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Identifying mass composition of ultra high energy cosmic rays using deep learning

We introduce a novel method for identifying fractions of primary air shower particles in an ensemble of events using deep learning. The suggested approach is developed for the Monte-Carlo simulated data for the Telescope Array experiment. For a given hadronic model, the error of identifying individual fractions of primary particles in an ensemble is less than 7%. We show that the developed method is sensitive to the underlying hadronic model and study the corresponding systematic error.

Significance

In many physical experiments detectors readings are subject to high variance. This fact complicates the usage of standard machine learning techniques as they yield low accuracy under such conditions. We show how one can overcome this problem on the example of Telescope Array data. The main ingredients of the method are: 1) switching to predictions for an ensemble of events and 2) using the chain of two neural networks, one for individual events and one for ensembles of events, to get best accuracy.

References

https://www.youtube.com/watch?v=MLnLlDe8OYA&list=PLQKIHTdtNqvifTuKIFnEM1IdMMN_9pfrx&index=5
and soon paper on arXiv.

Speaker time zone

Compatible with Europe

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