AI for inter-well saturation mapping

AI Berserkers

The problem and solution

Data Driven Method

Take the Data and use ensemble ML models:

-SciKit Bagging regressor. Train 2 hours. MSE - 0.086

- Catboost - CatBoost regressor.Train 10 minutes. MSE - 0.055

- XGBRegressor. Train 20 seconds. MSE-0.076

Data Driven+Physics

Take the Data and use ensemble ML models plus use physical models simulation:

- Archie's law, Archie's - Dahnov formula. We need more parameters for the equation.We use a=1,n=2,m=2 and Pickett plot.

Reformulated for electrical resistivity, the equation reads

$$R_t = a\phi^{-m} S_w^{-n} R_w$$

with R_t for the fluid saturated rock resistivity, and R_w for the brine resistivity.

Challenges deep-dive

Challenge 1

Data interpretation problem.

We try to understand how the data is organise. It takes some time to understand but we manage it.

Challenge 2

Materials about petrophysics.

We try to get some domain specific information about problem.

Challenge 3

Choose right models and combine with physics simulations.

We need to choose ensemble models, deep learning models. What best models Archie,double water ets?

Data Exploration

Porosity Distribution

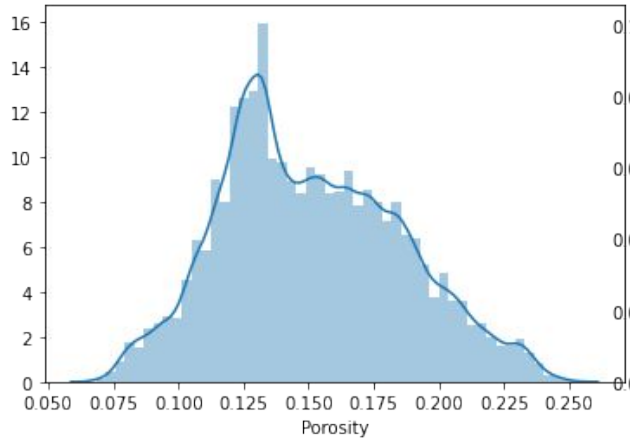
Clearly see close to normal data distribution.

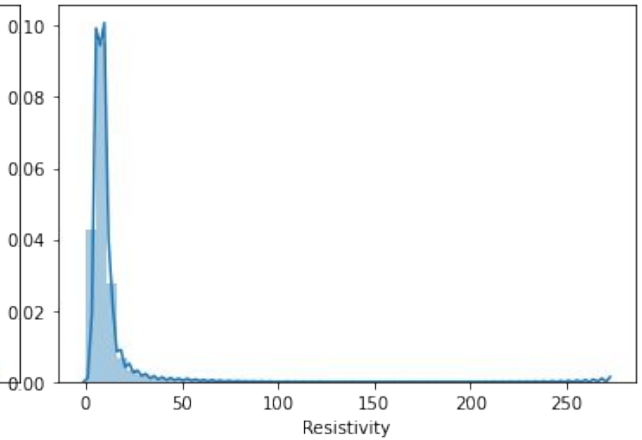
Resistivity Distribution

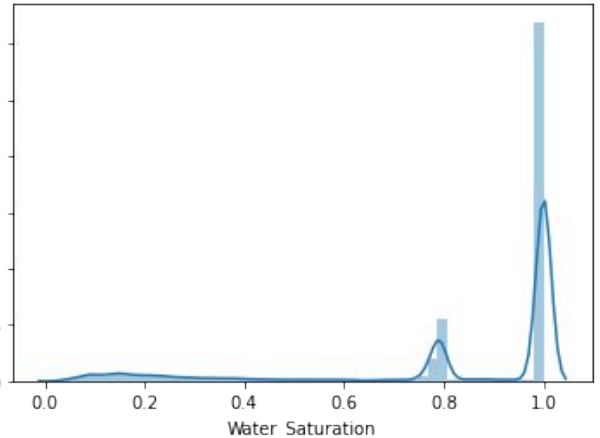
Most of the data between 0 and 15.

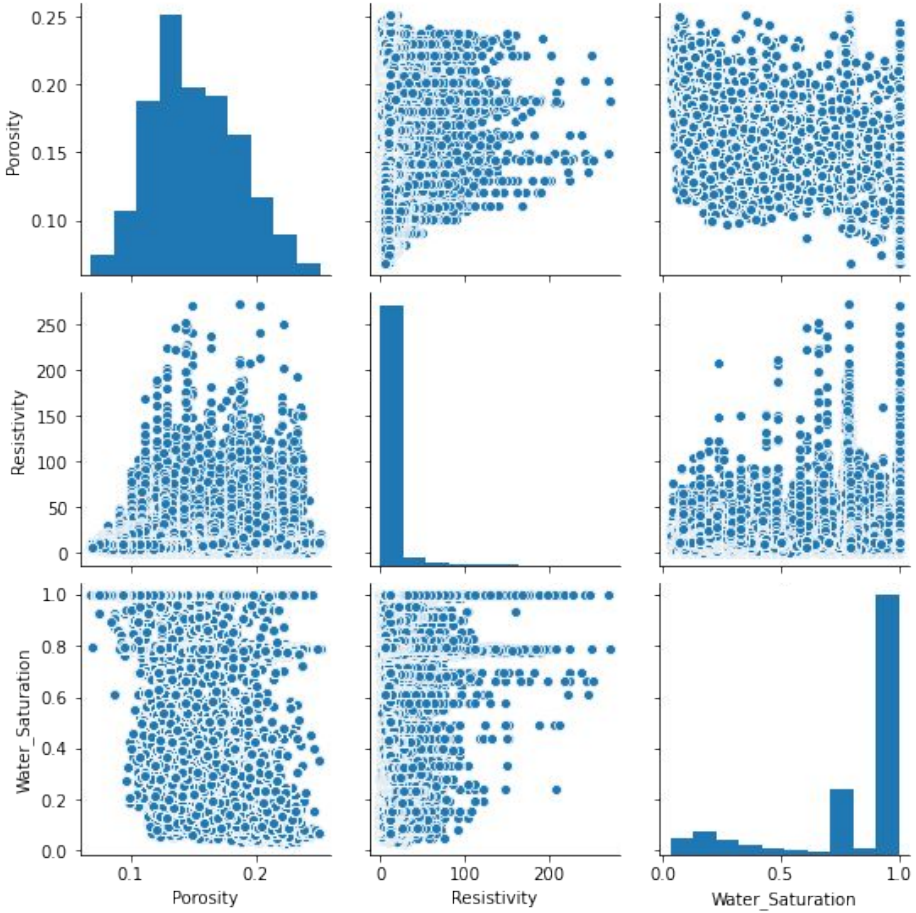
Water Saturation Distribution

Two peaks 1.0 and 0.8

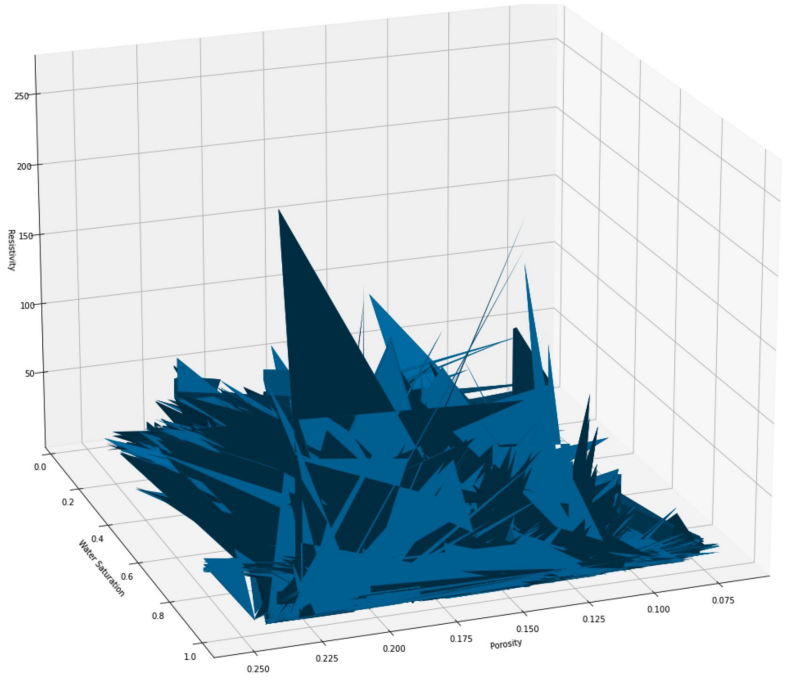








Pair plot correlation chart between all features. Not seen any good correlation.



3D Cube model.It helps us to correctly interpret the data.

Possible models strategy