

ICT PHD

Research project for a PhD curriculum in ICT – Computer Engineering and Science

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Proposed Title of the research:

Deep learning in real-time on the astrophysical data obtained from the Cerenkov CTA Observatory

Keywords – (5)

Deep learning, Real Time, Astrophysical Data, Cerenkov CTA Observatory, Big Data

Research objectives: – (max 10 rows)

Objective of the research activity is the development of on-line deep learning techniques in real-time (i.e., during the data acquisition) on astrophysical data of the CTA gamma-ray astronomical observatory, for the identification of transient events during data taking, with changing observational conditions and high data flow. The aim is to develop advanced online deep learning algorithms, with training on CTA data during acquisition, to 1) include changes in observational conditions in real time, 2) dynamically adapt algorithms to new patterns in the data to identify unknown sources and gamma-ray transients, integrating time series analysis with astronomical images. Due to the high volume of data (gigabytes/sec) typical of Big Data, the online execution of these algorithms requires the most advanced high performance computing technologies: IBM's Power technology will be used.

Proposed research activity – (max 10 rows)

The PhD student will carry out research on the topic of on-line deep learning techniques in real-time on astrophysical data of the Cherenkov Telescope Array (CTA) astronomical observatory, for the identification of transient astrophysical events in real time. The astronomy of transient events (a.k.a time-domain astronomy) is the most important scientific problem in the astrophysical field and in continuous evolution, with strong repercussions also on the research of gravitational waves.

A period of activity is expected to be carried out in the E4 Computer Engineering company of Scandiano (Reggio Emilia) which allows the Candidate to have all Power technology available, one of the most advanced high performance computing technologies, essential for the online execution of algorithms of deep learning on a high volume of data.

Supporting research projects (and Department)

Co-financing by: INAF - Osservatorio di Astrofisica e Scienza dello Spazio Bologna

Possible connections with research groups, companies, universities.

The research may involve the undergoing collaborations with research groups at:

- CTAO (CTA Observatory), with the head quarter located in Bologna
- Laboratoire d'Annecy de Physique des Particules (LAPP), Annecy, France
- Scientific groups of CTA Consortium (PHYS Workgroup)
- Software Engineering groups of CTA Consortium (Analysis and Simulation Workgroup)
- Collaboration with the AGILE space mission INAF team