Application of a Naive Bayesian Model in Predicting Fault Seal

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Abstract

The fault seal is of great significance for hydrocarbon migration and accumulating, and affected by many factors. Commonly used method could only focus on certain main controlling factor, which might be determined by experts and as a consequence delivers subjective outcomes. In this work, Naive Bayesian Model (NBM) was used to make a prediction for the fault seal by selecting the main controlling factors and providing a predicting model by machine learning process, which is known for its unparalleled ability to efficiently handle large volumes of data, intelligently extracting diagnostic features, and establishing complicated non-linear relationship between data and interpretations. The NBM were trained with a database of fault dip angle, fault throw, fault activity rate, capillary pressure of fault rock, normal stress of fault plane, SGR value, surface density of microfracture, content of carbonate cements and test points with known status of fault seal, including open, closed and half open. The training results showed that the Shale Gouge Ratio (SGR), surface density of microfracture and content of carbonate cements were dominant factors for fault seal in Huimin Depression, Bohai Bay Basin. During the machine learning process, the predicting model of fault seal was provided by the NBM method by establishing a non-liner relationship between the three dominant factors and the fault seal status. Furthermore, three sets of data with the data size of 10, 50 and 200 were used to test the reliability and stability of the predicting model. The result showed great match between predicted fault seal and real situation, the accuracy for three tests were all over 90%. This study showed that fault seal evaluation by NBM method could provide more accurate prediction and judgement of fault seal for precise exploration and hydrocarbon reservoir evaluation.