

# Convolutional Neural Networks to improve the speed and accuracy of seismic interpretation

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# Back in the 1990's





# Block 21/5

All of the seismic data used in this work comes from the July 2013 3D seismic survey acquired by Dolphin Geophysical for Sendero Petroleum Limited and now owned by Zennor Petroleum Limited.

The data all comes from the National Data Repository and as such is shown under the terms of the <u>Oil and Gas</u> <u>Authority Open User Licence</u>. The material is acknowledged as being OGA copyright.



Inline through the middle of the block showing minor faulting in the Tertiary due to overpressure in shale.



Seismic amplitude



## Inline Dip

The Inline dip attribute is an estimate of dip components along inline directions.



line - Time Slice 1.400

Dip Magnitude

The Dip Magnitude attribute is an estimate of the descent of seismic reflectors.



agnitude - Time Slice 1.400

#### Curvedness

The Curvedness attribute is a measure of total deformation and describes the deformation of rocks.



p\_Curvedness - Time Slice 1.400

### Curvature K1

K1 and K2 measure the most positive and most negative curvature on the direction of first and second principal component. They identify the structure corresponding to the axis of the fold.  $k_1$  and  $k_2$  along with other curvature volumes are often seen as regional stress and strain indicators.



K1 - Time Slice 1.400

### Curvature K2

K1 and K2 measure the most positive and most negative curvature on the direction of first and second principal component. They identify the structure corresponding to the axis of the fold.  $k_1$  and  $k_2$  along with other curvature volumes are often seen as regional stress and strain indicators.



K2 - Time Slice 1.400

## RGB Blend of

- Confidence
- Similarity
- Chaos

Similarity is a measurement between traces based on the coherence of the waveforms. The Confidence attribute is the semblance of the window with the maximum coherence.



RGB Blend of

- Curvature Amplitude e Mean
- Curvature Amplitude e Max
- Curvature Amplitude e Pos

The curvature attributes correspond to amplitude curvature anomalies. These attributes capture geologic information in the form of second derivative of the amplitude behavior of seismic data. The lateral variation in amplitude can detect the geologic properties such as changes in porosity, thickness, and/or lithology



**RGB** Blend of

- Curvature S Shape Index
- Curvature S K1
- Curvature S K2

These attributes reveal faults, flexures, anticlines, and synclines. These attributes are also very good at defining upthrown and downthrown portions of fault systems.



- Chaos
- Confidence
- Similarity



- Azimuth
- Chaos
- Confidence
- Crossline
- Similarity
- Inline dip
- Magnitude



arameters-7/22/2020 2:33:07 PM - Block 21 5 - Volume

- Curvature Amplitude\_e\_Max
- Curvature Amplitude\_e\_Mean
- Curvature Amplitude\_e\_Min
- Curvature Amplitude\_e\_Negative



- Curvature K1
- Curvature K2
- Curvature Shape Index
- Curvature Shape Ridge
- Shape Valley



fault Parameters-7/22/2020 5:54:13 PM - Block 21\_5 - Volume

Self Organising Map combining:

- Euler Curvature 0
- Euler Curvature 30
- Euler Curvature 60
- Euler Curvature -30
- Euler Curvature -60
- Euler Curvature -90

Euler curvature calculates the most positive and negative principal curvatures (k1 and k2) at apparent angles. It is especially useful when looking for the fracture trend in the area of interest. The images may provide insights of local stress and strain. Curvatures of a structure are often associated with discontinuity (faults), but not necessarily.



# Conservative Convolutional Neural Networks



e - Time Slice 1.400

# Aggressive Convolutional Neural Networks



ve - Time Slice 1.400

Aggressive Convolutional Neural Networks After Cleaning



Aggressive Convolutional Neural Networks After cleaning 3D view







For more details about the attributes, Self Organising Maps (SOM) or the Convolutional Neural Network (CNN) processes, please visit <u>https://www.geoinsights.com/</u>

Thank You

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