.org/abs/2506.21539v1

Abstract: We present WorldVLA, an autoregressive action world model that unifies action and image understanding and generation. Our WorldVLA intergrates Vision-Language-Action (VLA) model and world model in one single framework. The world model predicts future images by leveraging both action and image understanding, with the purpose of learning the underlying physics of the environment to improve action generation. Meanwhile, the action model generates the subsequent actions based on image observations, ...

9. Maximal Matching Matters: Preventing Representation Collapse for Robust Cross-Modal Retrieval

Date: 2025-06-26

Source: arXiv

URL: http://arxiv.org/abs/2506.21538v1

Abstract: Cross-modal image-text retrieval is challenging because of the diverse possible associations between content from different modalities. Traditional methods learn a single-vector embedding to represent semantics of each sample, but struggle to capture nuanced and diverse relationships that can exist across modalities. Set-based approaches, which represent each sample with multiple embeddings, offer a promising alternative, as they can capture richer and more diverse relationships. In this paper, ...

10. ResQ: A Novel Framework to Implement Residual Neural Networks on Analog Rydberg Atom Quantum Computers

Date: 2025-06-26

Source: arXiv

URL: http://arxiv.org/abs/2506.21537v1

Abstract: Research in quantum machine learning has recently proliferated due to the potential of quantum computing to accelerate machine learning. An area of machine learning that has not yet been explored is neural ordinary differential equation (neural ODE) based residual neural networks (ResNets), which aim to improve the effectiveness of neural networks using the principles of ordinary differential equations. In this work, we present our insights about why analog Rydberg atom quantum computers are esp...

11. How quantum computing can enhance biomarker discovery.

Date: 2025-04-29

Source: PubMed

DOI: 10.1016/j.patter.2025.101236

URL: https://pubmed.ncbi.nlm.nih.gov/40575130

Abstract: Biomarkers play a central role in medicine's gradual progress toward proactive, personalized precision diagnostics and interventions. However, finding biomarkers that provide very early indicators of a change in health status, for example, for multifactorial diseases, has been challenging. The discovery of such biomarkers stands to benefit significantly from advanced information processing and means to detect complex correlations, which quantum computing offers. In this perspective, quantum algo...

12. Deep Genomics: Deep Learning-Based Analysis of Genome-Sequenced Data for Identification of Gene Alterations.

Date: 2025-06-01

Source: PubMed

DOI: 10.1007/978-1-0716-4690-8_20

URL: https://pubmed.ncbi.nlm.nih.gov/40553343

Abstract: The convergence of next-generation sequencing and advanced computational methods has reshaped genomic analysis by enabling unprecedented volumes of

molecular data to be generated and scrutinized. This chapter surveys the rapidly evolving landscape of deep genomics, highlighting how breakthroughs in deep learning frameworks-such as Convolutional Neural Networks, Recurrent Neural Networks, Transformers, and Graph Neural Networks-allow researchers to detect, characterize, and interpret complex gene...

13. Quantum machine learning-based electrokinetic mining for the identification of nanoparticles and exosomes with minimal training data.

Date: 2025-05-21

Source: PubMed

DOI: 10.1016/j.bioactmat.2025.03.023

URL: https://pubmed.ncbi.nlm.nih.gov/40496630

Abstract: Synthetic and naturally occurring particles, such as nanoparticles (NPs) and exosomes; a type of extracellular vesicles (EVs), have garnered widespread attention across various fields, including biomaterials, oncology, and delivery systems for drugs and vaccines. Traditional methods for identifying NPs and EVs, such as transmission electron microscopy, are often prohibitively expensive and labor-intensive. As an alternative, the assessment of electrokinetic attributes such as zeta potential or e...

14. Machine reading and recovery of colors for hemoglobin-related bioassays and bioimaging.

Date: 2025-06-04

Source: PubMed

DOI: 10.1126/sciadv.adt4831

URL: https://pubmed.ncbi.nlm.nih.gov/40465724

Abstract: Despite advances in machine learning and computer vision for biomedical imaging, machine reading and learning of colors remain underexplored. Color consistency in computer vision, color constancy in human perception, and color accuracy in biomedical imaging are intertwined, complicating digital color-based diagnostics. Existing color reference charts and correction algorithms are inadequate for mobile health (mHealth) and telemedicine in digital health applications where detecting subtle color c...

15. Current AI technologies in cancer diagnostics and treatment.

Date: 2025-06-02

Source: PubMed

DOI: 10.1186/s12943-025-02369-9

URL: https://pubmed.ncbi.nlm.nih.gov/40457408

Abstract: Cancer continues to be a significant international health issue, which demands the invention of new methods

for early detection, precise diagnoses, and personalized treatments. Artificial intelligence (AI) has rapidly become a groundbreaking component in the modern era of oncology, offering sophisticated tools across the range of cancer care. In this review, we performed a systematic survey of the current status of AI technologies used for cancer diagnoses and therapeutic approaches. We discuss ...

16. Creatine kinase in prostate cancer: A biosensor-driven diagnostic paradigm.

Date: 2025-05-28

Source: PubMed

DOI: 10.1016/j.cca.2025.120402

URL: https://pubmed.ncbi.nlm.nih.gov/40446893

Abstract: Prostate cancer (PC) remains a leading cause of cancer-related morbidity in men worldwide. Emerging evidence suggests that the brain-type creatine kinase isoenzyme (CK-BB) is overexpressed in PC tissue and correlates with tumor progression. However, conventional assays for CK-BB lack the sensitivity and rapid turnaround required for routine clinical use....

17. Chemical imaging for biological systems: techniques, AI-driven processing, and applications.

Date: 2025-06-18

Source: PubMed

DOI: 10.1039/d4tb02876g

URL: https://pubmed.ncbi.nlm.nih.gov/40433910

Abstract: Visualizing the chemical compositions of biological samples is pivotal to advancing biological sciences, with the past two decades witnessing the emergence of innovative chemical imaging platforms such as single-molecule imaging, coherent Raman scattering microscopy, transient absorption microscopy, photothermal microscopy, ambient ionization mass spectrometry, electrochemical microscopy, and advanced chemical probes. These technologies have enabled significant breakthroughs in diagnosing pathol...

18. The Potential Role of Quantum Computing in Biomedicine and Healthcare: The Next Frontier Beyond Artificial Intelligence.

Date: 2025-04-22

Source: PubMed

DOI: 10.7759/cureus.82759

URL: https://pubmed.ncbi.nlm.nih.gov/40406784

Abstract: Quantum computing is poised to revolutionize biomedicine and healthcare, offering computational advantages that surpass classical and artificial intelligence-based approaches. Its ability to process complex biological data, simulate molecular interactions, and optimize drug discovery presents unprecedented opportunities for personalized medicine and disease modeling. Quantum algorithms can enhance genomic analysis, accelerating

diagnostics and therapeutic interventions. Quantum-enhanced machine ...

19. Enhancing thermal stability of pectinase using thermal titration molecular dynamics and density functional theory approach.

Date: 2025-05-21

Source: PubMed

DOI: 10.1080/07391102.2025.2505100

URL: https://pubmed.ncbi.nlm.nih.gov/40395215

Abstract: Pectinase, an enzyme primarily produced fromAspergillus niger, is essential in various industrial applications. However, the enzyme's functionality at high temperatures is challenging, restricting its effectiveness and potential uses. Therefore, the present study investigated the potential of peptide binding to enhance the thermal stability of pectinase. Thermal titration molecular dynamics (MD) simulations were performed at 300, 320, 340 and 360 K to identify regions susceptible to thermal fluc...

20. Exploiting network optimization stability for enhanced PET image denoising using deep image prior.

Date: 2025-05-16

Source: PubMed

DOI: 10.1088/1361-6560/add63f

URL: https://pubmed.ncbi.nlm.nih.gov/40341245

Abstract: Objective. Positron emission tomography (PET) is affected by statistical noise due to constraints on tracer dose and scan duration, impacting both diagnostic performance and quantitative accuracy. While deep learning-based PET denoising methods have been used to improve image quality, they may introduce over-smoothing, which can obscure critical structural details and compromise quantitative accuracy. We propose a method for making a deep learning solution more reliable and apply it to the condi...
