LITERATURE SURVEY

Crude Oil Price Prediction using Artificial Neural Network

Crude oil is amongst the most important resources in today's world, it is the chief fuel and its cost has a direct effect on the global habitat, our economy and oil exploration, exploitation and other activities. Prediction of oil prices has become the need of the hour, it is a boon to many large and small industries, individuals, the government. The evaporative nature of crude oil, its price prediction becomes extremely difficult and it is hard to be precise with the same. Several different factors that affect crude oil prices. We propose a contemporary and innovative method of predicting crude oil prices using the artificial neural network (ANN). The main advantage of this approach of ANN is that it continuously captures the unstable pattern of the crude oil prices which have been incorporated by finding out the optimal lag and number of the delay effect that controls the prices of crude oil. Variation of lag in a period of time has been done for the most optimum and close results, we then have validated our results by evaluating the root mean square error and the results obtained using the proposed model have significantly outperformed.

Architecture Proposal for Machine Learning Based Industrial Process Monitoring

In the context of Industry 4.0, an emerging trend is to increase the reliability of industrial process by using machine learning (ML) to detect anomalies of production machines. The main advantages of ML are in the ability to (1) capture non-linear phenomena, (2) adapt to many different processes without human intervention and (3) learn incrementally and improve over time. In this paper, we take the perspective of IT system architects and analyse the implications of the inclusion of ML components into a traditional anomaly detection systems. Through a prototype that we deployed for chemical reactors, our findings are that such ML components are impacting drastically the architecture of classical alarm systems. First, there is a need for long-term storage of the data that are used to train the models. Second, the training and usage of ML models can be CPU intensive and may request using specific resources. Third, there is no single algorithm that can detect machine errors. Fourth, human crafted alarm rules can now also include a learning process to improve these rules, for example by using active learning with a human-in-the-loop approach. These reasons are the motivations behind a microservice-based architecture for an alarm system in industrial machinery.

Assessment and Use of Unmanned Aerial Vehicle for Civil Structural Health Monitoring

Unmanned Aerial Vehicles or UAVs can be employed in a multitude of civil applications owing to their ease of use, low maintenance, affordability, high-mobility, and ability to hover. Such vehicles are being utilized for real-time monitoring of road traffic, providing wireless coverage, remote sensing, search and rescue operations, delivery of goods, security and surveillance, precision agriculture, and civil infrastructure inspection. They are the next big revolution in technology and civil infrastructure is expected to dominate their more than $45 Billion worth market. This paper surveys the UAV assisted Structural Health Monitoring or SHM literature over the last decade and categorizes UAVs based on their aerodynamics. Further, it presents the payload product line to facilitate the SHM tasks, details the different applications of UAVs exploited in the last decade to support civil structures and discusses the key challenges faced in its application across various domains.

Developing Digital Transformation Strategy for Manufacturing

The digital era is characterized by fast development, growth, innovation, and disruption. Organizations that want to survive must be ready to adapt to the new digital landscape. The digital transformation process is more than just implementing new technology, investing in tools, or upgrading existing systems. These steps are important, but they are not the whole picture. If an organization wants to stay competitive, it won't just be able to respond to changes, it should expect them and stimulate innovation itself. To do this, companies need to plan ahead and be active designers for their future. This is where the digital transformation strategy comes in. The digital transformation strategy helps leaders answer the questions for their business such as the current digitalization level, future vision, and how to get there. To be protected from digital disruption, companies need to develop three core competencies related to awareness, informed decision-making, and rapid implementation. The development and implementation of a digital transformation strategy have become a key concern for many organizations across manufacturing industries, but how such a strategy can be developed remains an open question. In this paper, we will be discussing how manufacturing could develop a digital transformation strategy that including a different aspect of the strategy tailored to the nature of the manufacturing sector.

Oil Forecasting Using Artificial Intelligence

The motivation for this research paper is the application of two novel models in the prediction of crude oil index. The first model is a generic deep belief network and the second model is an adaptive neural fuzzy inference system. Furthermore we have to emphasize on the second contribution in this paper which is the use of an extensive number of inputs including mixed and autoregressive inputs. Both proposed methodologies have been used in the past in different problems such as face recognition, prediction of chromosome anomalies etch, providing higher outputs than usual. For comparison purposes, the forecasting statistical

and empirical accuracy of models is benchmarked with traditional strategies such as a naive strategy, a moving average convergence divergence model and an autoregressive moving average model. As it turns out, the proposed novel techniques produce higher statistical and empirical results outperforming the other linear models. Concluding first time such research work brings such outstanding outputs in terms of forecasting oil markets.

Machine Learning Approach for Crude Oil Price Prediction with Artificial Neural Networks-Quantitative (ANN-Q) Model

The volatility of crude oil market and its chain effects to the world economy augmented the interest and fear of individuals, public and private sectors. Previous statistical and econometric techniques used for prediction, offer good results when dealing with linear data. Nevertheless, crude oil price series deal with high nonlinearity and irregular events. The continuous usage of statistical and econometric techniques for crude oil price prediction might demonstrate demotions to the prediction performance. Machine Learning and Computational Intelligence approach through combination of historical quantitative data with qualitative data from experts' view and news is a remedy proposed to predict this. This paper will discuss the first part of the research, focusing on to (i) the development of Hierarchical Conceptual (HC) model and (ii) the development of Artificial Neural Networks-Quantitative (ANN-Q) model.

Crash Severity and Rate Evaluation of Conventional Vehicles in Mixed Fleets with Connected and Automated Vehicles

Connected and Automated Vehicle (CAV) technology, although in the development stage, is quickly expanding its market but a full market penetration might not be rapid. The safety concern is the paramount challenge to widespread adoption of this disruptive technology. During the transition period, fleets will be composed of a combination of CAVs and conventional vehicles, and therefore it is germane to investigate the repercussions of CAVs on traffic safety at different penetration. Since crash severity and frequency in conjunction reflect the traffic safety, this study attempts to investigate the effect of CAVs on both crash severity and frequency. PTV VISSM microsimulation platform is used to simulate M1 Geelong Ring Road network (Princes Freeway) in Victoria, Australia, which is the testbed for this study. Network performance is evaluated using performance metrics (Total System Travel Time, Delay and instantaneous speed profiles). Surrogate safety measures (time to collision, post encroachment time, etc.) are examined to inspect the safety in the network. The results showed that CAVs would not inevitably decrease the crash severity and crash rate involving manual vehicles, despite the improvement in network performance, given the demand and the set of parameters used in our operational CAV algorithm are intact. Additionally, the study identifies that the safety benefits of CAVs are not proportional to CAV penetration, and a full-scale benefits CAVs can only be achieved at 100% CAV

penetration. The results presented in this study provide an insight into the repercussion of CAVs on comprehensive traffic safety to the insurance companies and other industry participants, enabling safety-related services and more enterprising business models.

Forecasting Model for Crude Oil Price Using Artificial Neural Networks and Commodity Futures Prices

This paper presents a model based on multilayer feedforward neural network to forecast crude oil spot price direction in the short-term, up to three days ahead. A great deal of attention was paid on finding the optimal ANN model structure. In addition, several methods of data pre-processing were tested. Our approach is to create a benchmark based on lagged value of pre-processed spot price, then add pre-processed futures prices for 1, 2, 3,and four months to maturity, one by one and also altogether. The results on the benchmark suggest that a dynamic model of 13 lags is the optimal to forecast spot price direction for the short-term. Further, the forecast accuracy of the direction of the market was 78%, 66%, and 53% for one, two, and three days in future conclusively. For all the experiments, that include futures data as an input, the results show that on the short-term, futures prices do hold new information on the spot price direction. The results obtained will generate comprehensive understanding of the crude oil dynamic which help investors and individuals for risk managements.

A Blending Ensemble Learning Model for Crude Oil Price Prediction

Given that the price of crude oil is driven by a number of factors with varying frequency, it is difficult to accurately capture its behavior, which in turn leads to challenges in forecasting. Moreover, different mechanisms of fluctuations have been observed at different time series periods. To efficiently capture these diverse fluctuation profiles, we propose to combine heterogenous predictors for predicting the crude oil price. Specifically, a forecasting model is developed using blended ensemble learning is developed that combines various machine learning methods, including linear regression, k-nearest neighbor regression, regression trees, support vector regression, and ridge regression. Brent and WTI crude oil data at various time series frequencies are used to validate the proposed blending ensemble learning approach. To show the effectiveness of the proposed model, its performance is compared with existing individual and ensemble learning methods used for crude oil price prediction, such as lasso regression, bagging lasso regression, boosting, random forest, and support vector regression. We show that our proposed blending ensemble learning model dominates the existing forecasting models in terms of forecasting errors. The proposed model exhibits a good prediction performance for both short- and long-term forecasting horizons, which is beneficial to stakeholders and related industries that depend on this energy source.

The Prediction of Brent Crude Oil Trend Using LSTM and Facebook Prophet

Crude oil and petroleum products are among the critical inputs of industrial production and have an essential role in logistics and transportation. Hence, sudden increases and decreases in oil prices cause particular problems in global economies and thus, they have a direct or indirect effect on economies. Furthermore, due to crises in developing economies, trade disputes between major economies, and the dynamic nature of the oil price effect on demand and supply for oil and petroleum products, and time to time volatility in the oil price are very severe. The uncertainty in oil prices can leave both consumers and producers with heavy potential losses. Due to this rapid variability, predicting oil prices has global importance. In this study, to increase the accuracy and stability, the Long-Short Term Memory (LSTM) and Facebook's Prophet (FBPr) were applied to foresee future tendencies in Brent oil prices considering their previous prices. Comparing the two models made using the 32-year data set between June 1988 and June 2020 weekly for oil prices, and the model with the best fit was determined. The dataset was split into two sets: training and test sets—the twenty-five years are used for the training set and the seven years are used to validate forecasting accuracy. The coefficient of determination (R2) for the LSTM and FBPr models was found as 0.92, 0.89 in the training stage, and 0.89, 0.62 in the testing stage, respectively. According to the results obtained, the LSTM model has superior results to predict the trend of oil prices.