EXPLORING THE ROLE OF DEEP LEARNING FOR HIGH ENERGY PHYSICS

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ABSTRACT

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Deep Learning has played a phenomenal role in making advances in many fields suc as computer vision, speech recognition, robotics. In this work, we explore the role of Deep Learning for problems in High Energy Physics. First, we present the complexities of the problem in detecting particles. Next, we present preliminary results on the applications of LSTMs to tracking particles in a detector array. We hope, with this work, to reach out to the broader machine learning community to both present our findings and seek out methods for solving challenging problems in high energy physics (HEP)

1 THE PATTERN RECOGNITION PROBLEMS IN HIGH ENERGY PHYSICS DETECTORS

Detectors typically are subterranean and are arranged in concentric layers around a core. Typically, an atoms of $_a rebombarded with aneutrons. The resulting splitting of the atom produces various subatomic particles. These particles exit the detector with different momenta, cha$

One of the pattern recognition tasks involved is to explain the trajectories of all particles from a single experiment. That is, given a 3D image $I(x, y, z)$, triplet of inputs, where each pixel has a binary value with 1 signifying a hit on the detector layer

The similarities in problems between those explored in computer vision, robotics and the HEP field are obvious. The obvious differences lie in the fact that in the case of HEP-LHC typically we would need to estimate the parameters of millions of tracks in parallel. Further, the required reliability of a model is significantly higher. For example, the existing state of the art methods can detect tracks with a reliability greater than 99%.

One advantage of solving this problem is that it could potentially have applications in real time vision and robotics. For example, to articulate a very high DOF actuator such as an elephant trunk, a humanoid arm, inferences of this nature are required to be solved.

2 MODELING

3 RESULTS