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Using a data mining CRISP-DM methodology for rate of penetration (ROP) prediction in oil well drilling

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Abstract

This work describes an implementation of a oil drilling data mining project approach based on the CRISP-DM methodology. Recent real-world data were collected from a from historical data of an actual oil drilling process in Hassi Terfa field, situated in South of Algeria. During the modelling process. The goal was to predict the rate of penetration (ROP) based on input parameters that are commonly used at the oil drilling process (weight on bit, rotation per minute, mud density , spp, ucs) . At the data preparation stage, the data were cleaned and variables were selected and transformed. Next, at the modeling stage, a regression approach was adopted, where three learning methods were compared : Artificial Neural Network, Support Vector Machine and Random Forest. The best learning model was obtained by the Random Forest method, which presents a high quality coefficient of correlation. The results of the experiment show that the proposed approach is able to effectively use the engineering data to provide effective prediction ROP, the ROP prediction allows the drilling engineer to select the best combination of the input parameters to have a better advancement.

Keywords

Data mining, CRISP-DM, oil drilling, rate of penetration, prediction

Biographies

Djamil Rezki obtained his Engineering degree in Computer Science from the University of Constantine, Algeria in 1995. He obtained Magister degree in Industrial Engineering Department, University of Batna 2, Algeria in 2016. He prepares his doctorate in industrial engineering at Batna 2 University, Algeria. He is interested in software engineering, artificial intelligence, manufacturing system, oil drilling optimization, data mining and big data.

Leila Hayet Mouss received the BSc degree in Electrical Engineering, in 1979, from the National Polytechnic School of Algiers, Algeria; the MSc degree in Electrical and Computer Engineering, in 1982, from the ENSERB, France; and finally the PhD degree also in Electrical and Computer Engineering, in 1985, Bordeaux University, French. After graduation, she joined the University of Batna, Algeria, where she is an Associate Professor of Electrical and Computer Engineering. She is a member of New York Science Academy. She is the Head of Automatic and Computer Integrated Manufacturing Laboratory.

Her current research interests include industrial diagnosis of production system using the artificial intelligence techniques in the Laboratoire d'Automatique et Productique (LAP) Lab at Batna, Algeria.

Abdelkader Baaziz is a PhD in Information Sciences. He is Associate Professor at Aix-Marseille Université (France) and Researcher at Institut Méditerranéen des Sciences de l'Information et de la Communication (IMSIC - France). He has held several senior positions in organizations and firms whose Mud Logging Operations Director at

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Drilling Division of Sonatrach (Algeria). He was an Associate Professor at Ecole Nationale Supérieure de Management (ENSM) - Algeria & Business School Netherlands (BSN) – Netherlands.