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Delivering added value services for deep learning in the EOSC

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Much hope has been recently placed on deep learning as a machine learning technique that enables scientists to develop novel hypotheses and analyse large and complex datasets. Deep learning techniques have emerged from two major technological developments. First, the evolution of the internet has led to the creation and global availability of large datasets. Second, through large-scale computing power, in particular with readily available GPU resources, optimization of large-scale networks with several layers of highly interconnected nodes has become feasible

Deep learning in scientific practice offers opportunities and challenges. The following three uses cases serve to illustrate this: Model training and re-training, model transfer, and model use and sharing.

Model training: For model raining a scientist may want to address a scientific problem or task by developing a new deep learning model on a complex scientific dataset. Apart from advanced machine learning expertise that is needed to design a suitable network architecture, the scientist is faced with a variety of nontrivial technological challenges. First, training of deep learning models is highly compute intensive, thus, the scientist needs access to adequate computing resources. Second, training of effective deep learning models requires access to very large datasets that need to be transferred close to the computing resources.

Model re-training: Deep convolutional neural networks (CNNs) are used to classify images into predefined taxonomic categories. CNNs decompose an image into a hierarchy of increasingly informative features. The features at the lower levels represent colors, contours, etc., whereas the features on the higher levels represent domain entities such as plant leaves or structures of biological cells or tissues. Parts of a CNN model that has learned to classify plant structures may be re-trained to classify cell or tissue structures. This is called transfer learning. The fundamental technological needs of re-training are similar to those needed for training a model from scratch, with the additional task of model transfer, including the transfer of relevant software libraries and transfer and integration of data.

Model use and sharing: A major scientific benefit of already existing deep learning models lies in sharing a model across the relevant scientific communities. This facilitates the scientific debate about the knowledge captured by the model and allows the community to use the model for relevant scientific tasks. Sharing and using a trained deep learning model with the scientific community may be realized as a web application. But in order to offer the model as a service, the model typically has to be transferred from a development environment towards a production environment, which is capable of offering the service in a sustainable way.

In this presentation we will showcase how the DEEP-Hybrid-DataCloud is developing services that will enable next generation e-Infrastructures to support machine learning and in particular deep learning applications covering the three aforementioned cases, and how these solutions can be used to bring knowledge closer to the users and citizens in the framework of the European Open Science Cloud.

Summary

In this presentation we will showcase how the DEEP-Hybrid-DataCloud is developing services that will enable next generation e-Infrastructures to support machine learning and in particular deep learning applications covering the three aforementioned cases, and how these solutions can be used to bring knowledge closer to the users and citizens in the framework of the European Open Science Cloud.

Type of abstract

Presentation

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