

Virtual Event: ECMWF-ESA Workshop on Machine Learning for Earth System Observation and Prediction



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Type: **Oral presentation**

Bayesian Deep Learning for Data Assimilation

Tuesday, 6 October 2020 16:00 (30 minutes)

Deep Learning has been shown to be efficient for many data-assimilation problems, and many deep learning methods have been used for this purpose. However, these applications typically focus on obtaining a best estimate of the atmospheric state, while providing a proper uncertainty estimate is as least as important. This is even more problematic as deep learning is prone to overfitting as the number of parameters to be estimated is always larger than the output dimension. Ad hoc techniques like weight decay and drop out have been proposed to avoid the overfitting, and indeed they do provide a regularisation of the problem, but the methods cannot be seen consistently as prior information (even though this has been claimed in the literature).

In this presentation I will discuss the problem, show why standard techniques for uncertainty quantification are not appropriate, and formulate a principled way to treat uncertainty quantification in Deep Learning. Existing ideas for Bayesian Deep Learning have been shown to scale badly with dimension, so special interest will be given to scalability, exploring existing techniques from data assimilation. Since it is unlikely that the full data-assimilation system will be abandoned in favour of deep learning, the incorporation of deep learning with uncertainty quantification into an existing data-assimilation structure will also be discussed.

Thematic area

1. Machine Learning for Data Assimilation - Including Model Error Estimation and Correction, Parameter estimation, Fast linearised models for DA, Hybrid DA

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Session Classification: Session 3 (cont.) and Session 4: ML for Data Assimilation and ML for Product Development

Track Classification: ECMWF-ESA Workshop on Machine Learning for Earth System Observation and Prediction