**INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI**
**SHORT ABSTRACT OF THESIS**

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| Programme of Study | : | Ph.D. |
| Thesis Title: Anomaly Detection in Oil Well Drilling Operation Using Artificial Intelligence Based Approaches | | |
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**SHORT ABSTRACT**

Artificial intelligence (AI) based approaches and in particular machine learning techniques have been extensively applied in domains such as health care, computer vision, and network security to build complex and accurate models that can produce more efficient solutions. Oil and gas sector is an area that generates massive and high volume data during the extraction of oil and gases. Stuck pipe, borehole instability, washout, and kick are among the more recurrent problems that occur during drilling operation and cause enormous financial loss to the oil and gas industries. In the ongoing situation, these problems are solved by first principle models and also appeal highly experienced drillers who can prevent such unwanted situations. Machine learning and AI techniques have shown tremendous performance to solve various re- search problems that involve massive real-time data, but their capabilities have not been explored entirely in the domain of oil industries. Still, there is a requirement of data-driven models that can solve the oil well drilling complications. The oil well drilling process needs a mechanical framework, also known as a rig. The rig contains different functional units having multiple sensors that provide the measurements of different hydraulic and mechanical parameters further helpful to monitor the oil well drilling process. The data measured by the rig sensors are stored in a database known as supervisory control and data acquisition (SCADA) system. The data stored in the SCADA system is multivariate time series data. The multivariate time series data stored in the SCADA system can be utilized to develop various machine learning models that can accurately provide the ongoing insight of the oil well drilling process. These data-driven supervisory models can be used for identifying oil well drilling complications. This research work primarily aims at developing AI based models that can be used to realize systems capable of automatically detecting anomalies during oil well drilling operations. The focus is on stuck pipe anomalies that care recurrent during the drilling operation. The above mentioned aim is attained through the following three contributions: The first contribution is development of a hierarchical classifier that identifies oil well drilling activities from the real-time oil well drilling data and also provides a detailed report that shows the percentage of time the drilling activity is performed in one complete cycle of the oil well drilling. The second contribution describes a novel probabilistic model that combines Dynamic Naive Bayesian Classifier and Fuzzy AdaBoost to identify the anomalies that lead to stuck pipe complication during the oil well drilling process. \The last contribution explains novel Contextual Dynamic Bayesian Network that detects contextual anomalies that occur during the oil well drilling process. All the developed models have been tested using real data from various wells located in Assam. The activity detection module has also been validated by deploying it at the well sites and the results are satisfactory.