NERC Centre for Doctoral Training in Oil & Gas (2018 start)

Project Title: An Artificial Intelligence Approach to Revisit History Matching

Host institution: Heriot-Watt University, EGIS, IPE

Supervisor 1: Romain Chassagne

Supervisor 2: Hamed Amini

Additional Supervisor (s): Colin MacBeth

Project description:

The current oil and gas fields are now challenging to produce from, the time for easy extraction is gone. More complex and accurate representations of the field with models are required to take any decision concerning the life of the field. A common technique is to update and constraint more frequently the model; with acquired data (well logs, seismic, coring etc.). These data are integrated together through history matching, a mathematical framework to correct the existing model to match to the observed data. One of the highly challenging tasks in the history matching procedure occurs when seismic is used. Indeed, seismic data needs to be processed through different and complicated steps which carries uncertainty, and is a difficult qualitative and quantitative mix of bias, errors, misinterpretations and cumulative numerical errors. For decades this uncertainty has been challenging to quantify, and it is still an unsolved problem up to now.

We propose in this project to replace these tedious multiple steps by an artificial intelligent framework (machine learning techniques). These methods, coupled with computing power, are mature enough to be carried over to this challenging topic of history matching. This new type of model update will deliver more rapid and reliable answers and then impact directly on decision-making. For instance, a successful output would be to propose zones for new infill drilling based on the Artificial Intelligence-driven history matched models. First, the student will get familiar with the data, then s/he will investigate the artificial intelligence framework (AIF) to develop for history matching. Finally, s/he will apply the designed AIF on the selected dataset in order to achieve the model update procedure. We already secured (already on my hard drive) a dataset from BP which is a good fit to this project. This will involve an entire project dataset of: 3D and 4D seismic data, wireline logs, production data, a field simulation model and possibly a geological model. The data will be for a field in UKCS.

CDT Research theme(s):

Artificial intelligence applied to Exploration in Challenging Environments for CDT research theme and AI for NPIF theme.

Research context:

The project itself and the tools developed for this project will be applicable on a wider domain, as it is about data integration. The machine learning tools and methodology used here could be applied to CO_2 projects for instance. More broadly, any domain involving data, specifically images (satellite imaging, medical imaging), to update a model is relevant and connected to this very project.

Research costs:

I confirm the £5k p.a. of allowance to support the student's research is enough for the needs of the project, e.g. equipment, conference travel.

Career routes:

Data integration team role in an Oil & Gas company, or more generally data scientist in Industry. On an academic side, postdocs in data integration/machine learning.

Submissions must conform to this single-sided A4 format. The Awards Committee reserves the right not to consider submissions that do not adhere to this condition.