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Dense Strata & Noise Attenuation

Kaushik Kislay*, *IIT Kharagpur*

Summary

Dense Strata is a 'game changing' technology which affects every level of seismic interpretation by creating dense layers of horizons. Noise Attenuation on other hand is an advance Non-coherent noise removal plugin based on sparsity promoting curvelets, which are amazingly good at representing seismic data, as it preserves the singularities[1,2].

Keywords: *Dense Strata, Noise Attenuation, Horizons, Curvelets Petrel, Ocean, Plugin*

Introduction

One of the biggest challenges currently faced by exploration and production industry is to maximize the value of geological data. While seismic interpretation technologies have improved dramatically over the last few years, too often operators remain dependent on highly generalized geological models as an input into their decision-making. There's no doubt that gigabytes of data are being generated, yet how much of this is accurate interpreted data that can play a major role in field development or prospect ranking decisions?

It's only through improved attribute analysis, an increase in the number and density of mapped horizons, and the ability to conduct low frequency model building that more closely honors the seismic, that E&P operators can genuinely claim that they are getting the most out of their geological data[3, 4]. The plugin Dense Strata precisely does that. It maps numerous horizons between conventionally met horizons leading to improved quantitative rock property estimation, an enhanced definition of stratigraphic traps, and more accurate, robust geological models.

Method

The package consists of 2 plugins implemented as Petrel Plugin. Dense Strata works with seismic data as input to the plugin. However the data has to undergo a special type of conditioning before it is fit for Dense Strata. This conditioning is provided by the plugin Noise Attenuation.

Noise Attenuation is based on curvelets. Curvelets are a recently developed mathematical transform that has as one of its properties minimal overlap between seismic signal and noise in the transform domain 1, thereby facilitating signal-noise separation. It also promotes continuity in the seismic events which facilitates much enhanced horizon picking.

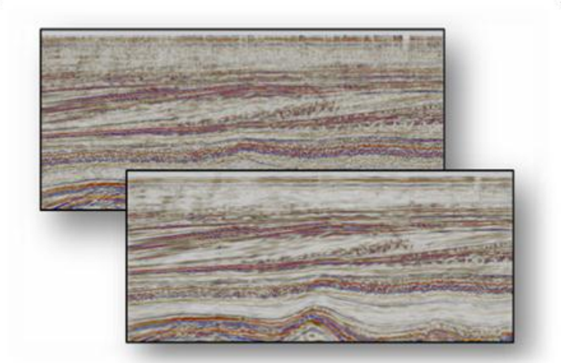

Figure 1: Denoised image over noisy seismic image

A general workflow would look as shown in figure 4. We start with attenuating the random noise using various algorithms and denoising parameters until we achieve the desired level of continuity and noise reduction. The next step is to use the output seismic data to generate dense set of horizons.

Dense Strata workflow starts with manual picking of conventional workflow which in our workflow would be called anchor horizons. Next step is to specify the horizon picking mode between these anchor horizons. The modes

IIT Kharagpur, West Bengal, India – 721302
kaushikkislay.kk@gmail.com

available are: Data driven, proportional slicing, parallel to top and parallel to bottom.

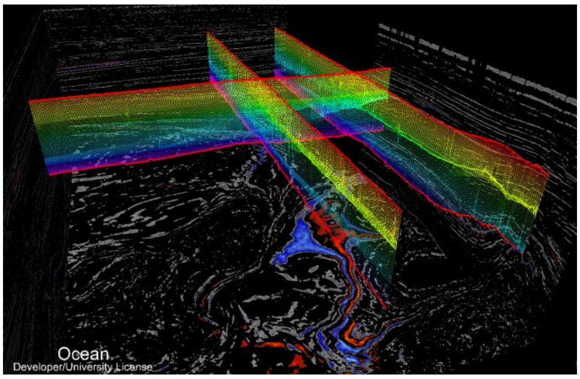

Figure 2: Dense Strata output as polylines in 3D

While data driven mode generates horizon based on seismic event, other modes can be used to generate horizons in noisy conditions. The output could be formatted as either polylines for visualization purposes or could be exported to horizons for further interpretation. A manual quality check can be done to ensure picked horizons are fit for further interpretation and modeling.

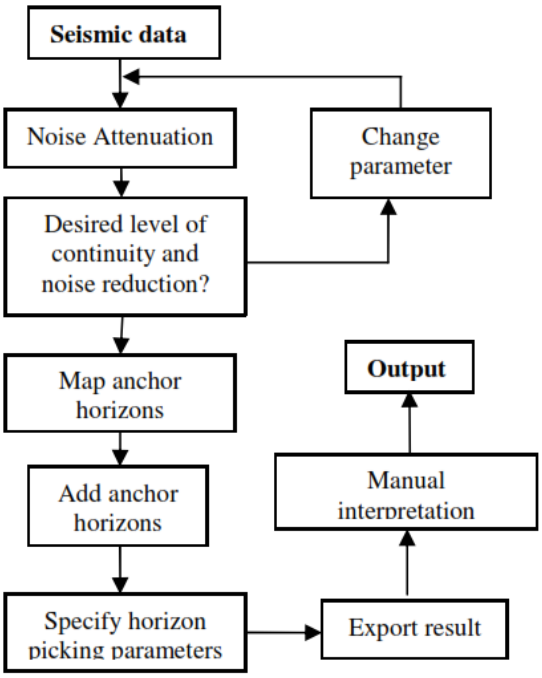

Figure 4: Baic Workflow

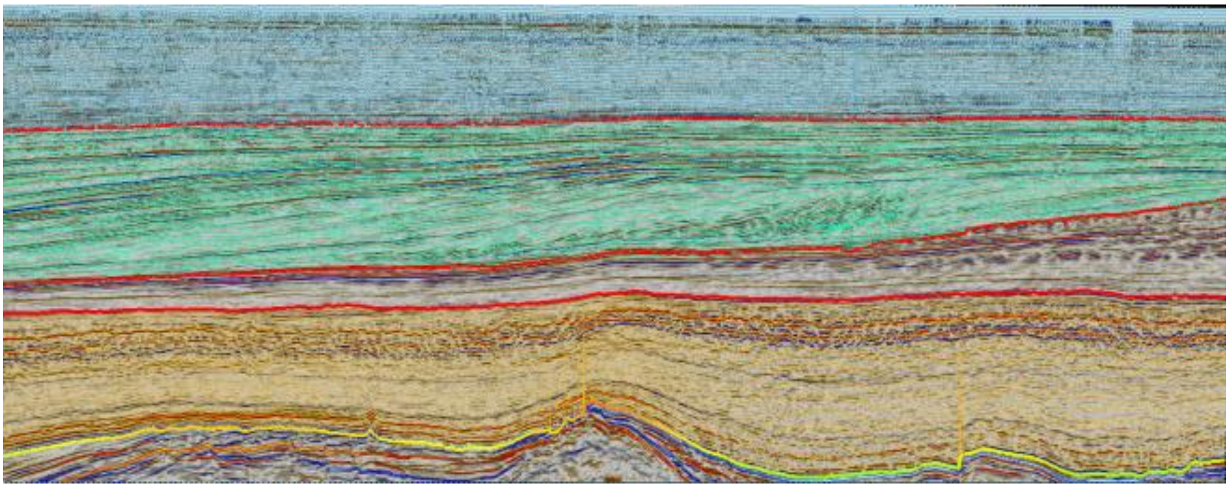

Figure 3: Horizons in color over seismic data

Conclusions

As mentioned earlier, implementing 'Dense Strata' in the workflow would greatly improve the process of seismic interpretation. This would lead to

- Better Property modeling
- High quality inversions
- Realistic low frequency models
- Extraction of maximum value from geological data

The greater the number of horizons, greater the accuracy in Acoustic impedance and Elastic Impedance inversion results, and the generation of a high resolution model which faithfully honors the seismic data[3, 4]. The result is a model that is the cornerstone of the seismic interpretation process with better seismic prediction and more accurate input to reservoir management decision making [3, 4].

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