





16 - 18 November 2024

Common Ground Bukit Bintang, Kuala Lumpur

Challenge 1

Predict the faults across a given 2D seismic dataset.

Sponsored by:













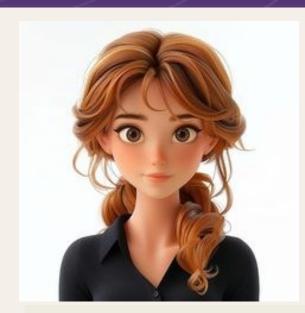
01 – Meeting between Nigel and Rachael





Mr. Nigel, Geoscience Mgr **Data Rich Oil Company**

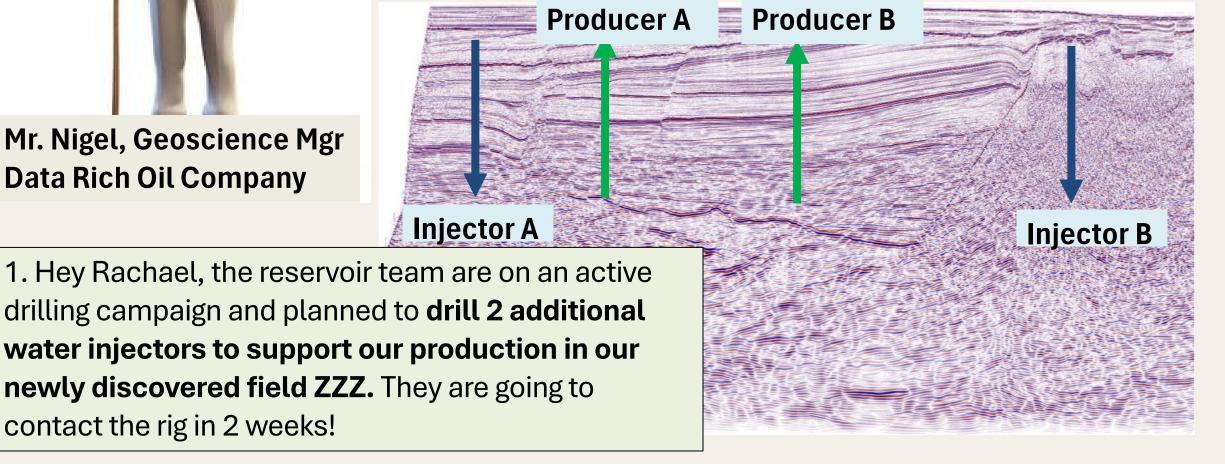
contact the rig in 2 weeks!



Racheal, Ambitious **Geoscientist**

2. Hi Mr Nigel. OMG! We have to stop them. Looking at some of the seismic images, Fault Block A and Fault Block B is clearly divided by a fault

But interpreting seismic for the whole field is so time consuming. It would take months, if not a year!





3. I have an IDEA. We can leverage our in-house DS team to built an AI tool

We have some interpreted seismic from our older field that we can use as dataset!

Seismic datasets

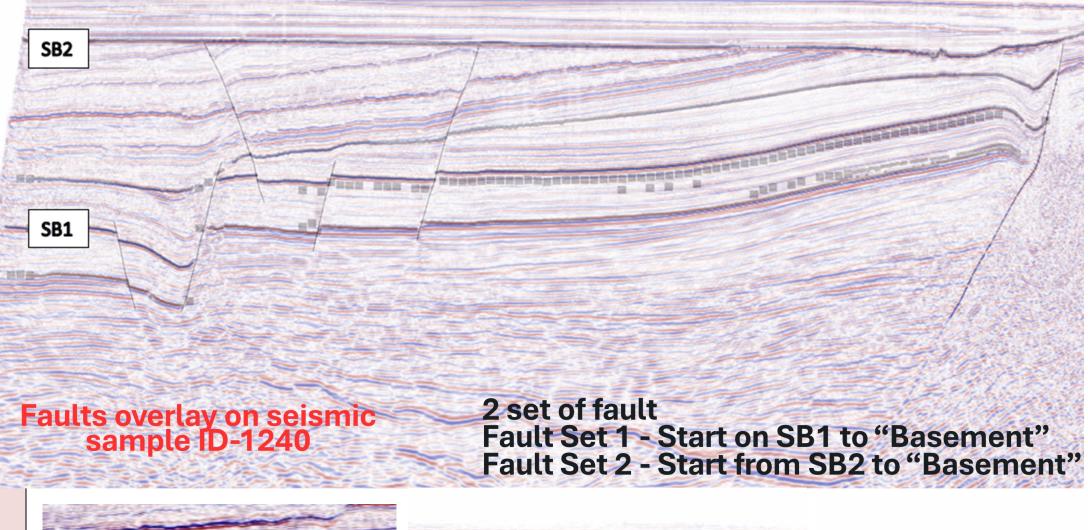
- 439 seismic images.
- 364 faults images, including 2 faults with missing seismic images.
- Only 362 seismic/faults images used.
- Train/Test split: 66% Train/33% Test

02 – The next day.....





1. Hey Rachael, this is an impossible task!
The given dataset is so imbalance. There is no incentive to force our model to accurately match the fault



Racheal, Very Ambitious Geoscientist

2. Hi Team!

I think we should pre-process our input data prior to training. Do you think we should **discretize** the dataset?

Also, we should use Focal Loss since the dataset is heavily imbalanced. Maybe hyperparameter tuning on the loss function will help?

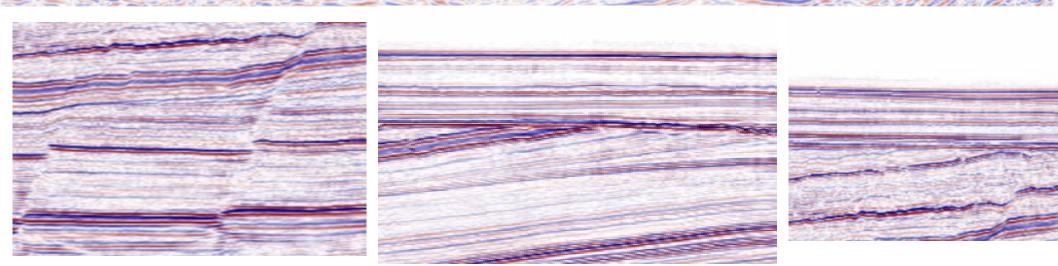


Image Discretization – To increase focus on imbalance dataset and increases the amount of dataset

03 – Methodology (Data Pre-Processing)

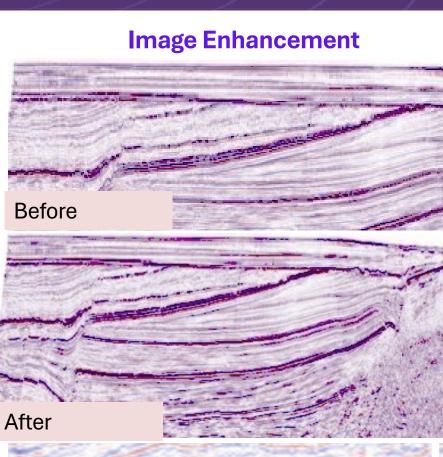




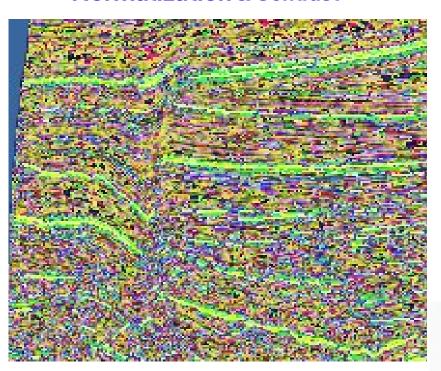
Data Science Team

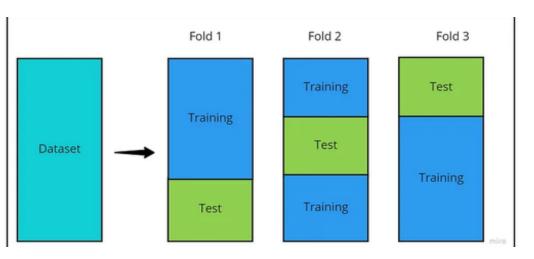
- 1. That's a really good idea. We can increase
- 2. What do you think of the idea of increasing the width of the labels?

It doesn't change the geology but will significantly help our model

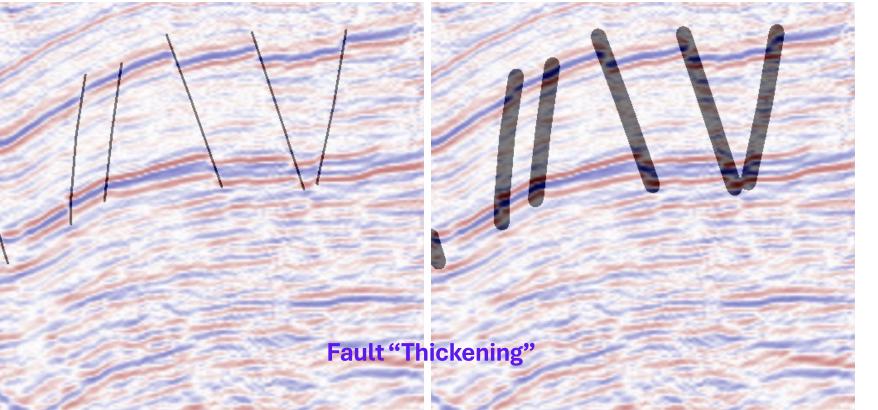


Normalization & Contrast





Cross Validation





Key Differentiators:

- 1. Tailored Pre-processing steps for seismic image
- Enhancing Seismic Reflector
 Wider fault to help interpretability
- 4. Addressing imbalanced data

04 - Results



Our Model - CrackNet

Epochs: Image Size: Batch Size:

50 512 x 512

0.0001 Learning Rate:

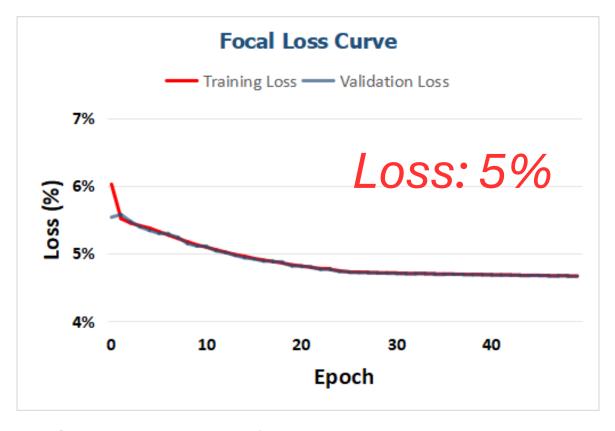
Evaluation Matrix: Weighted F1 Score (Addressing imbalanced data)_

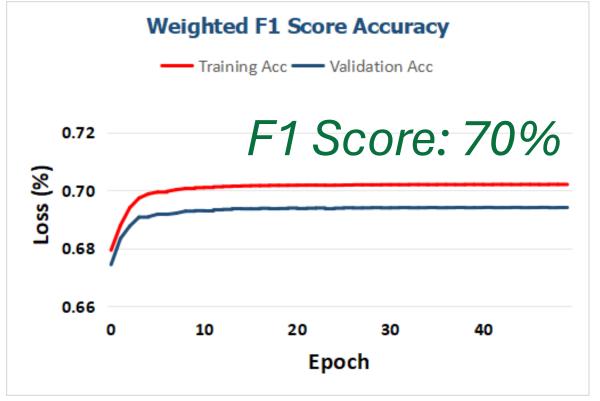
Enhanced Focal Loss with alpha Loss:

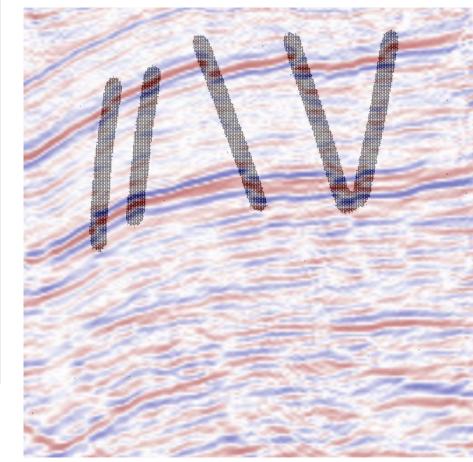
That's really impressive.

All our pre-processing work paid off

The CrackNet model is now able to capture the faults really well





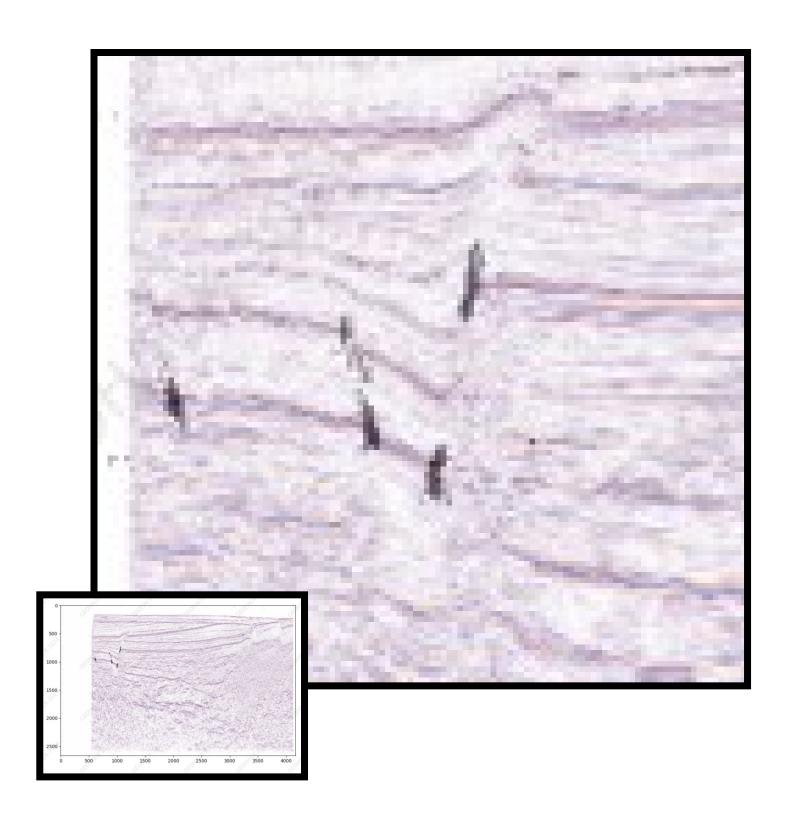


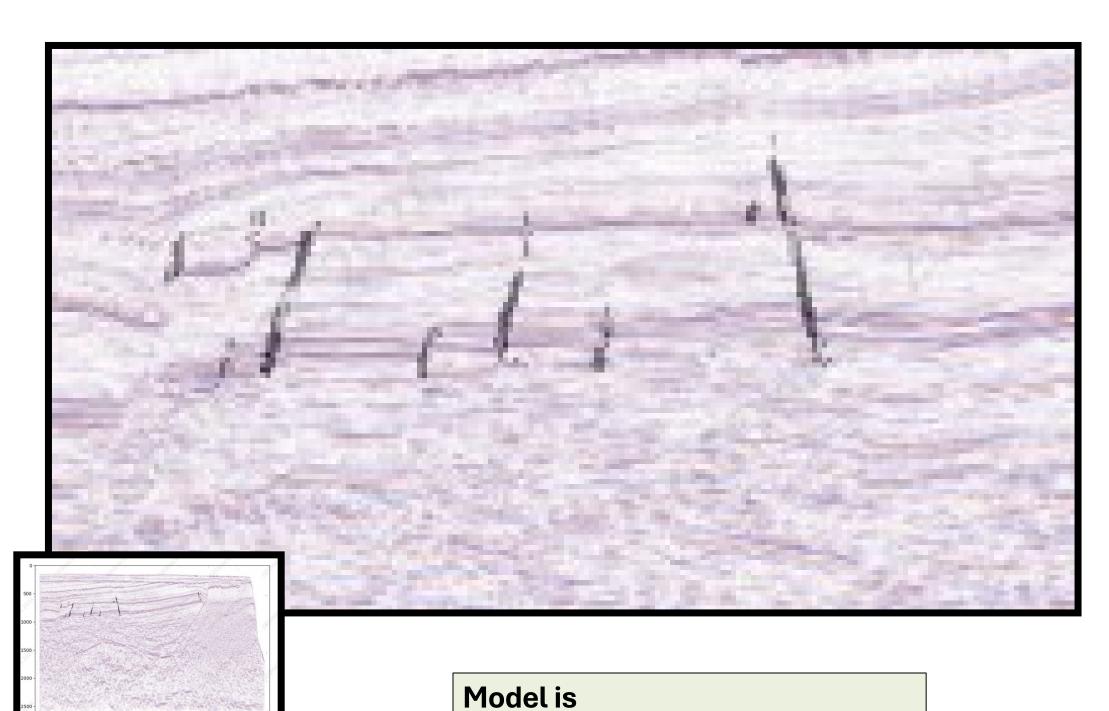
Our model CrackNet performance on the validation dataset with 3 folds cross validation

05 - Visualization of results

on holdout data

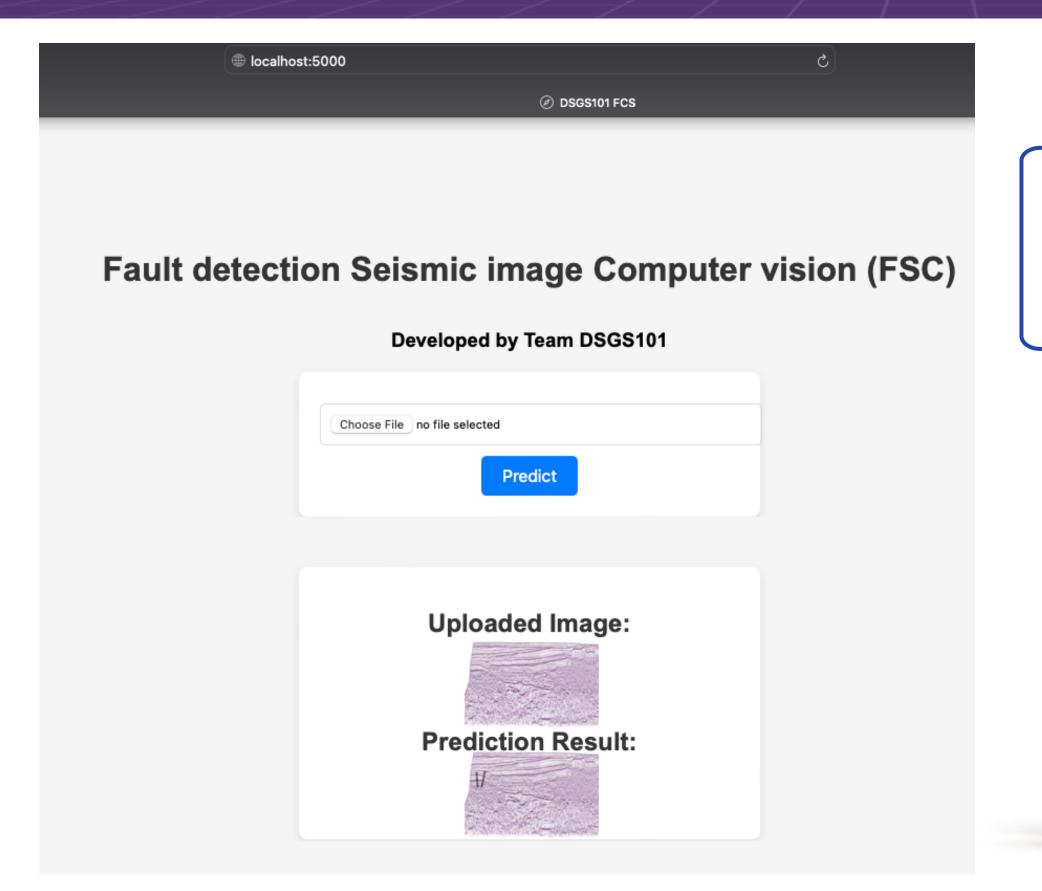






06 - How to interface with the model?





Web application developed with Python Flask framework.

The end user will upload their seismic image into the tool and the model will generate the fault that overlays on top of the seismic image.



1. Great job, team!

Thank you!

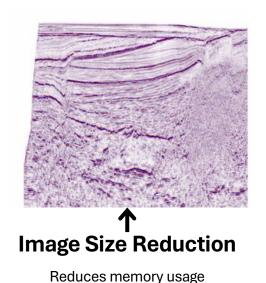


03 - Methodology The HOW?

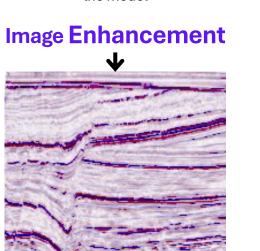




Data Pre-processing

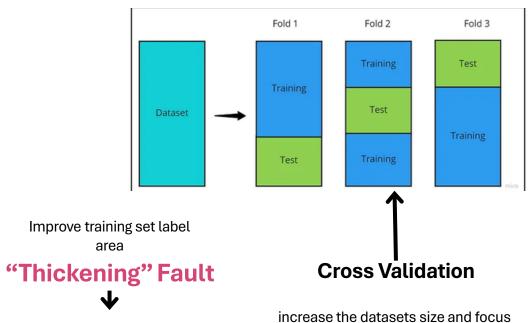


Ensure important feature are fed into the model



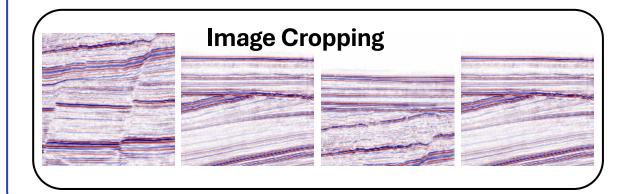
Normalization & Contrast

Ensure model compatibility



on the contours





Our Differentiator

- Tailored Pre-processing steps for seismic image
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Our Model - CrackNet

Epochs: Image Size: Batch Size: 50 512 x 512

Learning Rate: 0.0001 Evaluation Matrix: Weighted F1 Score (Addressing imbalanced

data)

Enhanced Focal Loss with alpha Loss:

BACK-UP