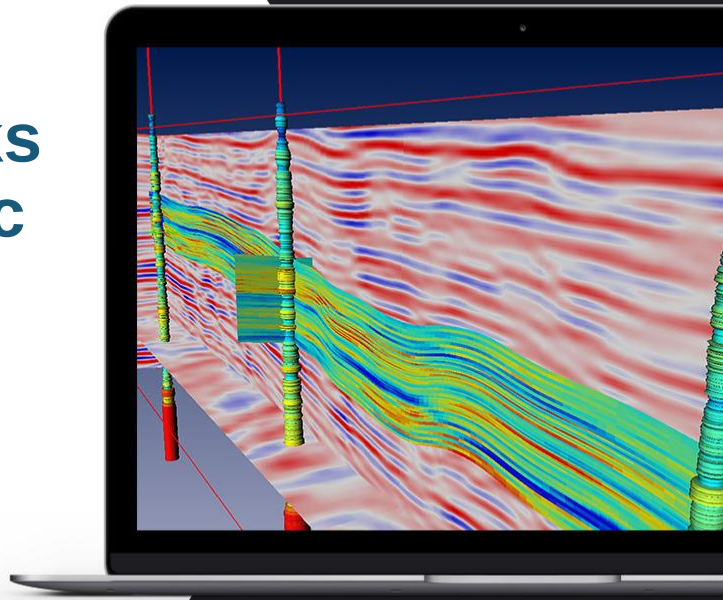
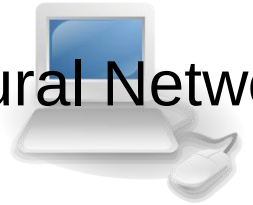
How to Train Deep Neural Networks is the Key to Predict More Realistic Reservoir Properties

Ali Moradi Tehrani

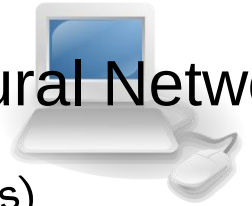
GeoSoftware™



Garbage in → Neural Networks → Garbage out



Bias in → Neural Networks → Bias out



Convolutional Neural Networks (CNNs)
Long Short Term Memory Networks (LSTMs)
Recurrent Neural Networks (RNNs)
Generative Adversarial Networks (GANs)
Radial Basis Function Networks (RBFNs)
Self Organizing Maps (SOMs)
Multilayer Perceptrons (MLPs)
Deep Belief Networks (DBNs)
Restricted Boltzmann Machines(RBMs)
Autoencoders
…

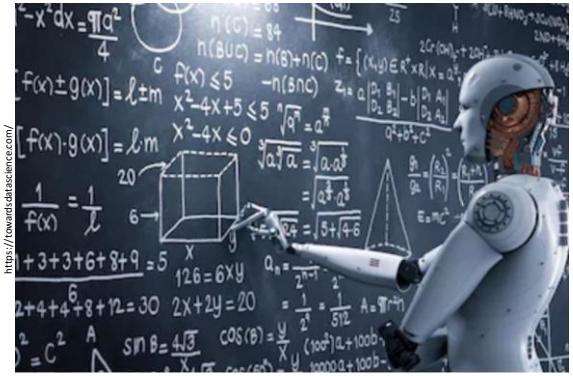
How to train Deep Neural Networks is the Key

Past

Move Science Forward

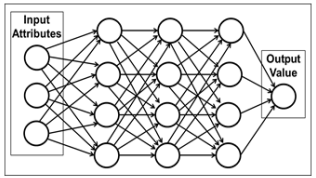
Now

Data Based Machine Learning Models



Teach Physics to Machine Learning Models

Make up Data



DNN

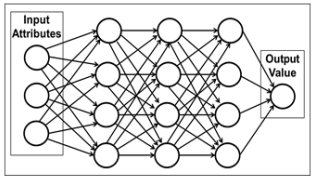
Prediction

Train the network with data only (partly garbage and bias)

Data

Physics Based Model

Augmented data



DNN

Prediction

Past

Move Science Forward

Now

Data-Driven ML

Trained by

Partly Non-Physical
Not Geologically Meaningful
Some Irrelevant Data

Non-Realistic Reservoir Properties

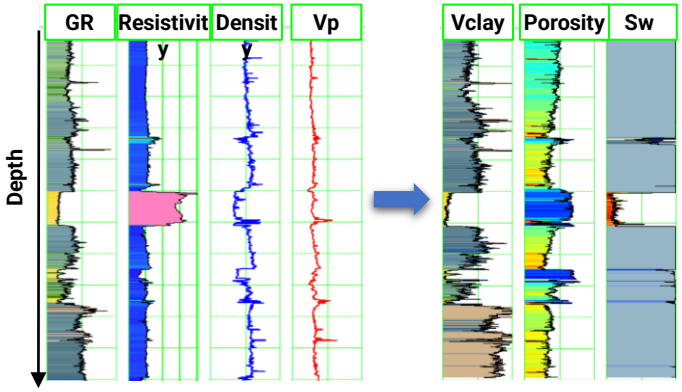
Physics-Driven ML

Trained by

Physically and Geologically Meaningful Data

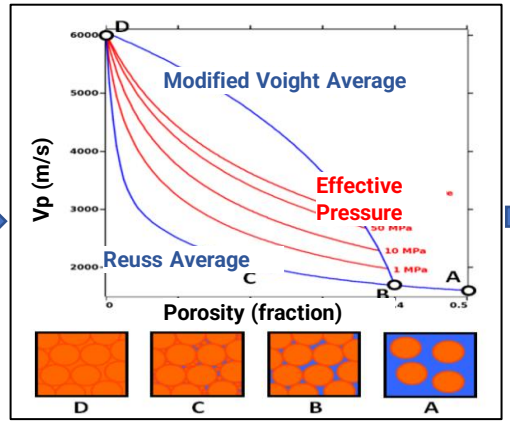
More Realistic Reservoir Properties

Physics-Driven ML

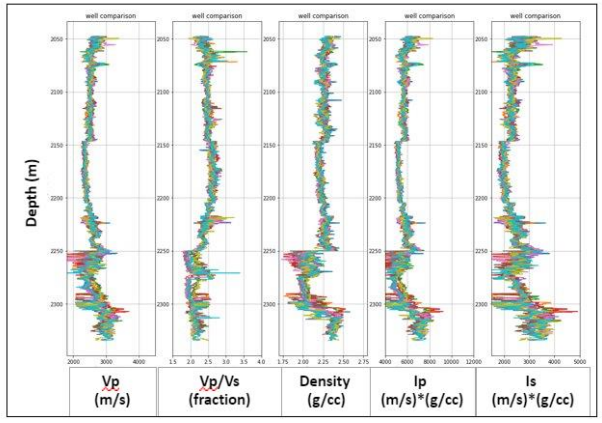


Petrophysical Properties

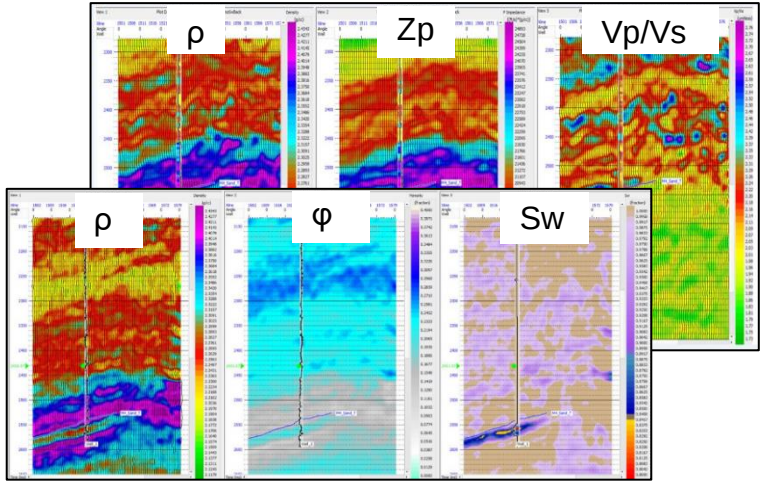
Reservoir Properties



Rock Physics Modeling

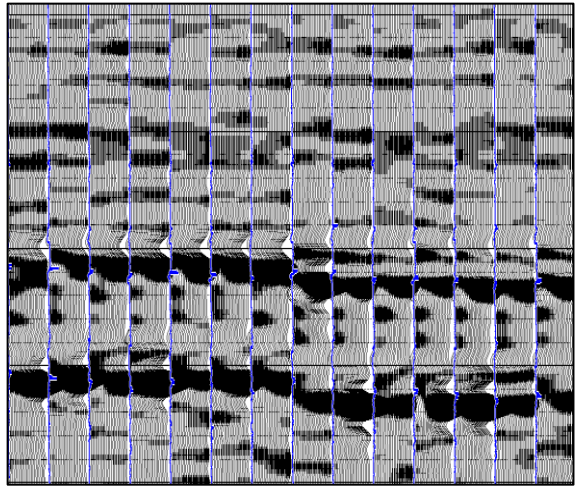


Synthetic Simulations of Well Data



Predicted Elastic and Rock Properties

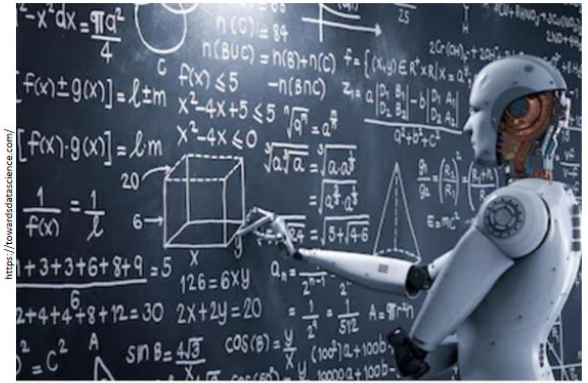
Train and Predict using Convolutional Neural Networks



Physics Based Model Augmented Data

Values:

- Physics Driven ML and not Assumptions and Guesses
- Geologically Meaningful and Realistic Predictions
- Reveals Full Wealth of Information from Data
- Fast and Easy Workflow to Operate
- Can address “not enough data” problem



Teach Physics to Machine Learning Models

Thank you

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