

Hello folks,

Here is what's been going on in medical physics and related areas the last 24 hours. Here's what you folks might find interesting today.

TOP PICKS

[Quasi-SVD: Learning a Lie-constrained matrix factorisation for real-time imaging](#) This paper introduces a differentiable, fully parallelized matrix factorization framework for GPUs that guarantees exact orthogonality for a single **Lie-parameterized factor** while recovering the remaining components through soft constraints. By prioritizing downstream reconstruction fidelity over exact spectral recovery, it accelerates computation by 3-20x relative to cuSOLVER and randomised SVD, enabling throughput above 25 FPS. This is a strong example of a geometric/Lie-constrained architectural primitive applied to **imaging physics and reconstruction**, specifically demonstrating robust domain transfer in ultrasound localisation microscopy and Mueller matrix polarimetry for neurosurgical tissue characterisation.

[Group Equivariant Diffusion for Anomaly Detection in Computational Cytology](#) This work proposes a **D4-equivariant diffusion framework** that enforces rotation and reflection symmetry both architecturally (via a D4-equivariant U-Net) and at inference (via equivariant noise coupling and frame averaging). Standard diffusion models often treat transformed views as distinct inputs, leading to unstable anomaly scores in cytology where cell-centric signals are rotation-invariant. By aligning the model with these biological invariances, the authors yield transformation-consistent pseudo-healthy reconstructions and more stable anomaly ranking, directly addressing the need for **equivariant/geometric architectures** in medical imaging.

[A systematic evaluation of machine learning classifiers for event-by-event background rejection in LAFOV PET scanners](#) This study tackles the substantial increase in background rates from accidental coincidences and scattered photons in long axial field-of-view (LAFOV) PET scanners. Rather than applying ML in post-processing, the authors formulate coincidence classification as a supervised multi-class problem and evaluate XGBoost, AdaBoost, and Neural Network classifiers as **pre-reconstruction filters** on raw data. A systematic robustness study via cross-phantom inference reveals that compact feature sets generalize significantly better across different phantom geometries, providing an effective and geometry-agnostic replacement for traditional cut-based selection in **imaging physics and reconstruction**.

[Unifying Active Learning and Semi-Supervised Learning for Medical Image Segmentation](#) This paper introduces RegAL, a unified active semi-supervised framework governed by a shared **topology-aware Pareto optimization** that couples sample acquisition with unlabeled data utilization. It evaluates images along voxel-wise uncertainty, feature diversity, and a novel topological consistency metric to select anatomically informative edge cases for annotation. The same criteria are used to identify geometrically stable atlas candidates for diffeomorphic registration-guided augmentation, addressing the cold-start problem in medical image segmentation under extreme annotation scarcity with a strong focus on **novel objectives**.

Back tomorrow with more!

P.S. In the most recent submission window: physics.med-ph: 3 papers cs.CV: 93 papers