Energy A.I. Hackathon 2022

Hackathon Project Final Presentation

March 27th, 2022

NFL

(No Free Lunch)

Javier Guerrero, Petroleum Engineering
Viridiana Salazar, Petroleum Engineering
Shuhan Shen, ORIE
Junyu Yao, Physics

What start here change the world!

Hook'em

Executive Summary

The Problem

Select the location of the next three oil production wells to be drilled in order to maximize the production for the next two years using Machine Learning models.

Our Solution

Integrate expert knowledge, geostatistical methods, and uncertainty modelling into our machine learning workflow to maximize the production of the following three wells to be drilled

Our Learning Outcomes

- Actually, cleaning and preparing the data **really** takes more than % of the time in a ML project.
- Expertise knowledge is a critical skill in every ML step. (Thanks to all our advisors in this Hackathon for share their knowledge with us!)
- There is a big potential in the Oil and Gas industry , which is a highly productor of big data, to solve problems by using ML techniques

Our Recommendation

- We have made some assumptions due to time constrain. However, in real life, we need to consider things such as the drainage radius of each well, workovers, maintenances of superficial facilities among other things that can affect the forecasting of oil production.

The University of Texas at Austin
Hildebrand Department of Petroleum and Geosystems Engineering
Cockrell School of Engineering

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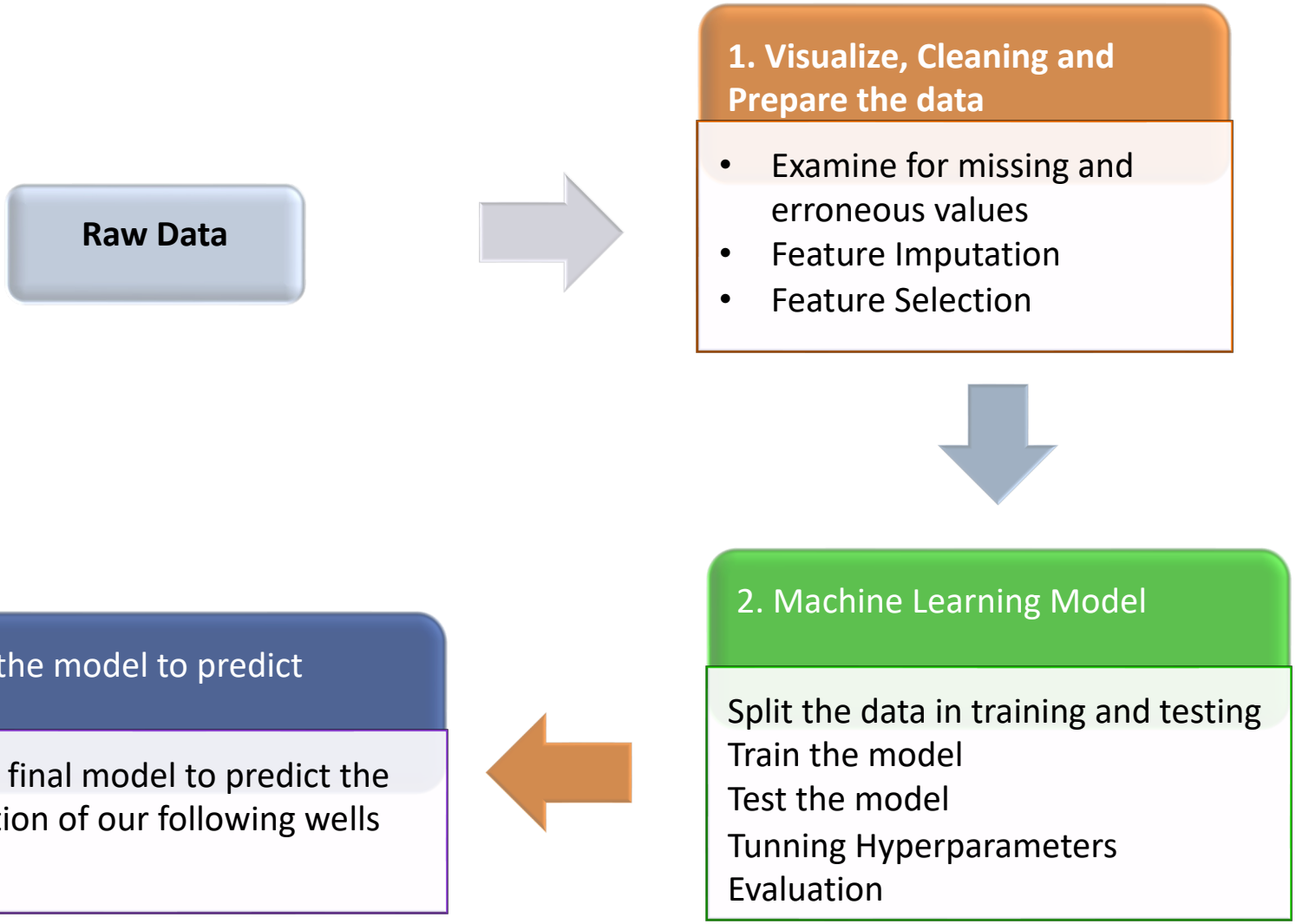

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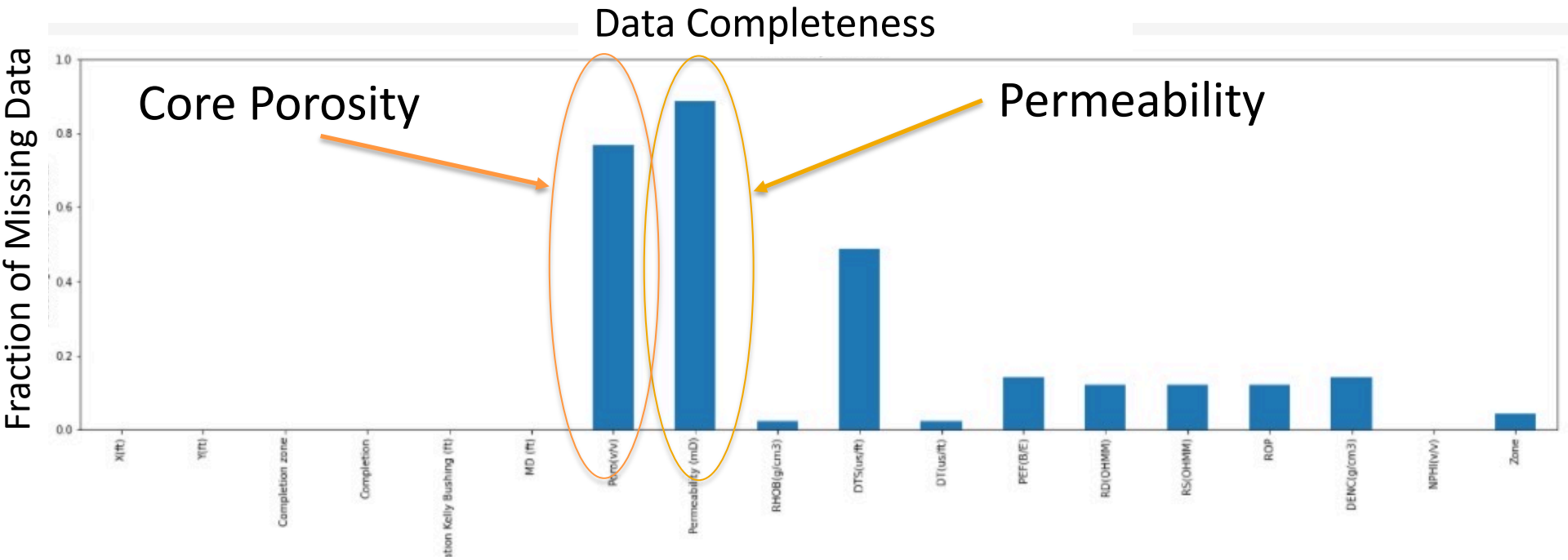
Feature Imputation

1. **Density**
   - K-Nearest Neighbors
2. **Porosity**
   - Multilinear regression (Density, NPHI)
3. **Acoustic Impedance Imputation**
   - Interpolation from the 2D MAP
4. **Permeability Imputation**
   - Petrophysics equations (Karman-Kozeny relation)



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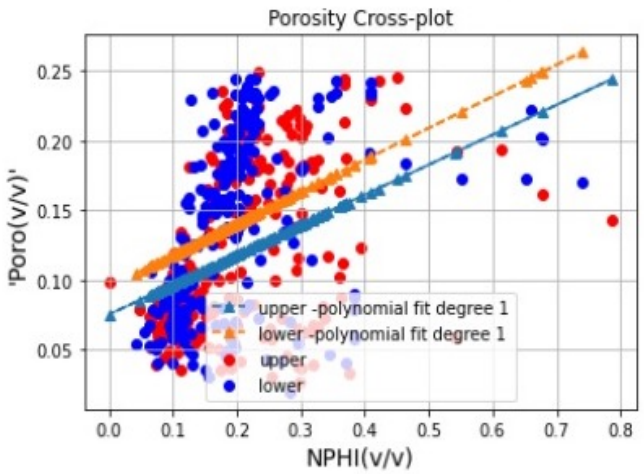
Feature Imputation

Porosity

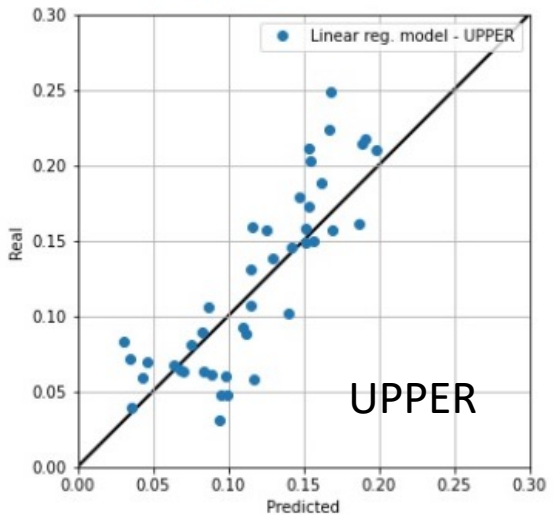


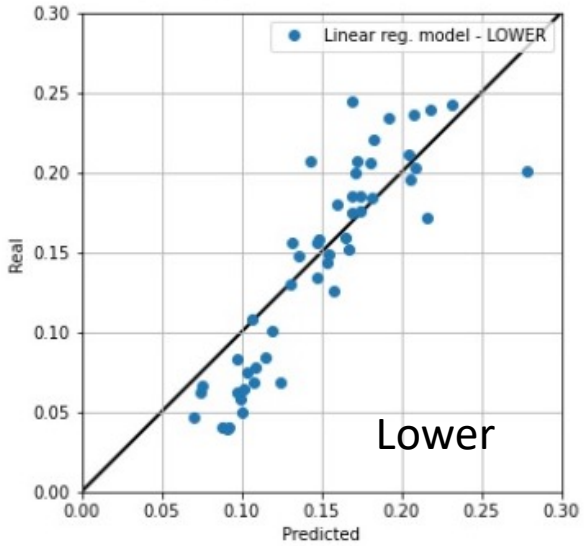
Linear Regression between NPHI and Core Porosity

Not good

Multivariate Linear Regression to predict porosity as a function of Density and NPHI

Good





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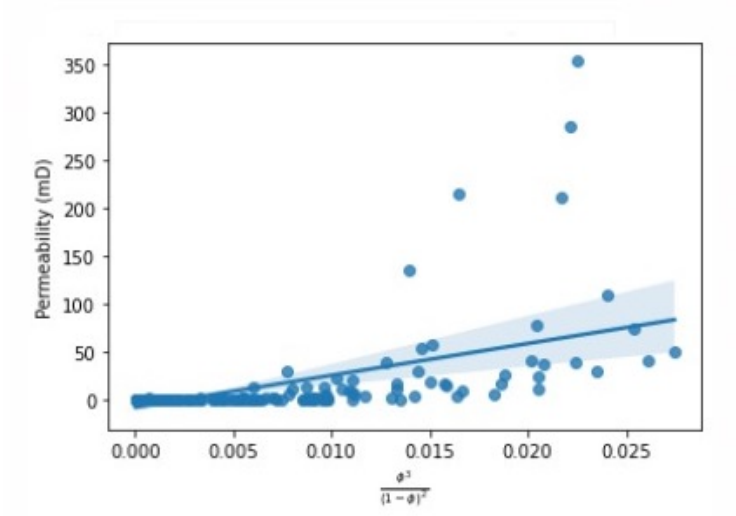
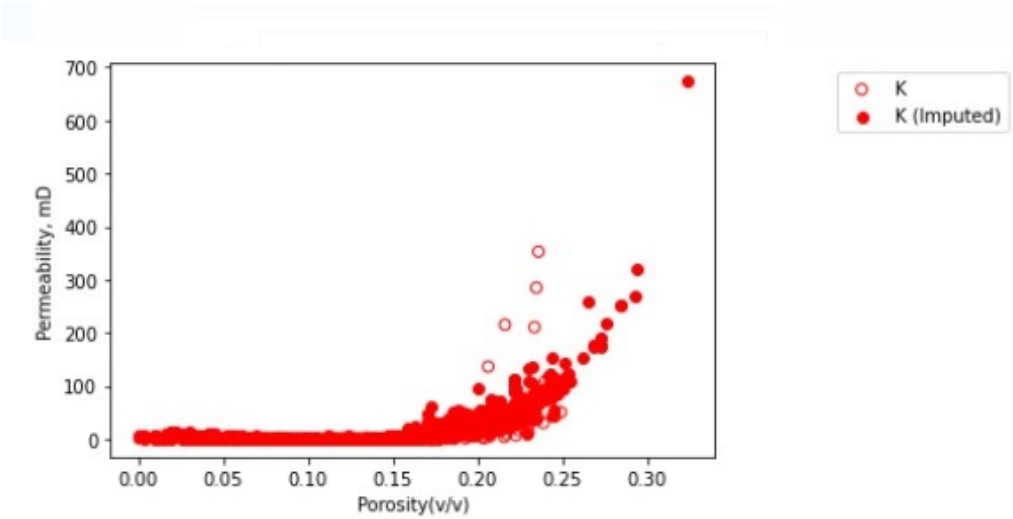
Feature Imputation

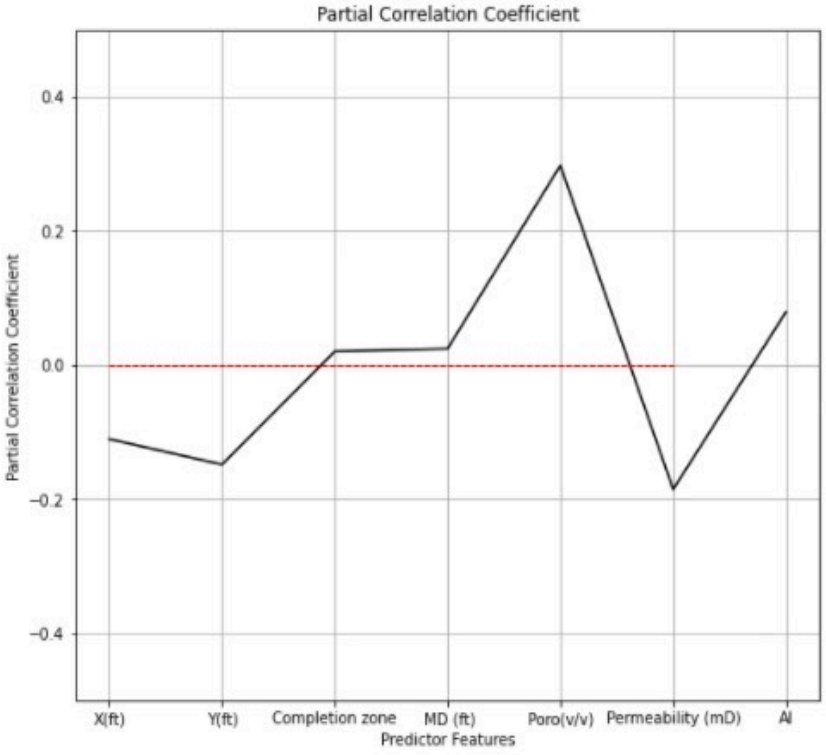
Permeability

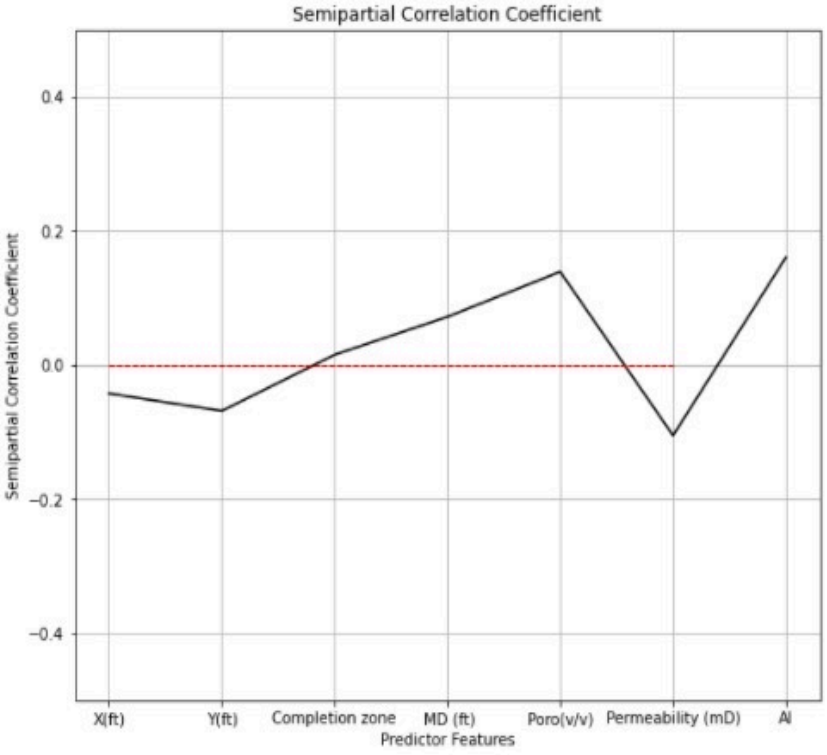


Permeability (Porosity)



Feature Ranking and Selection





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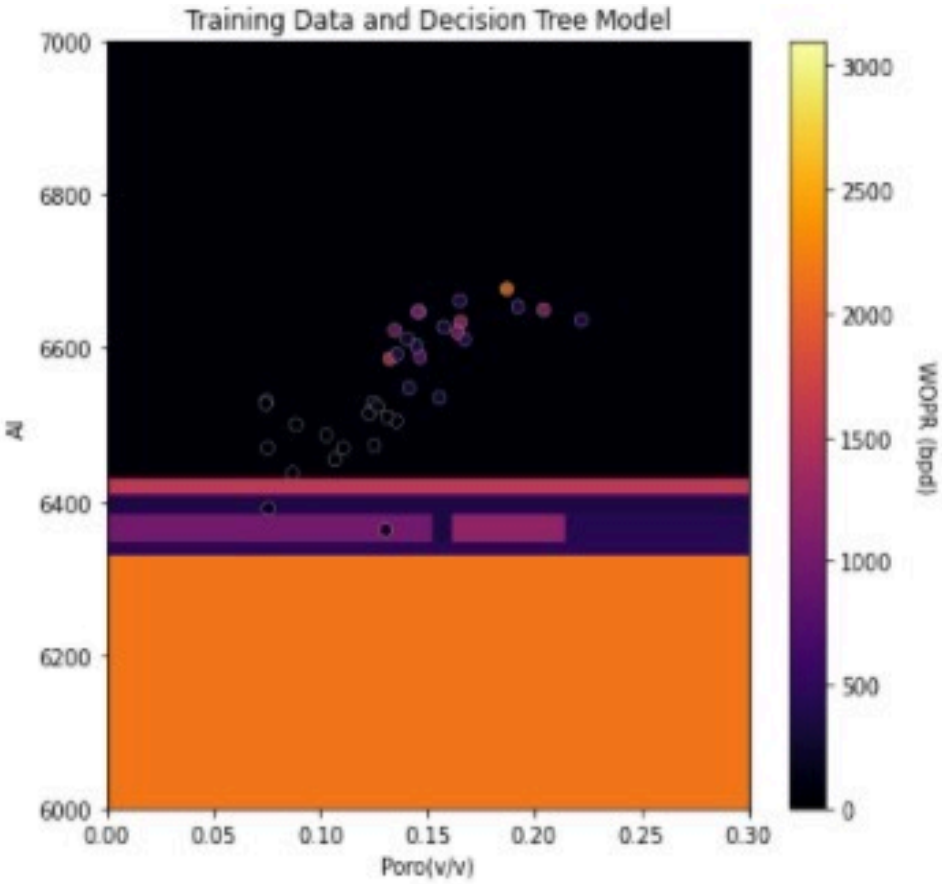
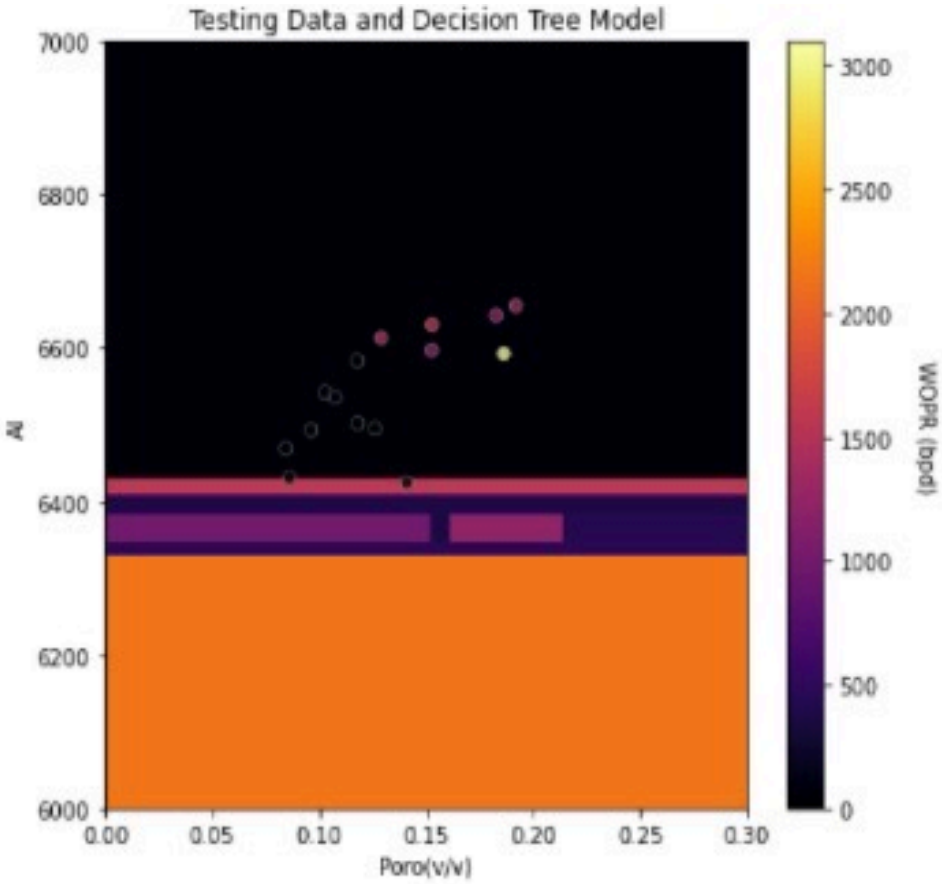
Decision Tree

Training

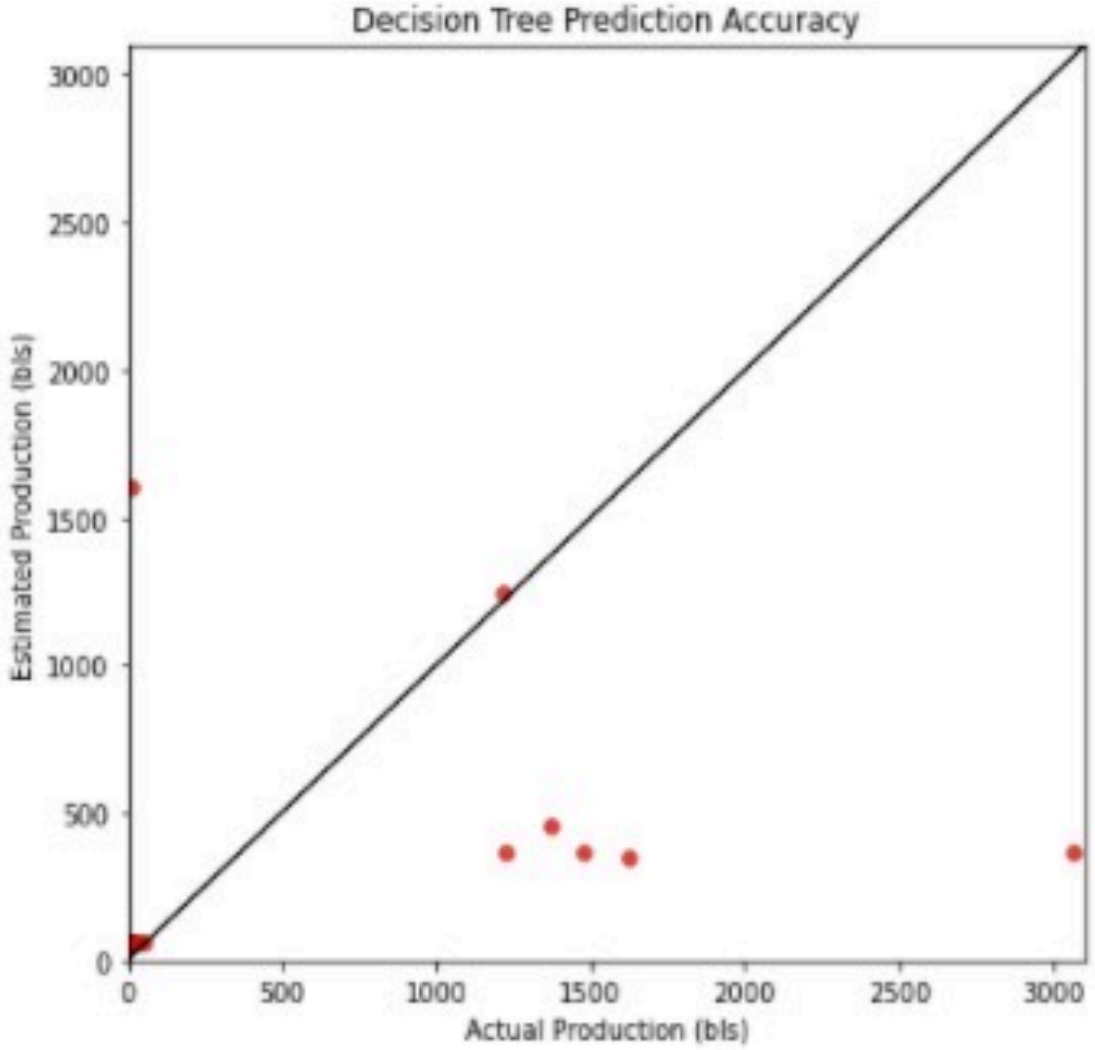


Testing



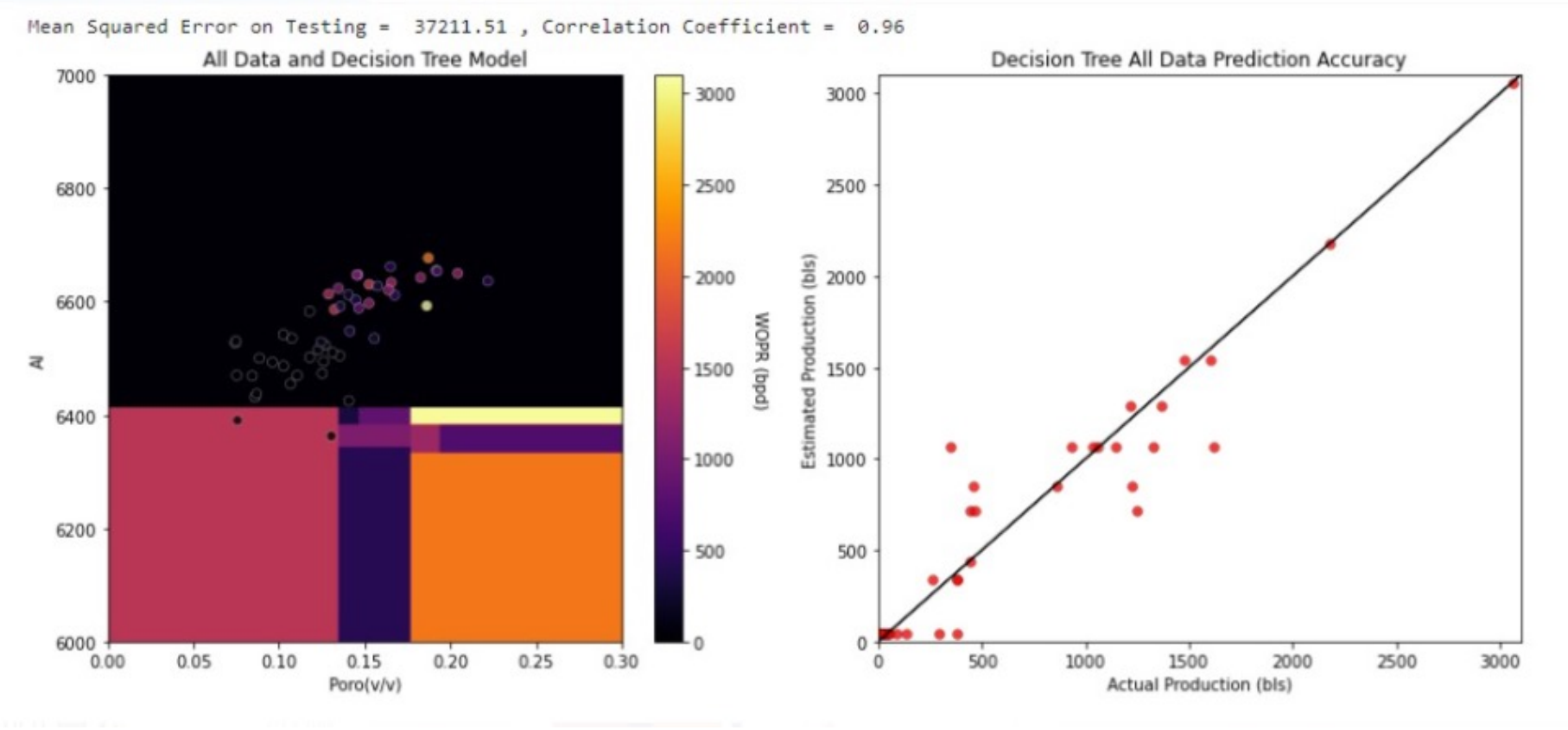
Decision Tree

Testing data Prediction Accuracy before hyperparameter tunning



Decision Tree

Final Model after hyperparameter tunning



Nodes=3 MSE= 176144.81 , Correlation Coefficient = 0.795
Nodes=5 MSE= 88694.48 , Correlation Coefficient = 0.910 5
Nodes=10 MSE= 37211.51 , Correlation Coefficient = 0.96

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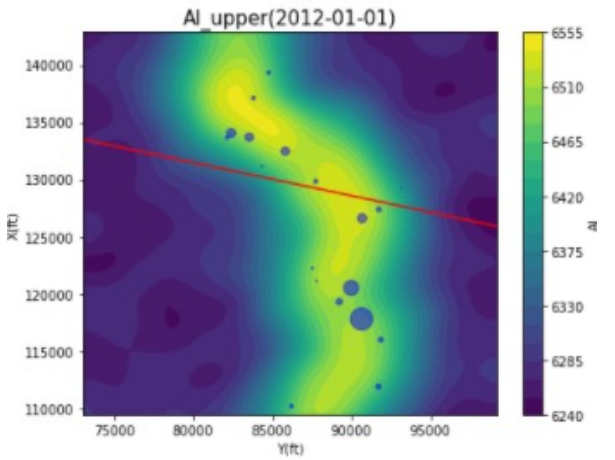
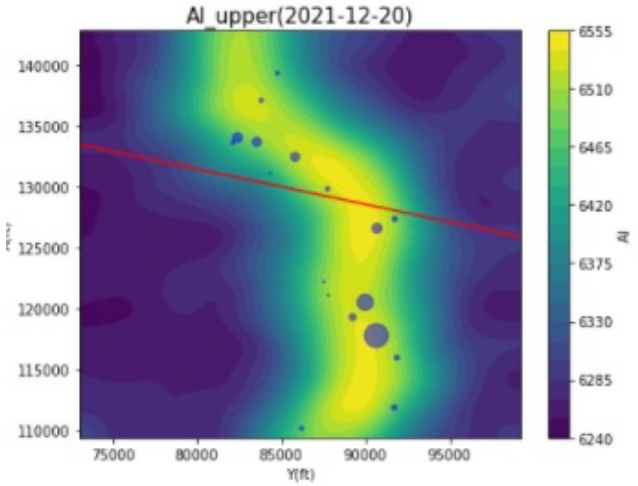
Feature Selection

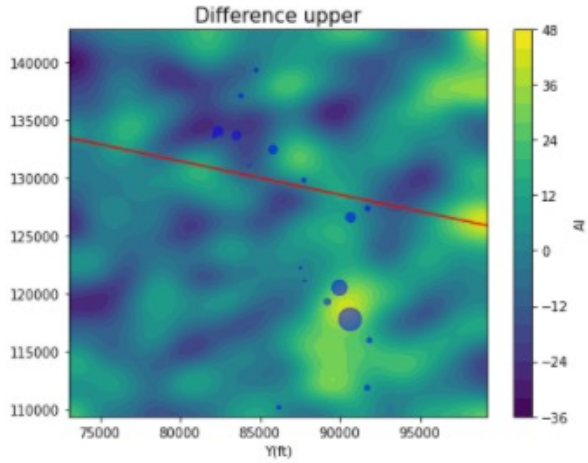
2021 – 2012=9 years
Rock density is the same
The AI difference along time give us an idea about the change in the fluids inside the porous media

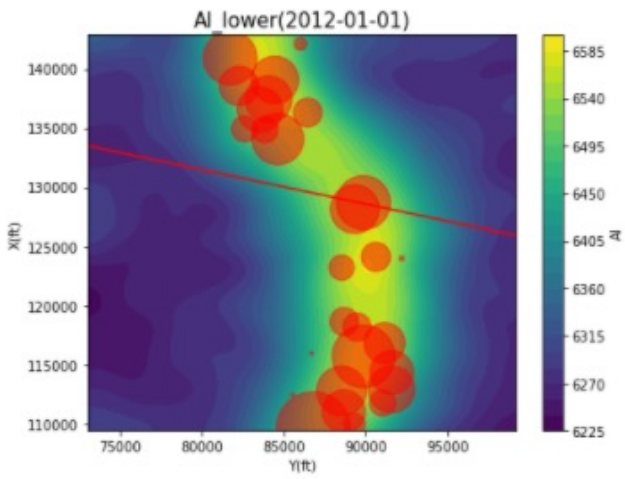
2012

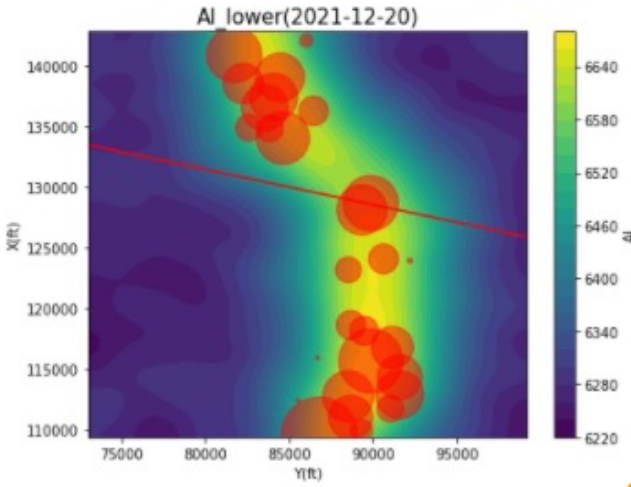
2021

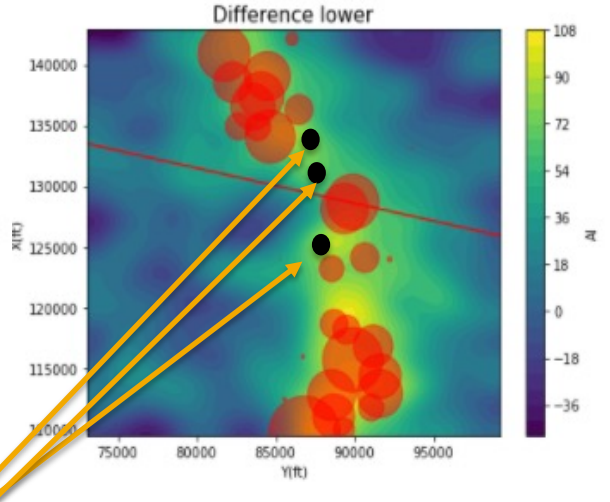












New 3 Wells

Decision Tree

Proposed wells and forecast cumulative production for the next two years

X (ft)	Y (ft)	unit	Np (bls)
88000	125500	Lower	1077407
88000	134000	Lower	627435
87500	131000	Lower	1077407

Feedback

What did your team learn?

Machine Learning is a helpful tool to maximize value in oil and gas projects in which we produce loads of data every day

How important is include expert knowledge in every ML step

"There ain't no such thing as a free lunch“

What did your team like?

The feedback and suggestion of all of the advisors

What could we do to improve next year?

The organization in general was awesome, we just like to suggest maybe one day more to solve the problem