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# Identification of salt dome boundary by integration of seismic attributes in GIS environment

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**Extended Abstract**

**Summary**

Complex structures in seismic images introduce ambiguities in structural and stratigraphic interpretation of seismic data. On the one hand, using high quality seismic image could resolve some of structural ambiguities of seismic image. On the other hand, some seismic attributes, which extract additional information from seismic data, could be used in interpretation step. However, vast number of introduced attributes brings another ambiguity that is which attributes would be appropriate for the specified purpose. Thus, several methods have been introduced to select appropriate attributes for a special case and furthermore, integrate attributes to extract as much as possible information and make their contribution in one single image. In this study, we have introduced a novel strategy for integration of seismic texture attributes in GIS environment. In the proposed strategy, each attribute is considered as a separate information layer, and then, these attributes undergo fuzzification process, and subsequently, are weighted by conventional functions and are integrated in GIS environment. This strategy has been applied on a complex seismic data containing a salt dome. Results of the application this novel strategy has proved that this strategy could image salt boundary and internal reflection of salt much better than conventional integration methods.

## Introduction

Seismic attributes could be used as an appropriate tool to extract as much as possible information from seismic data. By introducing vast number of attributes in recent decades, we find out that the problem moves to define a strategy on how select the most relevant attributes for each special interpretation and how it could be more useful if these attributes could be combined to obtain more and more precise and accurate information. Subsequently, numerous methods have been introduced for integration of best selected attributes to extract as much as possible information. Fuzzy methods are among conventional and most popular methods in this regard. In this study, we introduce a strategy to integrate attributes related to the family of gray level co-occurrence matrix (GLCM) texture analysis tool in GIS environment.

## Methodology and Approaches

The GLCM group of attributes gives different information from seismic data. These attributes could be more used by application of an appropriate integration method. In mineral exploration, a strategy is used by integration of different exploration information. The same strategy has been applied here for the GLCM attributes to obtain a final image for further geological interpretation purposes. These attributes undergo a fuzzification step performed by logistic function. Subsequently, they are weighted by conventional fuzzy weighting method. Converting the information layers (weighted attributes, known as an information layers) to binary domain, we then integrate these information layers by fuzzy operators. Finally, a unique map would be obtained which contains the most level of information of the target study. This strategy has been applied on a seismic image containing nearly horizontal layers and a complex geological structure of a salt dome.

## Results and Conclusions

We extracted conventional attributes from the seismic data. These attributes were energy, cluster prominence, entropy, variance, similarity, dissimilarity, intensity and contrast. Structural interpretation based on these attributes could not be performed precisely. For instance, boundary of salt dome, accurate truncation position of layers in conjunction with salt

boundary, exact width of salt and internal reflection within the salt were imaged differently in each attribute image. Thus, they were not precise for further structural interpretation. Therefore, they were processed by the proposed method to obtain an appropriate seismic attribute image. Initially, each attribute image, known as an information layer, was processed by fuzzification function and was prepared for suitable weighting. Then, these information layers were weighted in GIS environment prepared for further integration. Based on the final goal of interpretation, which is the most accurate separation of the salt and surrounding sedimentary media in the seismic image, higher weights were allocated to those attributes containing more information of the salt structure. As midway result, the images of fuzzy GLCM attributes could better separate the salt and surrounding sedimentary media from each other, and as a consequence, they could better image the salt boundary and internal reflection within the salt. Finally, these results were integrated by the proposed method and the final image was considered for any further structural interpretation.