FESAus July 2021 Sundowner Talk - The Benefits and Dangers of using Artificial Intelligence in Petrophysics – Dr Steve Cuddy

Artificial Intelligence, or AI, is a method of data analysis that learns from data, identify patterns and makes predictions with the minimal human intervention. Essentially AI solves problems by writing its own software. AI is bringing many benefits to petrophysical evaluation. Using case studies, this presentation describes several successful applications. The future of AI has even more potential. However, if used carelessly there are potentially grave dangers.

A complex Middle East Carbonate field needed a bespoke shaly water saturation equation. AI was used to 'evolve' an ideal equation, together with field specific saturation and cementation exponents. One gas field, on the UK continental shelf, had an 'oil problem'. Here, AI was used to unlock the hidden fluid information in the NMR T1 and T2 spectra and successfully differentiate oil and gas zones in real time. A North Sea field with 30 wells had shear velocity data (Vs) in only 4 wells. Vs was required for reservoir modelling and well bore stability prediction. AI was used to predict Vs in all 30 wells. Incorporating high vertical resolution data, the Vs predictions were even better than the recorded logs.

As it is not economic to take core data on every well, AI is used to discover the relationships between logs, core, litho-facies and permeability in multi-dimensional data space. As a consequence, all wells in a field were populated with these data to build a robust reservoir model. In addition, the AI predicted data upscaled correctly unlike many conventional techniques. AI gives impressive results when automatically log quality controlling (LQC) and repairing electrical logs for bad hole and sections of missing data.

AI doesn't require prior knowledge of the petrophysical response equations and is self-calibrating. There are no parameters to pick or cross-plots to make. There is very little user intervention and AI avoids the problem of 'garbage in, garbage out, by ignoring noise and outliers. AI programs work with an unlimited number of electrical logs, core and gas chromatography data; and don't 'fall-over' if some of those inputs are missing.

AI programs currently being developed include ones where their machine code evolves using similar rules used by life's DNA code. These AI programs pose considerable dangers far beyond the oil industry as described in this presentation. A 'risk assessment' is essential on all AI programs so that all hazards and risk factors, that could cause harm, are identified and mitigated.

Steve Cuddy holds a PhD in petrophysics from Aberdeen University. He also holds a BSc in physics and a BSc in astrophysics and philosophy. He writes AI software and has 45 years industry experience in petrophysics working with Schlumberger, BP and Baker Hughes. He is the inventor of the Fractal FOIL Function that describes the distribution of fluids in the reservoir model. In recognition of outstanding service to the SPWLA, Steve was awarded the Distinguished Service Award in 2018. He is a SPWLA Distinguished Lecturer for the current 2020-21 season.

DATE: **Tuesday July 13, 2021** - 5 – 6 PM, Sundowner 6-7pm (AWST, GMT+8)
VENUE: Ibis hotel (Perth), on the web (rest of the world)
COST: Members $30.00; Non Members $40.00; Students/Retirees $10.00; Remote access also available
              Online registration at www.fesaus.org by Friday 4th July at 11.00 am