PREDICTIONEER

Dynamic Machine Learning To Forecast Live OIl Prices

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INTRODUCTION

The ability to predict the future is an extension of artificial intelligence, not magic. In today's changing environment, it is essential to be able to anticipate the future using the most recent computing technologies. Oil is the lifeblood of industrialized nations. In recent years, we have seen that control of oil-rich regions is a fundamental geopolitical issue that dictates relation between nuclear superpowers. Being oil rich is a profound natural blessing, the nations who use it well end up prosperous like Norway, the ones who do not end up in treacherous situations like Venezuella. The fact that oil products underpin modern society justifies the obsession and need for it. Oil prices, equities, and derivatives are therefore some of the most eagerly anticipated items being tracked in several stock markets throughout the world. Thus chemical engineers need to be particularly good at foreseeing oil prices and staying ahead of the curve, literally speaking.

OVERVIEW

Determining the occurrence of global macroeconomic events is an arduous task. To aid in the process we have primarily relied upon two ML models, *Linear Regression* and *CNN- LSTM.*

For predicting after 14 November, since we were not having any feature dataset for further dates, we updated the dataset each time, trained our model on the new dataset and predicted the dates from 14th November to 31st December 2022. The input dataset at each time step comprised of 10 data values as input.

Oil Price Series
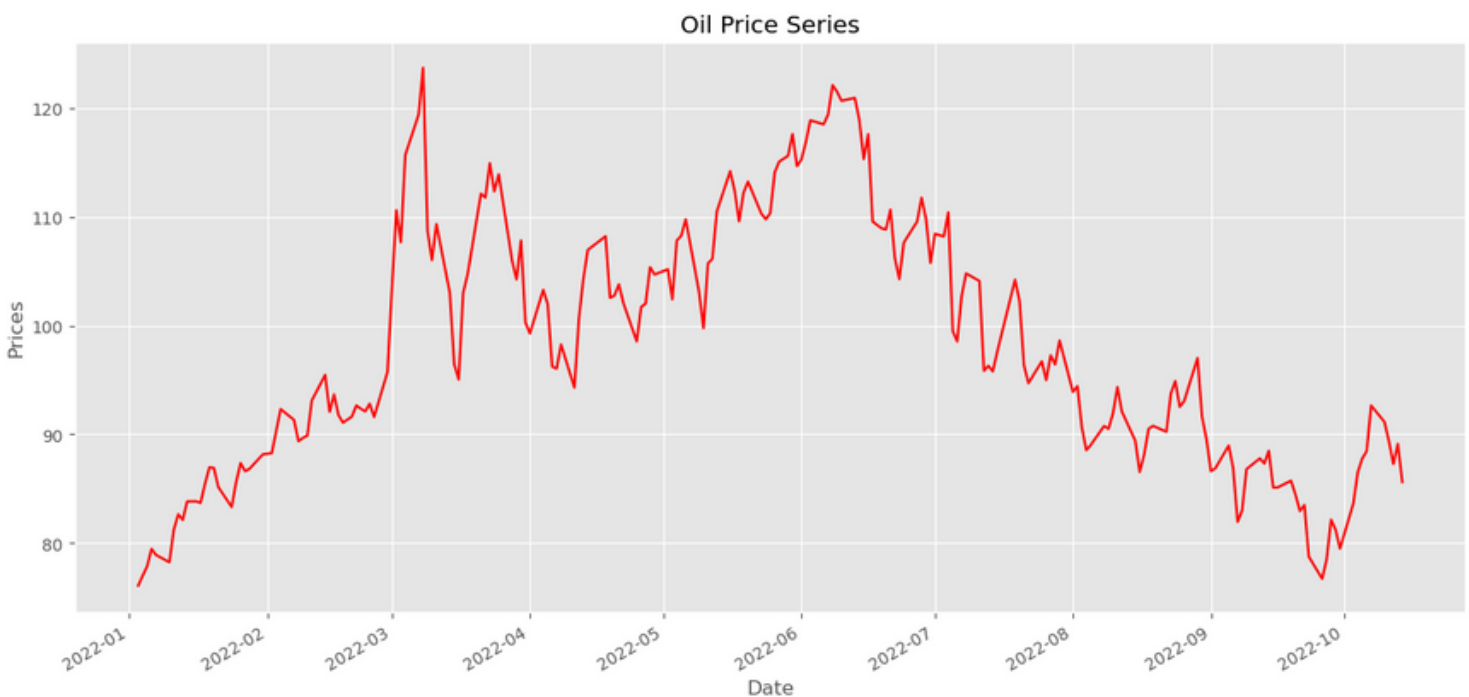
MODEL

To study various trends and correlations, we also calculated the moving averages and based on that strategised the concept of *Dual Moving Average Crossover*. Depending on the impact of short term and long term moving averages, we also predicted the next day price using Linear Regression

Trends in Price & Short-Term & Long-Term Moving Averages

In this project, we use *Convolutional Neural Network(CNN) - Long short-term memory(LSTM) Model* to predict oil prices. The accuracy of traditional methods is difficult to be convincing. On the contrary, this model is a high accuracy-high performance model based on the amount of data we have for training the model.
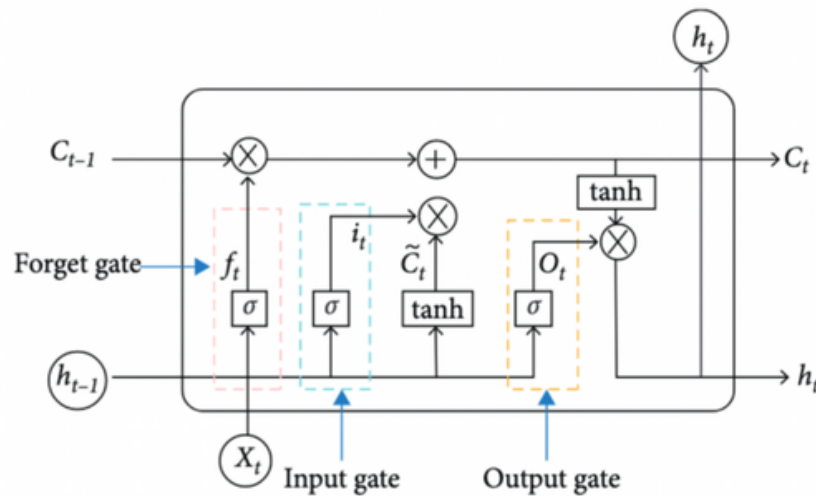
Figure 1: CNN-LSTM structure diagram.

CNN(Convolutional Neural Network) helps in understanding and finding patterns and features using convolution layer and pooling layer.

LSTM(Long Short-Term Memory) networks are well-suited to classifying , processing and making predictions based on time series data.

According to the characteristics of CNN and LSTM, a oil price forecasting model based on CNN-LSTM is established. The model structure (refer Figure 1) includes input layer, one-dimensional convolution layer, pooling layer, LSTM hidden layer, and full connection layer.

FORECAST

Our data set majorly comprised of prices (Open, High, Low, Close, Volume and Change%) from January 3, 2022 to October 14, 2022 provided by the global oil benchmark organiation, the West Texam Intermediate (WTI) to predict real life stock prices of crude oil WTI. We compiled the predicted oil prices from the day after the deadline (1st November 2022) to the end of the year (31st December 2022) in an excel or CSV file and implemented our models henceforth.
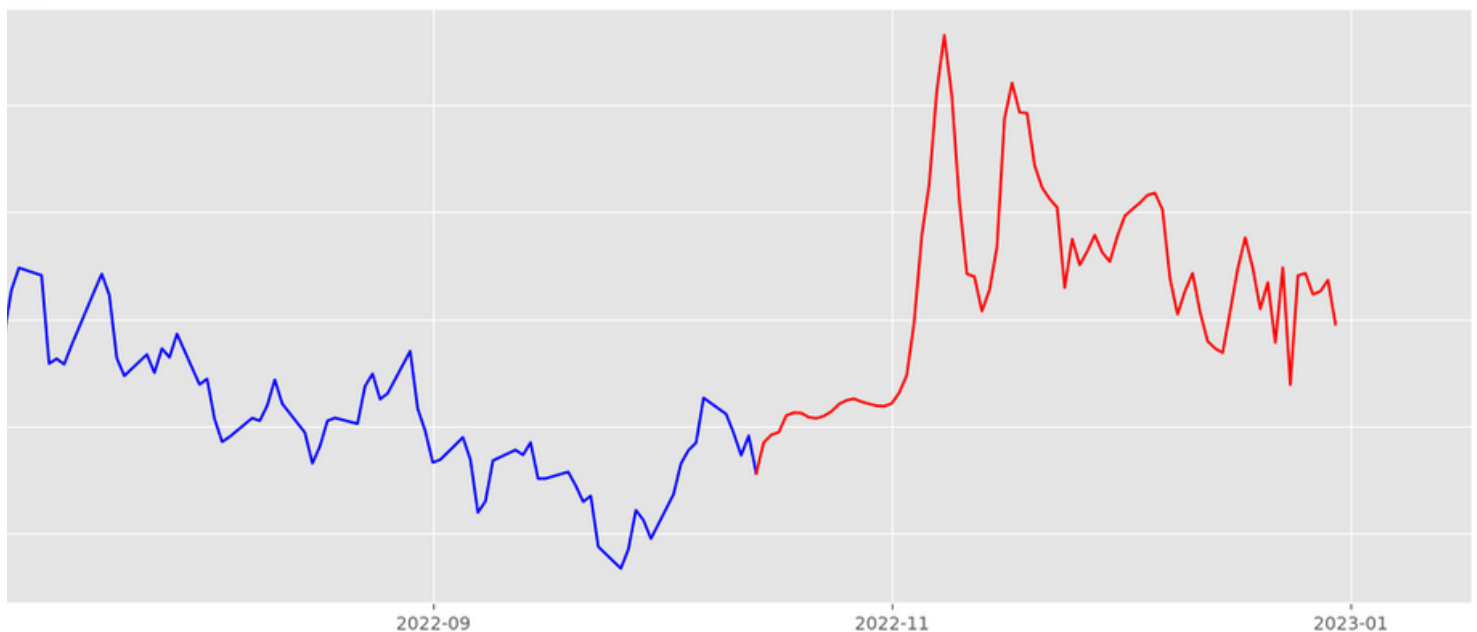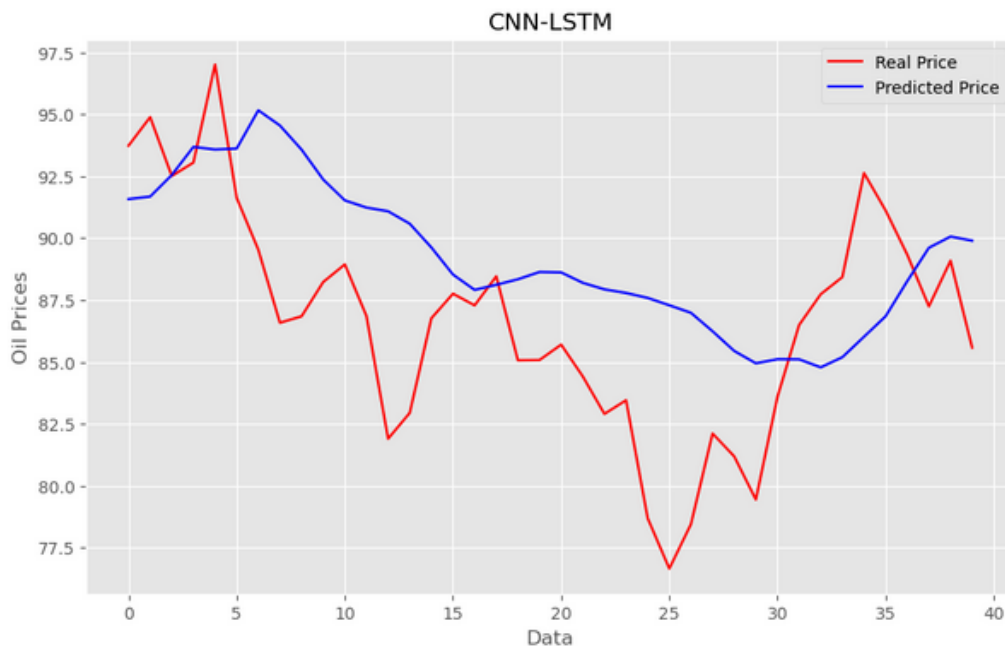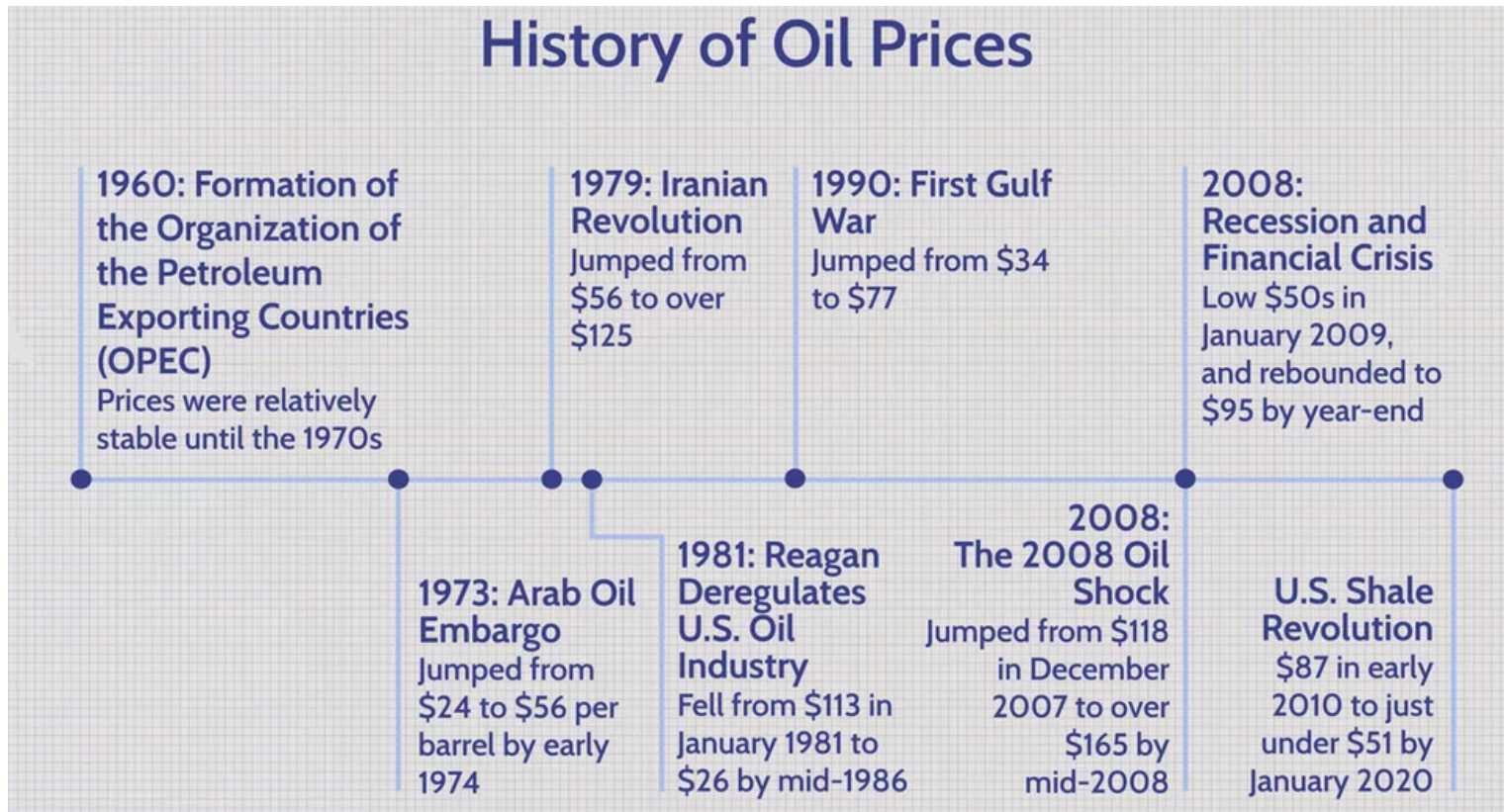
ACCURACY

In order to evaluate the forecasting effect of CNN-LSTM, the accuracy was assessed on test data taken from 30 September to 14 October, using multiple R-squared values and the residual error values from the actual oil prices in the specified dates.

$$R^2 = 1 - \frac{SS_{res}}{SS_{tot}} = 1 - \frac{\sum_i^n (y_i - \widehat{y_i})^2}{\sum_i^n (y_i - \overline{y_i})^2}$$

The accuracy for our CNN-LSTM Model came out to be 78 %

INTERPRETATION

History of Oil Prices

1960: Formation of the Organization of the Petroleum Exporting Countries (OPEC)
Prices were relatively stable until the 1970s

1979: Iranian Revolution
Jumped from $56 to over $125

1990: First Gulf War
Jumped from $34 to $77

2008: Recession and Financial Crisis
Low $50s in January 2009, and rebounded to $95 by year-end

1973: Arab Oil Embargo
Jumped from $24 to $56 per barrel by early 1974

1981: Reagan Deregulates U.S. Oil Industry
Fell from $113 in January 1981 to $26 by mid-1986

2008: The 2008 Oil Shock
Jumped from $118 in December 2007 to over $165 by mid-2008

U.S. Shale Revolution
$87 in early 2010 to just under $51 by January 2020

If we stroll down the memory lane and study the major historical events of the past, a lot of major peaks and throughs can be attributed to Wars and Economic recessions. From 1979 Iranian Revolution to 1990 Gulf war, we have seen prices more than double. Similar scenario occurred during the 2008 global financial meltdown and even during the Internet bubble bust of early 2000s.

The behaviour of humans and nations is speculative and it is expected to show a similar trend in future as well.

INTERPRETATION

The next two peaks in the prices can be very well explained by the two major global conflicts that are emerging all of a sudden. The Russia Ukraine War and the China Taiwan crisis. The repercussions of the war by Russia on Ukraine is catastrophic for the entire global economy because Russia is one of the major players among the OPEC (Organisation for petroleam exporting countries) nations and the China Taiwan crisis is going to adversely affect the western developed world because the Taiwan is the major manufacturer of silicon chips, a necessity for all electronics manufacturing companies.
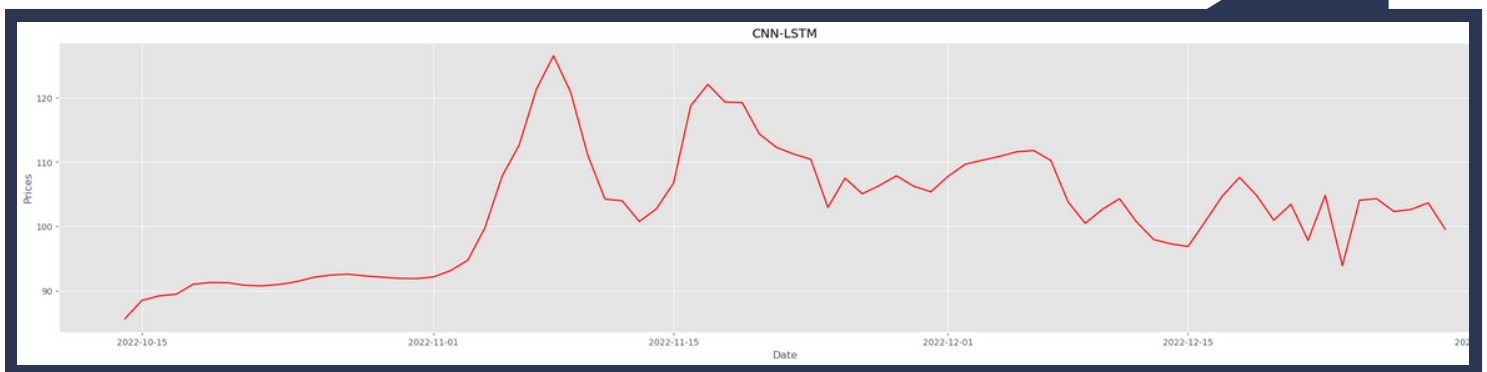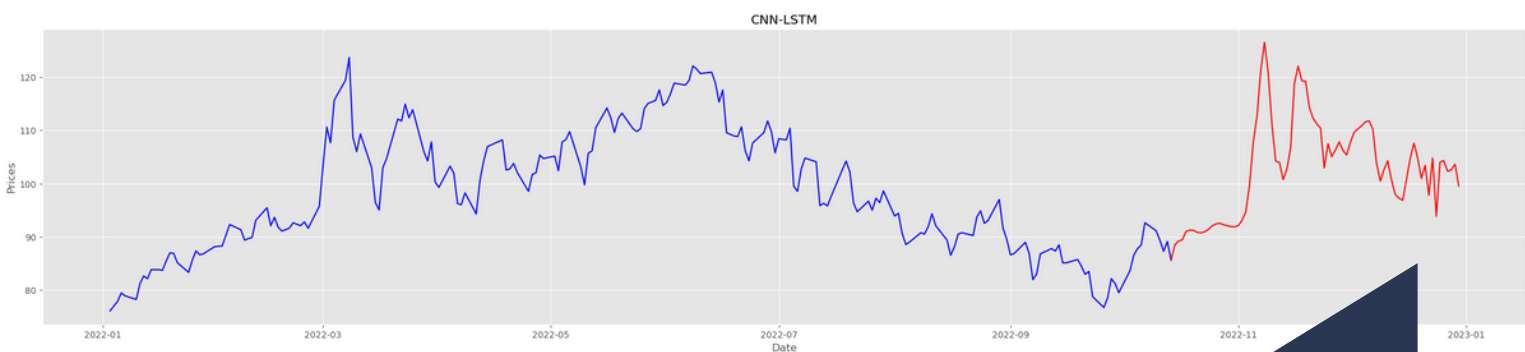
INTERPRETATION

As USA, the controller of the global reserve currency, the dollar, is severely involved in both these crisis and as we are already seeing the decline of people's trust on the dollar with Saudi Arabia in talks with China to trade oil in Yuen and Russia-China agreement to trade natural resources in their own currencies, there are bound to be repurcusssions. Consequently, our model shows an unstable future on the price of oil with major ups and downs in coming months.

PS: Although no one can predict the future with 100% certainty, we can see that our model hands over a fairly indication of what the future macroeconomic events have in store for us.

We hope you loved our presentation just as much as we loved presenting it to you.

LINKS

Links

- CNN-LSTM Model - Presenting accuracy of 78% over test dataset

https://drive.google.com/file/d/176eFuSDQ_8zWEHPT
qPQNpigoFE21IHY8/view?usp=share_link

- Linear Regression Model with DMAC Strategy based on trends in Short-Term & Long-Term Moving Averages

https://drive.google.com/file/d/1GQsQOOaetTWrfcNx1
qxhzHKTOiPDsBA6/view?usp=share_link