Artificial Intelligence for Weather Prediction and Climate Research

Gottfried Schwarz, Octavian Dumitru, and Mihai Datcu

DLR Oberpfaffenhofen, IMF, Wessling, Germany (gottfried.schwarz@dlr.de)

During the last decade, much progress was made in the fields of artificial intelligence and machine learning. Typical applications range from production control in industrial environments to the automated analysis of scientific data. This development is a result of theoretical and practical advances mainly reached by innovative data representation, feature extraction, clustering, classification, modelling, analysis of time series, prediction techniques, machine learning, querying of relationships within data sets stored in big archives, distributed processing on the web, etc.

In the overall geophysical domain, one can see numerous artificial intelligence examples presented in conferences and journal publications; however, new weather prediction and climate research techniques are less frequent than general technical image processing approaches as, for instance, developments for autonomous driving under realistic conditions.

When we try to compare and categorize the main scientific and technical artificial intelligence approaches, one can already recognize some established techniques and their future potential that could also be exploited more routinely in weather prediction and climate research.

We will present some typical state-of-the-art artificial intelligence techniques and their potential application in geophysics, in particular, for weather prediction and climate research. These techniques have to support the reliable extraction of geophysical quantities, together with their estimated error bars.

Another important point is the required implementation effort and risk. We will demonstrate some characteristic cases where artificial intelligence software tools are already available, and we will also outline some basic lessons learnt from the perspectives of remote sensing and distributed processing.

Finally, we will try to predict future developments in artificial intelligence and their impact on weather prediction and climate research.