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Uncertainties in Deep Learning

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Deep learning algorithms, based on deep neural networks, have been deployed for numerous applications over the past few years, especially in the fields of image processing and natural language processing. Their relevance are now studied for scientific applications, for instance, as new methods to solve inverse problems or as surrogate models to accelerate computations in complex simulations. In this framework, it is necessary to be able to provide a quantification of the uncertainty on the outputs given by these methods. However, in their conventional form, deep neural networks are used as deterministic algorithms and they do not raise uncertainty estimations on their predictions. Recent works are developed to address this problematic and the scientific literature provides some technics to model and estimate these uncertainties.

In this talk, we present a general overview of the state-of-the-art on this topic. We firstly introduce the notions and definitions for uncertainties and their origins in the case of machine learning predictions. Then, we present the main techniques that exist in the literature to quantify these uncertainties for deep neural networks and their possible limitations. Finally, we provide some elements to establish a methodology in order to validate and calibrate the uncertainties given by these methods.

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Classification de Session: Dealing with Uncertainties workshop