Pre-Interpretation Processing Services:
Automated Geometric Surface Analysis and Object Extraction

Why calculate a surfaces geometric properties?

- The most fundamental property of a surface is its geometric characteristics.
- These geometric properties reveal features and objects not easily identifiable by visual analysis alone.
- Allows for the detailed analysis of features present on a surface.
- Improves our understanding of the subsurface.

What are the advantages of this surface analysis technique?

- Unique approach based on differential geometry applied to digital data.
- Analysis and parameterization is automated and unbiased, yielding robust results.
- The technology implemented does not introduce random or coherent noise.
- Fast and consistent automatic analysis of large numbers of surfaces.
- The higher the data density, the better the result.
- The automatically created objects and their already quantified properties are stored into a database for further analysis or extraction.

Why store the results in a spatial database?

- Complete dataset - No pre-imposed assumptions or filters have been applied. Interrogation of the database allows for an observation led analysis.
- Attributes – Associated with every object for every surface.
- Queryable - The database can be queried using attributes and spatial relationships.
- Filtering - Undesired objects can be filtered out.

What are the advantages of this approach compared to manual digitization?

- Data Size- The approach is fully automated meaning it is easy to apply to small, large or very large datasets.
- The technology uses mathematical properties as the basis to feature extraction.
- Consistency: All results can be replicated.
- Each processing step can be reviewed and QC'd.

What are some of the applications of this technology?

Surface Feature Extraction

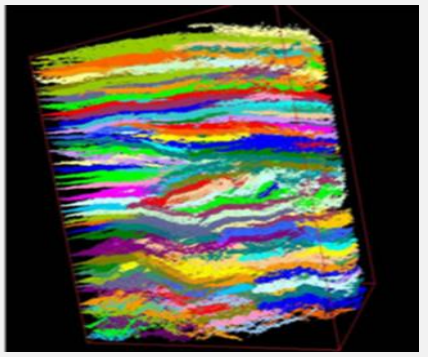
- Since no apriori knowledge about the "surface" or its properties is required, any type of surface can be analysed.
- This example demonstrates analysis of Seismic Attributes (Amplitude, TWT, Fitness, Spectral Signatures).
- Other applications include Potential Fields, Lidar, Orthophotogrammetry, DEM, and many more.

Seismic Related applications.

Identify features present on surfaces including:

- Faults, Joints/Shear Fractures, Folds (mounds, ridges, 4-way dip closures), Collapse Structures (Pockmarks, Karsts, etc..), Channels (Fluvial and Marine), Deltas and many more morphometric features.

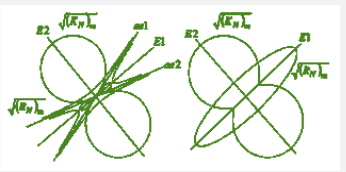
Quantitatively define features patterns and objects from surfaces from TWT, Depth, Frequency, 3D, 4D and pre-stack domains.

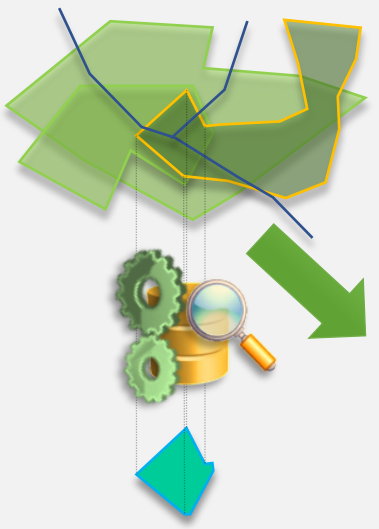


Processing Sequence

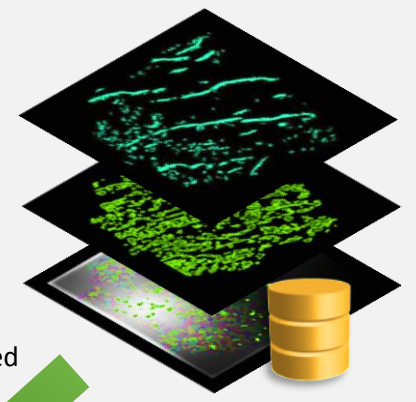
Input: A database of surfaces created by pre-interpretation processing using was loaded and prepared for processing. *Applicable to any type of surface*.

1st Stage: The technology uses new differential geometry techniques to automatically map a surface's geometric properties as defined by Dupin's Indicatrix.

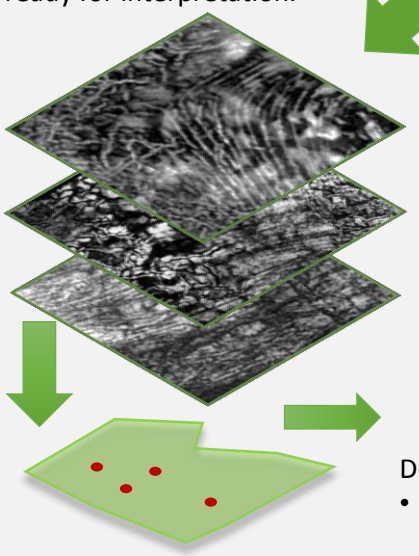




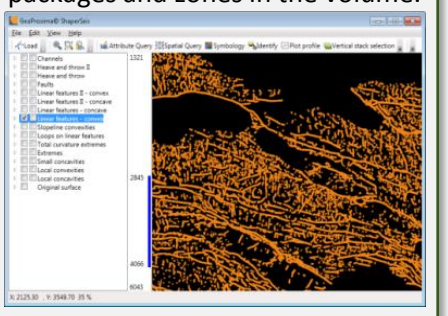
2nd Stage: Features and objects are generated using pre-defined combinations and patterns of geometric and spatial attributes.



The features extracted are compiled into a queryable database which is ready for interpretation.



Optical Stacks of surfaces are generated to analyse the prevalence of attributes over packages and zones in the volume.



Add well and cultural data.

Deliverables:

- Final project database containing morphometric properties of all surfaces with viewer.

For more information and pricing please contact Jim Dirstein

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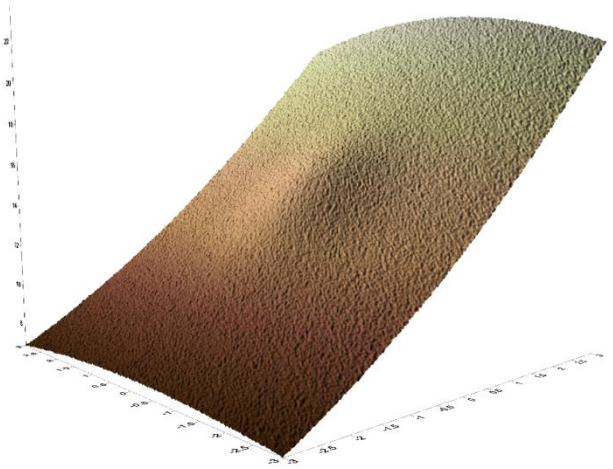
Calculation of Curvature (Geometric) Attributes and Objects:
Comparison of Techniques

Traditional Technique:
Curvature for Continuous Data

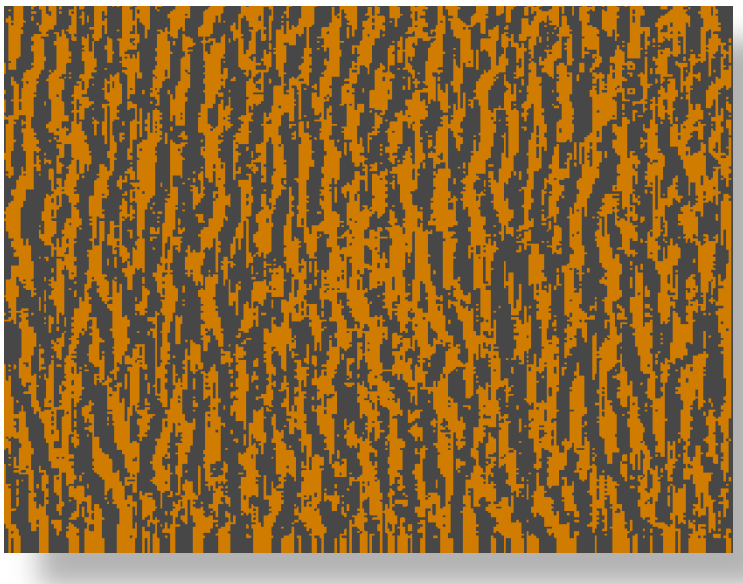
The traditional method used in the geophysical industry for generating curvature attributes were developed by Roberts and Woods in the late 1990's.

I. Various techniques are available for calculating curvature but all are based on very similar principles.
II. The techniques used by the industry assume that a digital surface can be described by a continuous mathematical function which is incorrect as we work with digital data.
III. The interpreter sets a lot of parameters based on their preferences, resulting in an inconsistent output.
IV. Due to the use of windowing and interpolation, coherent noise artefacts are added to the data.
V. Slow process because of every single surface requires parameterization before analysis.
VI. Higher data density causes degradation of results.
VII. Results are mostly displayed visually.



Digital representation of the modelled surface with additional random noise.

Dip curvature object Wood 1996 algorithm.

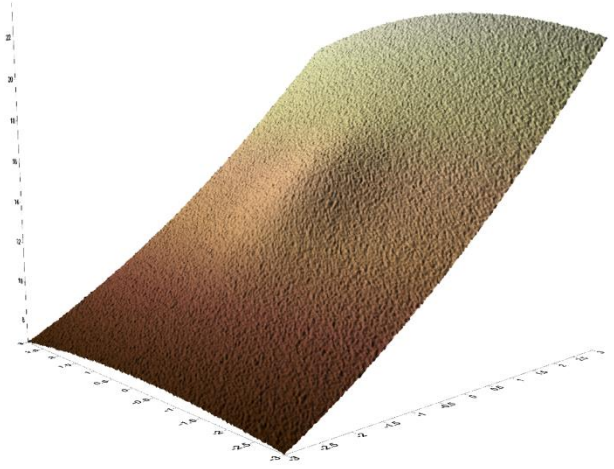


Failure: Clearly the object is not identified. Moreover, coherent noise artefacts dominate the results.

New Technique:
Differential Geometry for Digital Data

A new method for generating curvature attributes and objects has been developed.

I.The new approach to calculating a surfaces geometric attributes is unique.
II.The new techniques uses differential geometry methods designed specifically for digital data, it does make a false assumption.
III.Analysis and parameterization is automated and unbiased, yielding robust results.
IV.The technology implemented does not introduce random or coherent noise.
V.Fast and consistent automatic analysis of large numbers of surfaces.
VI.The higher the data density, the better the result.
VII.The automatically created objects and their already quantified properties are stored into a database for further analysis or extraction.



Digital representation of the modelled surface with additional random noise.

Dip curvature object calculated by new approach

Success: The object is identified reasonably well (without the introduction of significant artefacts).

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