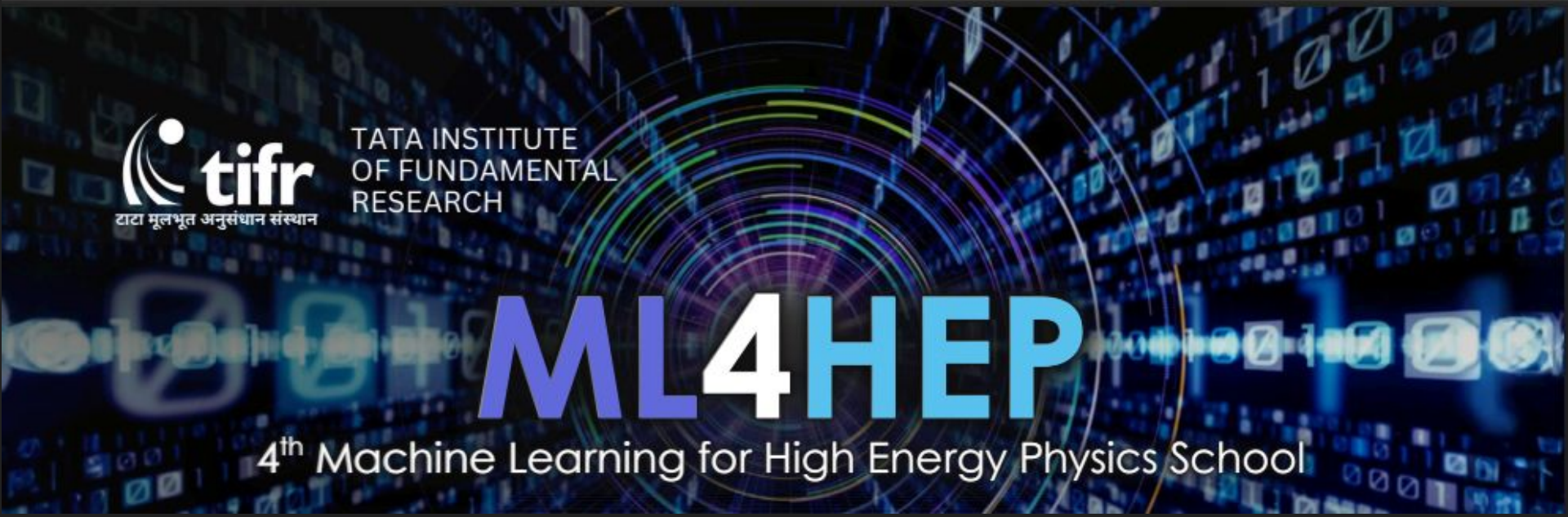
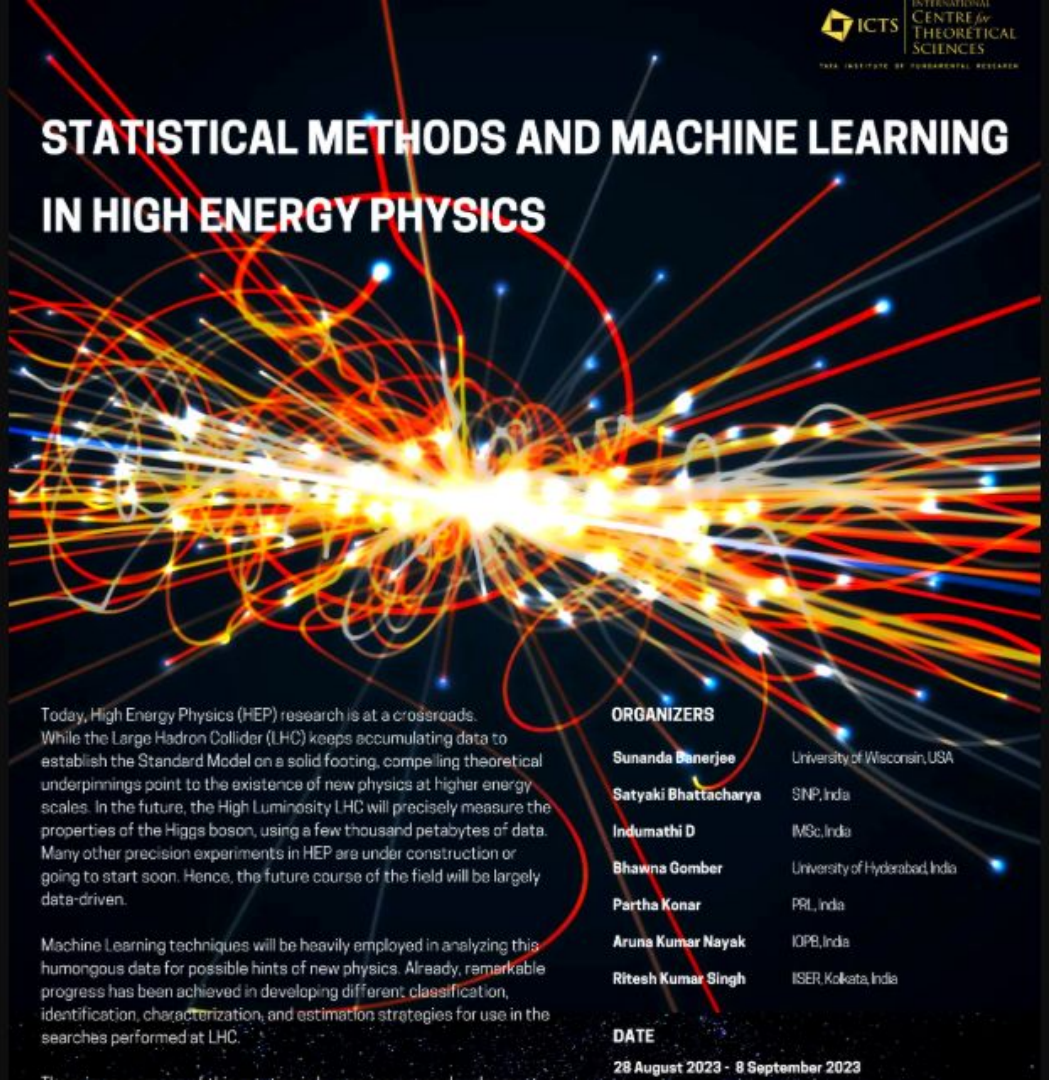
# ML4HEP 2026
# TIFR






2024 in IOP Bhubaneswar

2025 in IISER Kolkata

# Learning to discover: the Higgs boson machine learning challenge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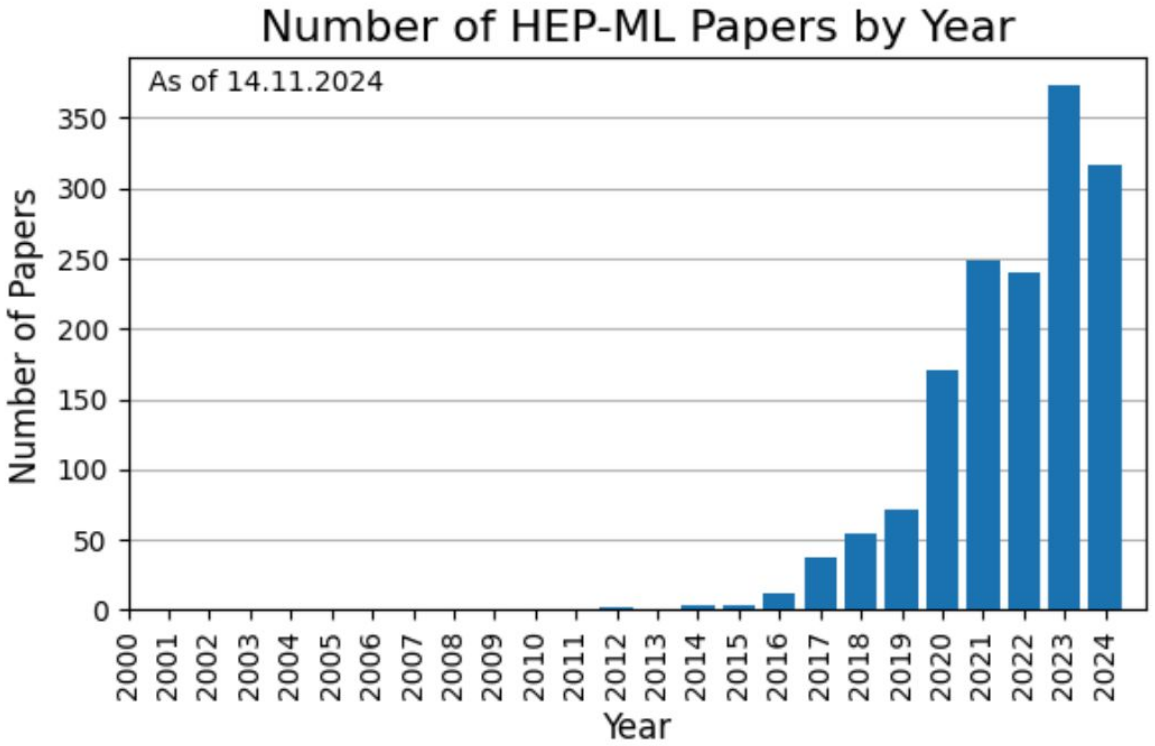
## Preamble

The Higgs boson machine learning challenge (HiggsML or Challenge in short) has been set up to promote collaboration between high energy physicists and data scientists. The ATLAS experiment at CERN provided simulated data used by physicists to optimize the analysis of the Higgs boson. The Challenge is organized by a group of ATLAS physicists and data scientists. It was hosted by Kaggle at https://www.kaggle.com/c/higgs-boson; the challenge data is now available on http://opendata.cern.ch/collection/ATLAS-Higgs-Challenge-2014;. This document provides technical background for the Challenge; reading and understanding it is not necessary to participate in the Challenge, but it is probably useful. No prior knowledge of high energy physics is required. This document has been minimally modified to serve as a permanent documentation for the dataset on opendata.cern.ch.

# Explosion of ML in HEP




https://iml-wg.github.io/HEPML-LivingReview/

# Machine Learning in Higgs Discovery

KUNGL. VETENSKAPS-AKADEMIEN
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During the 1990s, ANNs became a standard data analysis tool within particle physics experiments of ever-increasing complexity. Highly sought-after fundamental particles, such as the Higgs boson, only exist for a fraction of a second after being created in high-energy collisions (e.g. ~$10^{-22}$ s for the Higgs boson). Their presence needs to be inferred from tracking information and energy deposits in large electronic detectors. Often the anticipated detector signature is very rare and could be mimicked by more common background processes. To identify particle decays and increase the efficiency of analyses, ANNs were trained to pick out specific patterns in the large volumes of detector data being generated at a high rate.

ANNs improved the sensitivity of searches for the Higgs boson at the CERN Large Electron-Positron (LEP) collider during the 1990s [44], and were used in the analysis of data that led to its discovery at the CERN Large Hadron Collider in 2012 [45]. ANNs were also used in studies of the top quark at Fermilab [46].

https://www.nobelprize.org/uploads/2024/11/advanced-physicsprize2024-3.pdf