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Sophon meets LHC: Accelerating resonance discovery via signature-oriented pre-training

The search for heavy resonances beyond the Standard Model (BSM) is a key objective at the LHC. While the recent use of advanced deep neural networks for boosted-jet tagging significantly enhances the sensitivity of dedicated searches, it is limited to specific final states, leaving vast potential BSM phase space underexplored. In this talk, we introduce a novel experimental method, Signature-Oriented Pre-training for Heavy-resonance ObservatioN (Sophon), which leverages deep learning to cover an extensive number of boosted final states. Pre-trained on the comprehensive JetClass-II dataset, the Sophon model learns intricate jet signatures, ensuring the optimal constructions of various jet tagging discriminates and enabling high-performance transfer learning capabilities. We show that the method can not only push widespread model-specific searches to their sensitivity frontier, but also greatly improve model-agnostic approaches, accelerating LHC resonance searches in a broad sense.

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Track Classification: Machine Learning