Team ID : PNT2022TMID13112
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Title : A new approach for crude oil price prediction based on stream learning

Authors : Shuang Gao, Yalin Lei

Aim:
To predict the price of crude oil using a novel approach based on a new machine learning paradigm called stream learning

Implementation:

- Stream learning approach is used
- The main advantage of stream learning approach is that the prediction model can capture the changing pattern of oil prices since the model is continuously updated whenever new oil price data are available, with very small constant overhead.
- This stream learning approach is compared with other models in order to test the accuracy of results and it is observed that this model yields a higher performance result in terms of mean squared error and directional ratio over a variety of horizons
- Two types of prices are predicted:
    - The U.S. refiner acquisition cost for crude oil imports
    - The WTI crude oil spot price

- **Stream learning**
    - The model handles applications where continuous data streams are generated from non-stationary processes
    - Since the oil prices are non-stationary, a technique to handle continuous flow of data as opposed to a fixed sample of independent and identically distributed data is required
    - It is a supervised machine learning model
    - The oil prices of previous time slots are used to predict the oil prices of current time slot
    - For non-stationary time series data such as oil prices, a forgetting mechanism (e.g., sliding windows, fading factors) will be deployed when updating the machine learning model.
    - MOA (massive online analysis) has been used to develop stream learning models for oil price prediction.
    - Training data is split into 90% as training set and 10% as the development set

Results:

- Two performance metrics are used,One among them is the mean squared prediction error (MSPE) which measures the average of squares of prediction error. It is the difference between the true values and the predicted values
- Other is the directional accuracy ratio (DAR).It measures the accuracy of predicting the direction of oil price change
- The stream learning model achieves the lowest MSPE and highest DAR among all the other prediction models

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Title : **Forecasting the price of crude oil**

Authors : **Ramesh Bollapragada . Akash Mankude . V. Udayabhanu**

Aim:
To develop a forecasting model to predict the oil prices that aid management to reduce operational costs, increase profit and enhance competitive advantage.

Implementation:

- Implemented ARIMA models through MINITAB 19 software. The plot of the data of the oil prices from 1986 to 2017 showed an increasing trend.
- The autocorrelations are compared with their error limits, the only significant autocorrelation was at lag 1. Similarly, only the lag 2 partial autocorrelation was significant. The autocorrelations appear to cut off after lag 1, indicating MA (1) behavior.
- At the same time, the partial autocorrelations appear to cut off after lag 2, indicating AR (2) behavior.
- Neither pattern appears to die out in a declining manner at low lags
- So, it was decided to fit both ARIMA (2, 1, 0) and ARIMA (0, 1, 1) models to the data.
- Implemented the combination method also
- After obtaining the values of the forecasted crude oil prices, the values are compared with the prices of the previous period.

Results:

- To evaluate the forecast models, the actual crude oil prices from 1991 to 2017 are compared with the forecasted price obtained from the models.
- The best method was a combination model.
- It is inferred that the Combination Method performed better than ARIMA (2, 1, 0) across all metrics, and is better than ARIMA (0, 1, 1) on the MSE metric. ARIMA (0, 1, 1)

performs slightly better than the Combination Method on the MAD, MAPE and MPE metrics.

Title : Crude oil price prediction using artificial neural network

Authors : Nalini Gupta, Shobhit Nigam

Aim:

A contemporary and innovative method of predicting crude oil prices using artificial neural networks (ANN) is proposed.The main advantage 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.

Implementation:

- ANN architecture is used
- Back propagation algorithm and the error signal is cultivated through the network in the backward direction by changing and managing weights of the network to maximize the performance of the network.
- The ANN development model is as follows:

Fig. 2. Model development Diagram

Results:

- Root mean square error is used to evaluate the performance of the model

- The results are taken out by varying the lag value, the optimal lag is obtained with the least RMSE values.
- The flaw with the model is that it is difficult to find the exact price of crude oil with exact change in price

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Title : Analysis and forecasting of crude oil price based on the variable selection-LSTM integrated model

Author: Quanying Lu , Shaolong Sun , Hongbo Duan and Shouyang Wang

Aim:
A new research framework for core influence factors selection and forecasting has been developed.

Implementation:
- Firstly, this paper assesses and selects core influence factors with the elastic-net regularized generalized linear Model (GLMNET), spike-slab lasso method, and Bayesian model average (BMA).
- Secondly, the new machine learning method long short-term Memory Network (LSTM) is developed for crude oil price forecasting.
- Six different forecasting techniques are used to assess the price
- Finally, we compare and analyze the different results with root mean squared error (RMSE), mean absolute percentage error (MAPE), directional symmetry (DS).

Results:

- The empirical results show that the variable selection-LSTM method outperforms the benchmark methods in both level and directional forecasting accuracy.

Title : Beta Clustering Of Impact Of Crude-Oil Prices On The Indian Economy

Authors : Sumit Ghosh, N. Sivakumar

Aim:
After a review of research on the impact of crude-oil prices on various economic parameters across the globe, the paper gives the methodology of the study. The results of the study are then presented. The clustering of the extent impact of crude-oil prices on the Indian economy is discussed finally

Implementation:
- The study is based on Null hypothesis

- Null Hypothesis: The extent of impact of change in crude-oil prices on selected economic parameters is similar
- Statistical techniques are also used
- Regression: Regression equations were developed to study the impact of crude oil prices on the selected economic parameters
- To understand whether the beta values of all regressions were equal, the mean beta was subjected to a t test along with calculating its confidence interval and other descriptive statistics
- Beta clustering is a statistical technique of finding clusters of betas when variables are regressed against a common independent variable. Beta clustering is useful to understand the varying impact of the independent variable on several dependent variables

Result:

- The paper has shown that the impact of crude-oil prices is not similar across various economic parameters.
- Further, the paper has also shown that betas can be clustered meaningfully to understand the varying levels of impact of crude-oil prices on the Indian economy.
- The results of the study not only show the significance of crude-oil for the Indian economy, but also provide pointers to policy makers for effective use of the beta clusters for better policy making