Workshop *AI-based data-driven science*

September 7, 2018 at University of Oslo

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The workshop was organized by the University Center for Information Technology (USIT) and the University of Oslo Library (UB) to map current activities and future needs related to the use of AI[1] in research and research-based education at the university. Some 40-50 participants from UiO, UiB and Sigma2 attended the workshop which featured talks on upcoming IT projects to support scientists and talks by scientists about their use or planned use of AI methods in research and education.

Talks covered a wide range of disciplines (health care, biostatistics, immunology, statistics, language technology, physics, mathematics, geo sciences, robotics and knowledge management), represented different levels of expertise and approaches in using AI methods and diverse needs for support from IT departments. Below is an overview of the findings and suggestions for follow-up steps to nurture collaboration on AI at UiO (and beyond). In general, findings and suggestions apply to both non-sensitive data and sensitive data.

Competence build up

From the presentations and discussions we deduced that a variety of competences are needed by both the scientists and the IT support staff. Below we group competences into four major steps of an AI workflow: use case, data organisation, model learning and deployment.

Use case: implications of applying AI; ownership of results; regulatory issues; define specific, relevant, attainable, measurable and timely goals

Data organisation: acquire, explore, visualize, clean, enrich, filter, format, normalize, structure, integrate, curate

Model learning: be aware of data scarcity, quality, dimensionality; feature engineering; model design, implementation, training, validation, tuning; manage large parameter spaces; be prepared to explain results

Deployment: integration of AI-based functionality into services; monitor results and compare with goals set by use case

Support types

In general, we note that larger organisational units and those with a longer tradition in applying AI methods are better positioned to help themselves, i.e., to procure and maintain IT environments, to develop their own software (solutions) and to educate them in the use of AI. We see the following five types of support needed:

- special hardware configurations usually one of GPUs, many cores or huge memory

- maintained software frameworks

- blueprints for AI-based services

- basic training (introductiory courses, hands-on tutorials, best practice guides) and user support

- advanced user support

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[1]We use AI a bit loosely here by referring to a broad range of methods originating from statistics and computer science. Machine learning could also be used referring to a sub class of methods been developed in statistics. More recently, the subfield of Deep Learning has gained a lot of attraction due to the availability of large data sets, capable hardware, and easy-to-use software frameworks.

Hardware and software requirements

Hardware and software requirements differ from discipline to discipline and even from application to application within a discipline. Below is a list of requirements which may not be needed in combination.

Hardware

- significant number of consumer-grade GPUs

- servers with many cores (CPU-intensive workloads)

- servers with large amounts of RAM

- fast disk I/O (for data-intensive workloads where a data sets do not fit into RAM)

Software

- support for a variety of programming languages, particularly, R, Python

- support for a variety of frameworks optimized to use the underlying hardware, i.e., TensorFlow, Keras, Caffe, PyTorch, CNTK, XGboost, IML, etc.

- support for visualisation packages, e.g., Tensorboard, Visdom

- support for easy to use interfaces, e.g., Rstudio, matlab, Jupyter notebook

- support for data-intensive middleware, e.g., Spark

Access to resources should support both interactive development and batch production modes.

Follow-up steps & recommendations for UiO AI hub-node project

- obtain hardware filling gaps in the e-Infrastructure available for researchers and research-based education (ensure cost-efficiency and avoid redundancy to existing resources)

- work with scientists on use cases to benchmark hardware & services and to build up competence in providing assistance

- establish a forum where everyone interested in AI can meet to exchange ideas, to support each other, to start collaborations and to inform themselve about resources, expertise, activities, etc.

    - create an online channel for providing ad-hoc support (e.g., Slack)
    - provide email contact to get support and an email list for announcements
    - start a seminar series including talks on technology, methods, applications and hands-on sessions
    - jointly participate in online competitions, e.g., Kaggle

- provide a "page" which collects all kinds of information regarding use of or work with AI, e.g., available resources at UiO or in Norway, teaching materials, expert contacts, events, online platforms (Kaggle, OpenML, . . .), etc.