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The Rise of AI for EO

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The Rise of AI for EO

AI and EO is a marriage made in heaven!,
Today, AI is in the midst of a true "renaissance", driven by Moore's Law* and now super-fed by Big Data. We believe AI has a huge, but still largely untapped potential for EO technology. In a sense, we are now at an inflection point, at a kind of crossroads of opportunities, whereby on the one hand AI is becoming one of the most transformative technologies of the century, while on the other hand European EO capability is delivering a totally unique and comprehensive and dynamic picture of the planet, thereby generating big open data sets to be explored by AI.
Due to the rapid increase in the volume and variety of EO data sources, AI techniques become increasingly needed to analyse the data in an automatic, flexible and scalable way. Today, EO data remotely sensed from space are particularly suited - but at the same time challenging - for AI processing as they are:

• Big in size and volume with Terrabytes of data routinely streamed daily from space, which at the end needs to be turned into "small"actionable information.

• Diverse including a variety of sensors from optical (multispectral and hyperspectral) to radar data. Up to now, AI has been applied mainly to optical imagery, in particular at very high resolution by use of traditional Computer Vision techniques (using mainly RGB bands). More work is needed to make full use of all available spatial, temporal and spectral information of EO data at the global scale. e.g. exploiting the full information of the "complex nature"of radar data within AI schemes, including information on the amplitude, frequency, phase or polarization of the collected radar echoes,

• Complex and physically-based capturing dynamic features of a highly non-linear coupled Earth System. This goes well beyond merely recognising cats and dogs, in images where a wide variety of training datasets are available (such as ImageNet) and also calls to integrate physical principles into the statistical approach.

Machines algorithms powered by AI are therefore critically needed to accelerate "insight"into the data but always in combination with domain experts vital to properly interpret the statistical correlations and data. The intersection of AI and EO remains an emergent field, but a rapidly growing one. There has been a lot of work on ML applied to EO over the past decade, but with the rapid emergence of Deep Learning, the field has been growing rapidly, as illustrated by the increase in the number of publications. However, although being very powerful, DL techniques of course suffer from their own inherent limitations such as being data hungry while lacking transparency and not being able to distinguish causation.

In this talk, we will present some of the ESA activities on AI4EO, and in particular the Φ-lab, in order to better understand how to harness the full power of Artificial Intelligence for Earth Observation (AI4EO).

Thematic area

1. Machine Learning for Earth System Observations - Including Retrieval Algorithms, Fast/Improved/New Forward Models, Advanced Quality Control, De-biasing Techniques

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