Automated Reservoir Quality Prediction using Multi Feature Geoscience Data

Magnitude

IATMI

Schlumberger

Team Information

Magnitude

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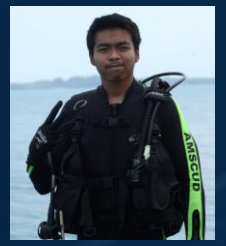

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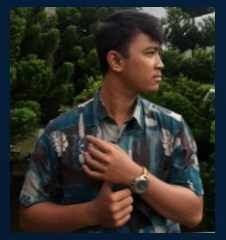
Full Stack Engineer



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Data Scientist

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Project Background

- Reservoir quality prediction is a **key challenge** for hydrocarbon exploration and development.
- Geoscientist, normally, need to work on a **very long hours** to do the whole reservoir evaluation process due to the present industry standard software and dealt with variety of data (structured and unstructured)
- The work include processing/interpreting different geoscientific information which need to be **manually analyze** thus prone to **human error.**
- Machine Learning for reservoir prediction will help Geoscientist to accelerate the process accurately by utilizing algorithm to compute multi-information in relatively **short time.**
- This will help Geoscientist to make **faster and better** technical decision for their daily job.

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Technical Solution (1/3)

- **Illustration and a general description of the proposed solution →**

1. We're using petrophysical data, mud log and other data that might be needed in order to **label good and bad quality reservoir in well**. (notes : this process could be automated too with machine learning based on Koroteev & Tekic, 2021)
2. Based on those labels, we can **choose prospective depth**. The prospective depth will be used to **slice** attribute to create **attribute map**.
3. With **many variation of attribute** that provided in petrel, all of them can be **feed to machine learning** model to **create one new heat map** that predict the reservoir distribution For example, 100% good reservoir is colored by dark blue and 100% bad reservoir is colored by light blue).
4. So, geologist can **focus to analyze the dark blue part**, instead analyze all of the region part.

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Technical Solution (2/3)

- List of Data and Data Type, and which Data Source is proposed to be used =

Dataset	Data	Data type
VOLVE	Seismic data	.segy
VOLVE	Well log data	.las or Excel
VOLVE	Mud log data	PDF
VOLVE	Other reports (such as geochemist, biostratigraphy, etc)	Excel or PDF
VOLVE	Petrophysical data	.las or Excel

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Technical Solution (3/3)

List of Technologies proposed to be used and how it integrates with the solution →

- DSS (Dataiku Data Science Studio) / Data Science Profile :
  - Data processing pipeline
  - ML training and computing
  - Data visualization tool
- Cloud Provider (GCP)
  - Data lake / blob storage (Google cloud storage)
  - Database instance (Big Query / Cloud SQL)
  - Compute instance: to hold model deployment server if needed
- Python
  - DS package (pandas, matplotlib, etc.)
  - ML package (sklearn, etc.)
- Petrel and TechLog (for interpretation tools, generate seismic attribute and quality-check / well-log analysis)

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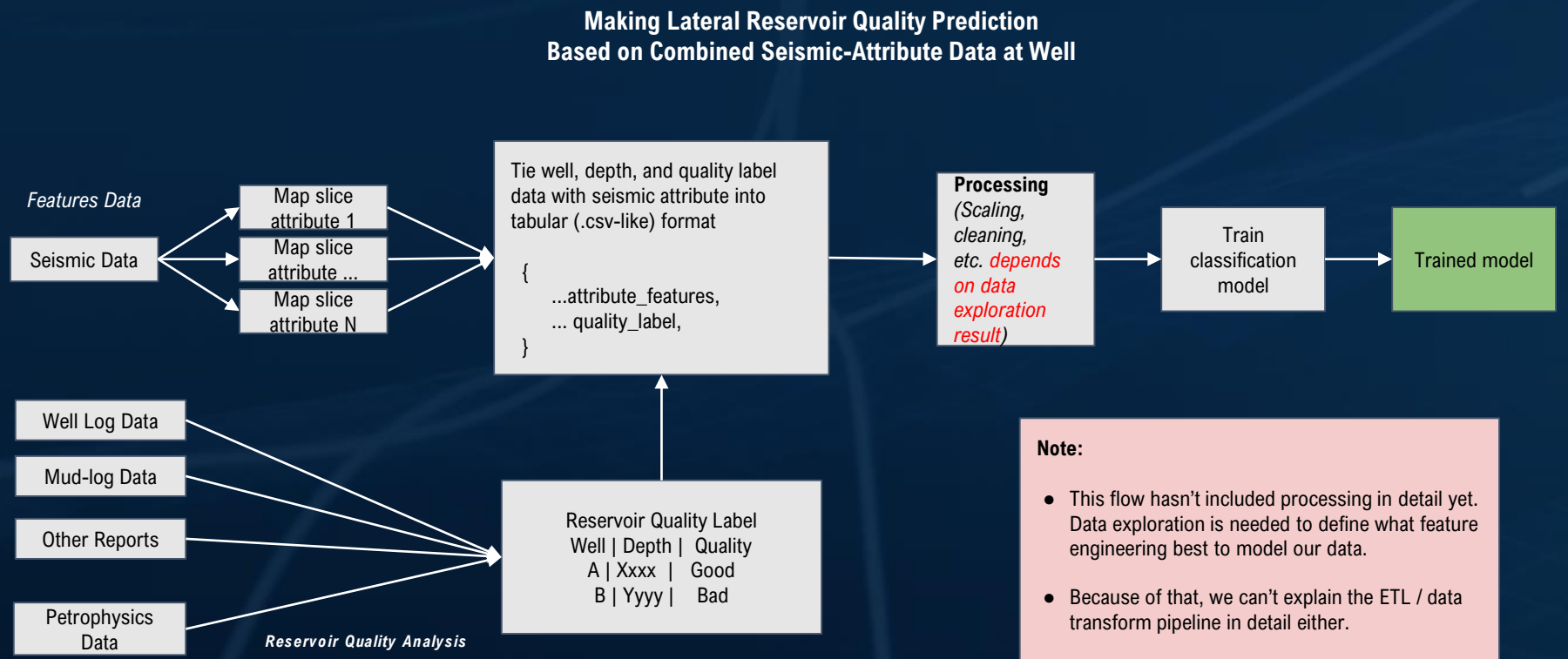
Proposed Architecture (1/3)

Training Flow



Note:

- This flow hasn't included processing in detail yet. Data exploration is needed to define what feature engineering best to model our data.
- Because of that, we can't explain the ETL / data transform pipeline in detail either.

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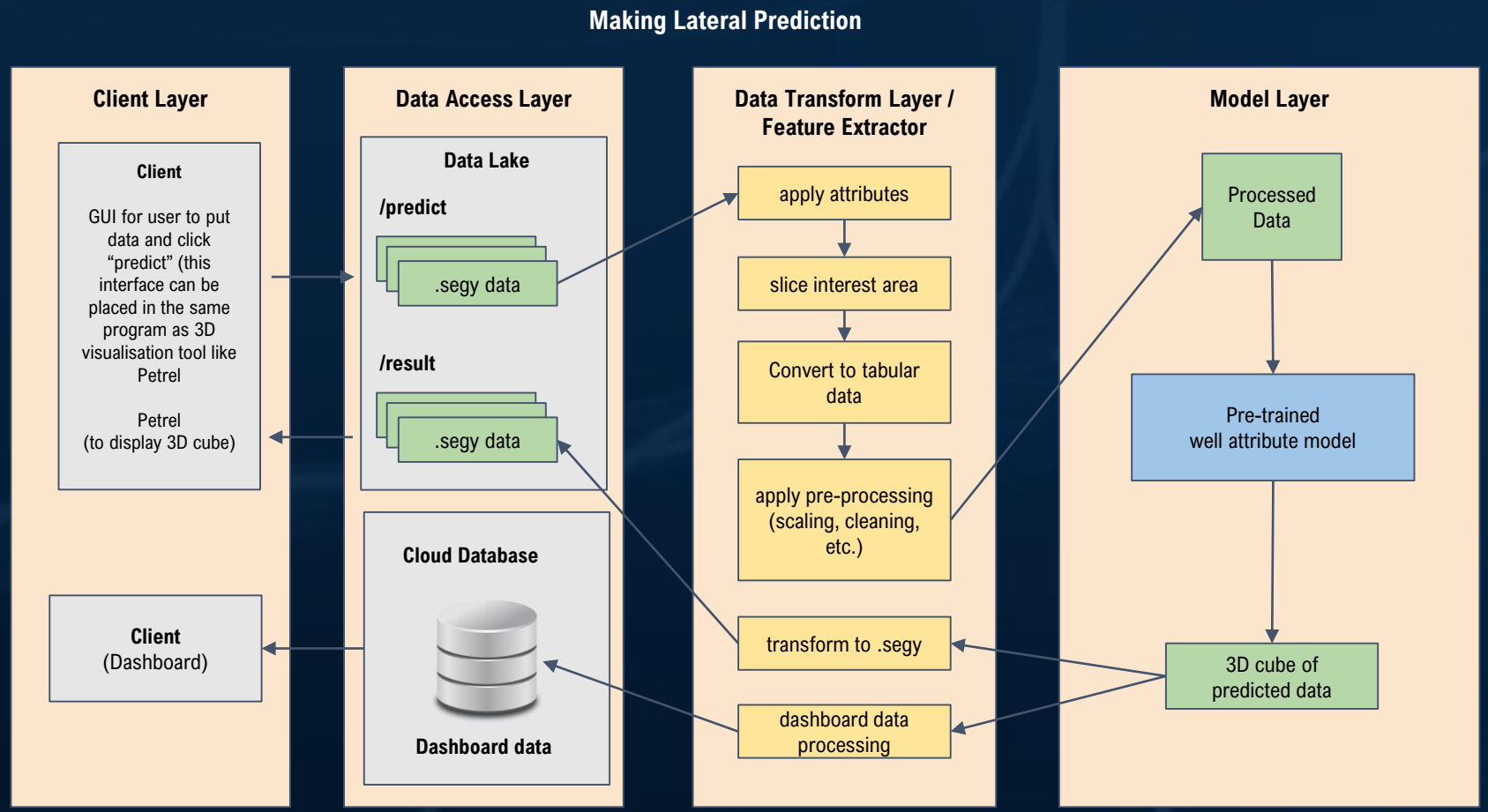
Proposed Architecture (2/3)

Deployment Flow Proposal (Simplified -> Need Further Technical Alignment)



Note:

- Here is the deployment architecture if anyone want to deploy our model in the future.
- But this trained model (generated after train VOLVE data) **might not be used** in any different field.
- We strongly suggest to **re-run the workflow** instead **re-use the** model since **availability data might be different** for each field.

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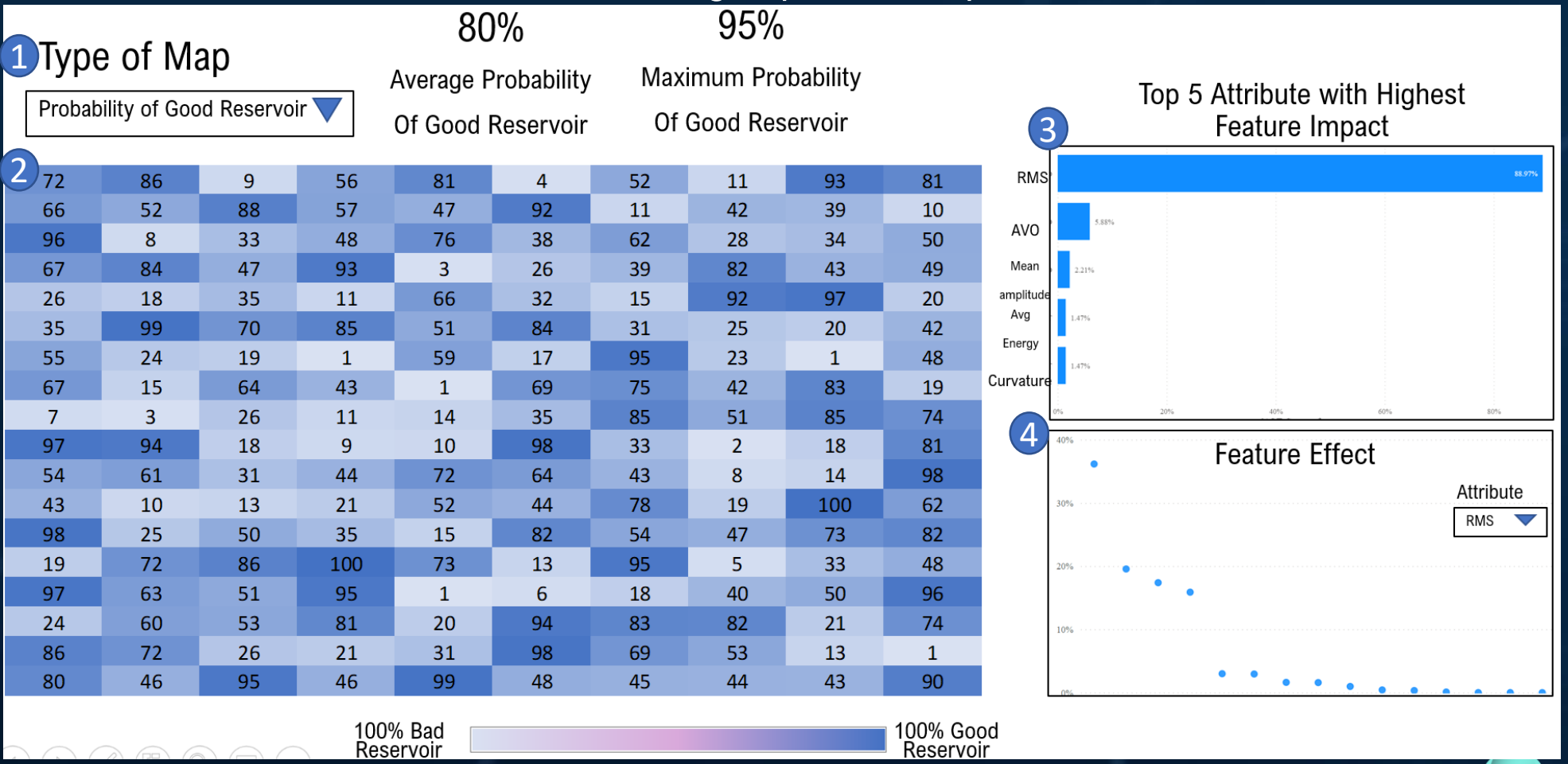
Proposed Architecture (3/3)

Resulting Report Mockup



1. User can choose what kind of map that will be shown if you want to analyze the area further. By default, it will show the reservoir quality distribution
2. Map that is chosen by user
3. Feature impact (sort by feature importance if tree-based model, and by SHAP if not tree-based model)
4. Show how the value in the parameters will affect the result. For example, in the mockup, if the value of chosen feature is **bigger**, than the probability of good reservoir is **smaller**

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Value Proposition

1. **Integrating** large and different type of data to make a **detail and thorough** Reservoir Quality Prediction.
2. **Better and faster** technical result for decision making in exploration and development.
3. **Shorter** workflow and working hours.
4. **Fully Incorporated** with Schlumberger Petro-technical Suite Software in the workflow.

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Solution Novelty

No	Solution Novelty	Advantages
1	**Cut** the traditional workflow for Reservoir Quality Prediction Mapping by approx. 50% .	• Cost Optimization • Fasten the process
2	**Flexibility** to mix and match the available data for Machine Learning process, e.g. analyze multi seismic attribute in one click.	• Flexibility
3	**Quantitative** end result coming from large information of data (diverse structured and/or unstructured data).	• Quality improvement • Reliability
4	Geoscientist can be **focused** more on : **reliable** interpretation result (rather than spending time working on the data evaluation), **comprehensively analyze on area of interest (AOI)** and **better** decision making.	• Quality improvement • Knowledge development
5	Small size team for each project (reduce the minimum number of project member).	• Efficiency • Cost Optimization

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Thank You

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