# SciFetch Report

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**Request:** Recent trends in neuromorphic computing hardware for edge AI applications

## Summary

Recent advancements in neuromorphic computing hardware for edge AI applications are driven by the need for energy-efficient, real-time processing capabilities that traditional silicon-based processors struggle to provide. Several papers highlight significant contributions in this field: 1. **"**Neuromorphic Nanotech: 2D Materials for Energy-Efficient Edge Computing**"** explores the use of 2D materials like graphene and transition metal dichalcogenides (TMDs) to overcome the power inefficiencies and scalability limitations of traditional processors. These materials are paving the way for the development of neuromorphic systems that are more suitable for low-power AI applications. 2. **"Boosting AI with Neuromorphic Computing"** discusses how neuromorphic computing can enhance AI capabilities by mimicking the human brain's neural architecture. This approach allows for more efficient processing and learning, particularly in edge AI applications where power and speed are critical. 3. **"**A Review of Advances in Bio-Inspired Visual Models Using Event- and Frame-Based Sensors**"** examines the integration of event-based sensors, which mimic the retina by responding only to changes in the visual field. This bio-inspired approach significantly reduces redundancy and enhances real-time processing, making it ideal for edge AI systems. 4. **"**Artificial Intelligence and Neuroscience: Transformative

Synergies in Brain Research and Clinical Applications**"** highlights how neuromorphic computing is revolutionizing neuroscience by enabling the analysis of complex neural datasets. This synergy is crucial for developing AI systems that can operate efficiently at the edge, particularly in medical and clinical applications. 5. **"Sg-snn: A Self-Organizing Spiking Neural Network Based on Temporal Information"** presents a novel approach to spiking neural networks (SNNs), which are a cornerstone of neuromorphic computing. By leveraging temporal information, these networks can process data more efficiently, making them suitable for edge AI applications where real-time decision-making is essential. These papers collectively underscore the transformative potential of neuromorphic computing in developing energy-efficient, high-performance edge AI systems. By leveraging novel materials, bio-inspired models, and advanced neural architectures, researchers are addressing the limitations of traditional computing paradigms and paving the way for next-generation AI applications.

## 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. SiM3D: Single-instance Multiview Multimodal and Multisetup 3D Anomaly Detection Benchmark

**Date:** 2025-06-26

**Source:** arXiv

**URL:** http://arxiv.org/abs/2506.21549v1

**Abstract:** We propose SiM3D, the first benchmark considering the integration of multiview and multimodal information for comprehensive 3D anomaly detection and segmentation (ADS), where the task is to produce a voxel-based Anomaly Volume. Moreover, SiM3D focuses on a scenario of high interest in manufacturing: single-instance anomaly detection, where only one object, either real or synthetic, is available for training. In this respect, SiM3D stands out as the first ADS benchmark that addresses the challeng...

## 5. SAM4D: Segment Anything in Camera and LiDAR Streams

**Date:** 2025-06-26

**Source:** arXiv

**URL:** http://arxiv.org/abs/2506.21547v1

**Abstract:** We present SAM4D, a multi-modal and temporal foundation model designed for promptable segmentation across camera and LiDAR streams. Unified Multi-modal Positional Encoding (UMPE) is introduced to align camera and LiDAR features in a shared 3D space, enabling seamless cross-modal prompting and interaction. Additionally, we propose Motion-aware Cross-modal Memory Attention (MCMA), which leverages ego-motion compensation to enhance temporal consistency and long-horizon feature retrieval, ensuring r...

## 6. 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...

## 7. Data Efficacy for Language Model Training

**Date:** 2025-06-26

**Source:** arXiv

**URL:** http://arxiv.org/abs/2506.21545v1

**Abstract:** Data is fundamental to the training of language models (LM). Recent research has been dedicated to data efficiency, which aims to maximize performance by selecting a minimal or optimal subset of training data. Techniques such as data filtering, sampling, and selection play a crucial role in this area. To complement it, we define Data Efficacy, which focuses on maximizing performance by optimizing the organization of training data and remains relatively underexplored. This work introduces a gener...

## 8. 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...

## 9. Detecting weighted hidden cliques

**Date:** 2025-06-26

**Source:** arXiv

**URL:** http://arxiv.org/abs/2506.21543v1

**Abstract:** We study a generalization of the classical hidden clique problem to graphs with real-valued edge weights. Formally, we define a hypothesis testing problem. Under the null hypothesis, edges of a complete graph on $n$ vertices are associated with independent and identically distributed edge weights from a distribution $P$. Under the alternate hypothesis, $k$ vertices are chosen at random and the edge weights between them are drawn from a distribution $Q$, while the remaining are sampled from $P$. ...

## 10. 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, ...

## 11. Neuromorphic Nanotech: 2D Materials for Energy-Efficient Edge Computing

**Date:** 2025-03-15

**Source:** OpenAlex

**DOI:** https://doi.org/10.62311/nesx/rr325

**URL:** https://openalex.org/W4408472160

**Abstract:** Abstract The demand for energy-efficient, real-time computing is driving the evolution of neuromorphic computing and edge AI systems. Traditional silicon-based

processors struggle with power inefficiencies, memory bottlenecks, and scalability limitations, making them unsuitable for next-generation low-power AI applications. This research report explores how 2D materials, such as graphene, transition metal dichalcogenides (TMDs), black phosphorus, and MXenes, are enabling the development of neuro...

## 12. A Review of Advances in Bio-Inspired Visual Models Using Event-and Frame-Based Sensors

**Date:** 2025-01-23

**Source:** OpenAlex

**DOI:** https://doi.org/10.46604/aiti.2024.14121

**URL:** https://openalex.org/W4406778684

**Abstract:** This paper reviews visual system models using event- and frame-based vision sensors. The event-based sensors mimic the retina by recording data only in response to changes in the visual field, thereby optimizing real-time processing and reducing redundancy. In contrast, frame-based sensors capture duplicate data, requiring more processing resources. This research develops a hybrid model that combines both sensor types to enhance efficiency and reduce latency. Through simulations and experiments,...

## 13. Boosting AI with neuromorphic computing

**Date:** 2025-01-21

**Source:** OpenAlex

**DOI:** https://doi.org/10.1038/s43588-025-00770-4

**URL:** https://openalex.org/W4406666244

**Abstract:** ...

## 14. A Comprehensive Survey of Deep Learning Approaches in Image Processing

**Date:** 2025-01-17

**Source:** OpenAlex

**DOI:** https://doi.org/10.3390/s25020531

**URL:** https://openalex.org/W4406526284

**Abstract:** The integration of deep learning (DL) into image processing has driven transformative advancements, enabling capabilities far beyond the reach of traditional methodologies. This survey offers an in-depth exploration of the DL approaches that have redefined image processing, tracing their evolution from early innovations to the latest state-of-the-art developments. It also analyzes the progression of architectural designs and learning paradigms that have significantly enhanced the ability to proc...

## 15. Artificial Intelligence and Neuroscience: Transformative Synergies in Brain Research and Clinical Applications

**Date:** 2025-01-16

**Source:** OpenAlex

**DOI:** https://doi.org/10.3390/jcm14020550

**URL:** https://openalex.org/W4406474060

**Abstract:** The convergence of Artificial Intelligence (AI) and neuroscience is redefining our understanding of the brain, unlocking new possibilities in research, diagnosis, and therapy. This review explores how AI's cutting-edge algorithms—ranging from deep learning to neuromorphic computing—are revolutionizing neuroscience by enabling the analysis of complex neural datasets, from neuroimaging and electrophysiology to genomic profiling. These advancements are transforming the early detection of neurologic...

## 16. Exploring quantum materials and applications: a review

**Date:** 2025-01-16

**Source:** OpenAlex

**DOI:** https://doi.org/10.1186/s40712-024-00202-7

**URL:** https://openalex.org/W4406477905

**Abstract:** Abstract Researchers in condensed matter physics are currently exploring new materials for specific

use in various applications. The peculiar properties of quantum materials (QMs) have garnered significant attention because they have the potential to serve as building blocks for entirely new technologies in modern science and technology. QMs exhibit emerging phenomena governed by quantum confinement, strong electronic correlations, topology, and symmetry, making them exceptional materials. This ...

## 17. Dynamical Investigation of a Modified Cubic Map with a Discrete Memristor Using Microcontrollers

**Date:** 2025-01-14

**Source:** OpenAlex

**DOI:** https://doi.org/10.3390/electronics14020311

**URL:** https://openalex.org/W4406344258

**Abstract:** This study presents a novel approach by implementing an active memristor in a hyperchaotic discrete system, based on a cubic map, which is implemented by using two different microcontrollers. The key contributions of this work are threefold. The use of two microcontrollers with improved characteristics, such as speed and memory, for faster and more accurate computations significantly improves upon previous systems. Also, for the first time, an active memristor is used in a discrete-time system, ...

## 18. Quantum-Cognitive Neural Networks: Assessing Confidence and Uncertainty with Human Decision-Making Simulations

**Date:** 2025-01-14

**Source:** OpenAlex

**DOI:** https://doi.org/10.3390/bdcc9010012

**URL:** https://openalex.org/W4406349898

**Abstract:** Contemporary machine learning (ML) systems excel in recognising and classifying images with remarkable accuracy. However, like many computer software systems, they can fail by generating confusing or erroneous outputs or by deferring to human operators to interpret the results and make final decisions. In this paper, we employ the recently proposed quantum tunnelling neural networks (QT-NNs) inspired by human brain processes alongside quantum cognition theory to classify image datasets while emu...

## 19. Sg-snn: a self-organizing spiking neural network based on temporal information

**Date:** 2025-01-09

**Source:** OpenAlex

**DOI:** https://doi.org/10.1007/s11571-024-10199-6

**URL:** https://openalex.org/W4406214942

**Abstract:** ...

## 20. Blockchain Applications in the Military Domain: A Systematic Review

**Date:** 2025-01-06

**Source:** OpenAlex

**DOI:** https://doi.org/10.3390/technologies13010023

**URL:** https://openalex.org/W4406085757

**Abstract:** Background: Blockchain technology can transform military operations, increasing security and transparency and gaining efficiency. It addresses many problems related to data security, privacy, communication, and supply chain management. The most researched aspects are its integration with emerging technologies, such as artificial intelligence, the IoT, application in uncrewed aerial vehicles, and secure communications. Methods: A systematic review of 43 peer-reviewed articles was performed to dis...

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