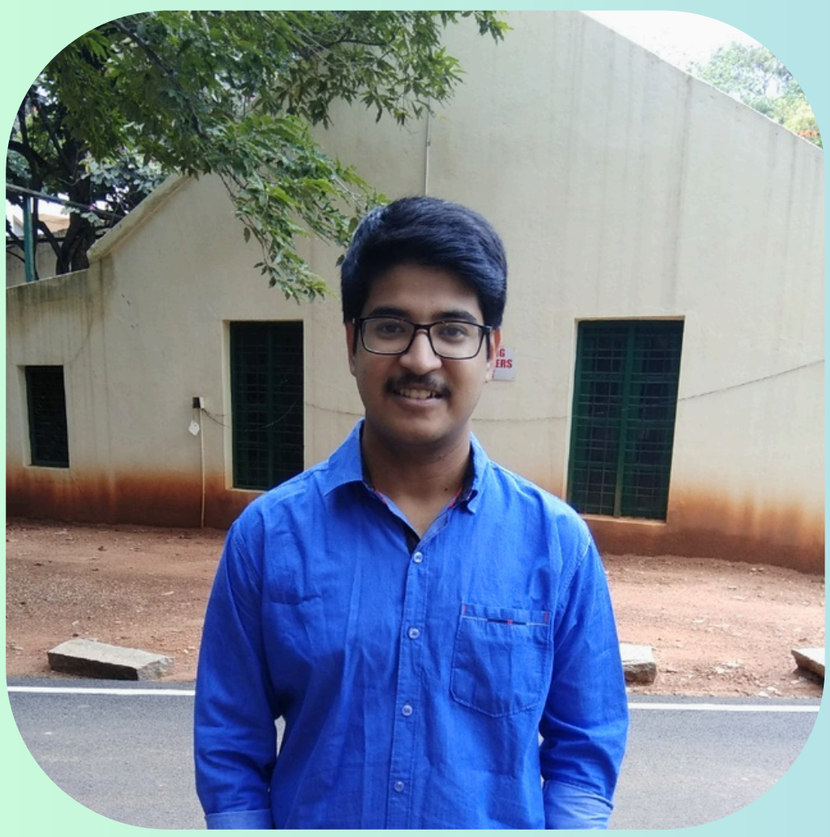
भारतीय विज्ञान संस्थान

DEPARTMENT OF INSTRUMENTATION AND APPLIED PHYSICS SEMINAR SERIES

Quantum-Inspired Benchmark for Intrinsic Dimension Estimation

SPEAKER : MR. ARITRA DAS

Machine learning models can generalize well on real-world datasets. According to the manifold hypothesis, this is possible because datasets lie on a latent manifold with small intrinsic dimension (ID). There exist many methods for ID estimation (IDE), but their estimates vary substantially. This warrants benchmarking IDE methods on manifolds that are more complex than those in existing benchmarks. We propose a Quantum-Inspired Intrinsic-dimension Estimation (QuIIEst) benchmark consisting of infinite families of topologically non-trivial manifolds with known ID. Our benchmark stems from a quantum-optical method of embedding arbitrary homogeneous spaces while allowing for curvature modification and additive noise. The IDE methods tested were generally less accurate on QuIIEst manifolds than on existing benchmarks under identical resource allocation. We also observe minimal performance degradation with increasingly non-uniform curvature, underscoring the benchmark's inherent difficulty. As a result of independent interest, we perform IDE on the fractal Hofstadter's butterfly and identify which methods are capable of extracting the effective dimension of a space that is not a manifold.



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13TH JANUARY

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04:00 PM

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ABOUT THE SPEAKER

Aritra Das is a 4th year PhD student at the University of Maryland, College Park. He previously was an undergraduate at IISc Bangalore, majoring in physics. Aritra's current interests lie at the intersection of physics and machine learning. He has previously worked on a broader emerging field called 'Physics of Learning' which seeks to understand physical principles of artificially intelligent systems. Currently, he also aims to investigate applications of ML to various physical problems, mainly in the domain of quantum information and processing.