Geophysical Research Abstracts
Vol. 14, EGU2012-12592-1, 2012
EGU General Assembly 2012

Operations Recognition at Drill-Rigs

B. Esmael (1), R. Fruhwirth (2), A. Arnaout (2), and G. Thonhauser (1)
(1) University of Leoben, 8700 Leoben, Austria , (2) TDE Thonhauser Data Engineering, 8700 Leoben, Austria

Drilling an oil & gas well is always guided by the demand to prevent crises affecting technique, investment and security. To overcome uncertainties caused by lack of knowledge about geological formations during drilling, real-time sensor measurements are used to support the prediction and thus the prevention of such crises. The proposed method supports the extraction of knowledge from sensor data to improve productivity and performance, prevent from mistakes and resolve problems faster. Many mechanical parameters, such as hookload and block position are continuously measured during drilling oil wells. Considering the amount and complexity of the drilling data, it is a real big challenge for a human expert to discover and understand the patterns within the data. In this work machine learning techniques are applied to discover and understand the patterns occurring in such drilling data. We propose a hierarchical approach for drilling operations recognition to break the total drilling time down into a set of pre-defined operation states. This process supports the drilling engineers not only to measure the performance of the drilling process but also to identify patterns in the data that presumably indicate emerging crises.

The proposed approach consists of two phases. In the first phase, five principal states describing very basic operational states at the rig will be recognized by use of the sensor data. In the second phase, those principal states will be combined to a set of drilling operational states. The principal operation states can be considered as an intermediate layer between sensor data and high level drilling operations. The five physical states used in the intermediate layer are related to drill string rotation & movement, mud circulation, the actual drilling itself and a state where the drill string is suspended from the hook. All those states are binary (yes/no) except drill string movement which has three values (up/down/static). For recognition of those principal states dedicated neural network classifier were trained using the sensor data as input. As network architecture the completely connected perceptron was applied in combination with parallel learning. Automatic network growing was used to match the model complexity to the complexity of the particular classification problem and thus to prevent from over fitting. In addition forward selection method was used to identify the sensor data necessary to recognise the particular states. The approach was evaluated using real-time/real-world data and the results show that the proposed approach has the ability to classify drilling operations highly accurate. The performances of the classifiers were evaluated by cross-validation, the average correct classification rate was above 99%, for both, the training and the testing data sets.