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Moving Towards Automation and Artificial Intelligence Solutions in Managing HSE Risks And Incidents

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ABSTRACT

Objective: To showcase the predictive and prescriptive modeling solutions namely Artificial Intelligence Incidence & Risk Analysis (AIIRA) to predict HSE risk and incident and prescribe specific intervention plan as new way of work in risk minimisation and incident avoidance. To share the overall framework and lifecycle process involved in developing the predictive and prescriptive modeling. To share the deployment key success stories and challenges experienced during pre- deployment and post deployment. **Method:** A quantitative method is being used via experimental approach utilising our project HSE incidence records. A total of about 700 incidents are being used from year 2018 until 2022 with more than 4000 occurrences are being analysed. Quantitative testing is being applied to experiment few machine learning algorithms to forecast potential high-risk activity, severity of the incidence i.e. Injurious, Non-injurious and Near Miss as well as Basic Risk Factor (BRF) that can lead to potential incidence so that the system can prescribe appropriate risk control measures that to be implemented at sites. These machine learning models are built with the following steps (i) data preparation (ii) feature selection (iii) model selection (iv) model training (v) model evaluation (v) model deployment. Models such as Random Forest (RF), Multi-layer Perception (MLP), and Gradient Boosting Machine (GBM) are selected due to the dataset structure as well as its capability to solve specific problem during model selection step. We also implement deep learning approach via Deep Boltzmann Machine (DBM), in which this model is well-established generative model technique that has been demonstrated to effectively capture the underlying probability distribution of numerical data. After training and evaluating the model, it is deployed in the production environment to serve real-world data. **Results:** Our findings show that the capability of AIIRA to predict HSE risk and incidence can go up to 95% accuracy level. Based on the actual deployment at our project sites and facilities, we are able to achieve incidence avoidance about 75% reduction in 2022. This conclude that adoption of AIIRA will inculcate proactive HSE culture and mindset shift to other O&G players and construction companies on the importance to leverage digital application in intensifying management of HSE risks and incidents at project sites. It will also enable to support the company in decision making process e.g., to prioritise on the hot spot project/sites locations, early planning in providing adequate resources and preventive control. measures for focused intervention and cost optimisation. Based on utilisation of AIIRA at PD&T, the business has successfully achieved accident avoidance of more than 50% in 2021 and 2022 as compared to past 3-years rolling average. **Conclusion:** Moving forward, PETRONAS continues to enhance AIIRA to be industry- adaptable solutions for sustainable risk and incident management across the industry.

Keywords: Oil and Gas, HSE, Artificial Intelligence, Big Data, Machine Learning, Predictive Analytics