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INTELLIGENT DRILLING RATE PREDICTOR

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Abstract. *Drilling rate prediction is crucial for improving the performance of drilling. However, large number of unforeseen factors and events influence the drilling rate and make it a complex and stochastic process. Consequently, prediction of drilling rate has remained challenging during last decades. Many different techniques have been introduced for this mission. Among those, Bourgoyne and Young model (BYM) has been widely used during last decades. BYM has been made up of eight functions. Each function represents the effect of some drilling parameters. Although the relationship between drilling rate and mentioned eight functions is nonlinear and very complex, Bourgoyne and Young simply multiplied all eight functions with each other to attain the drilling rate. In this research, after determining constant coefficients of Bourgoyne and Young model using Genetic Algorithm, a General Regression Neural Networks (GRNN) is employed hierarchically in order to uncover the complex relation saof drilling rate and mentioned eight functions of BYM. The data sets used in this study are nine wells of an Iranian gas field called "Khangiran". Simulation results show that the proposed approach is more accurate than a GABYM in drilling rate prediction.*

Keywords: Neural networks (NN), Bourgoyne and Young model (BYM), General regression neural networks (GRNN), Drilling rate prediction, Genetic algorithm (GA)

1. **Introduction.** Drilling engineers have been concerned about drilling rate prediction extensively during last decades because it is essential for optimum drilling parameters selection, which is important to decrease drilling cost per foot [1,2].

Rate of penetration is affected by many parameters. Such as, hydraulics, weight on bit, rotary speed, bit type, mud properties and formation characteristics [3]. Unfortunately, there exists no explicit mathematical relationship between drilling rate and different drilling factors. This is due to the large number of drilling parameters influencing the drilling rate. Furthermore, the relationship of these factors to each other and to drilling rate is nonlinear and complex [4]. However, experts have put forward some suggestions to address this issue. They have succeeded to model the effects of different drilling parameters involving drilling rate as mathematical functions. One of those methods is Bourgoyne and Young model (BYM), which is widely used in practice [5]. The Architecture of this method is demonstrated in Figure 1.

As can be interpreted from Figure 1, Bourgoyne and Young have introduced simplified models, which map important drilling variables onto its rate.