AI Methods for Application in Oil Industry

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Abstract - The article gives a general examination of artificial intelligence methods including support vector machines and artificial neural networks, as well as the key areas in which they are applied to the oil and gas sector. In this study, the interpretation of geological data, price forecasting, and flow regime forecasting are the three main applications of such technologies that are examined. The employment of artificial intelligence-based techniques improves the productivity of labour done in both exploration and production, allowing for better outcomes at a lower cost. Utilizing all possible mechanisms to increase efficiency is crucial in the changing market conditions created in the mining and energy sectors. At every level of the oil production process, data mining techniques are very practical.

Keywords- Geological data, price forecasting, support vector machine.

I. INTRODUCTION

Mining businesses have faced a significant challenge as a result of the recent decrease in the price of oil and other commodities. Cheap prices inspire them to seek out novel, creative solutions—ways to boost efficiency—as opposed to sticking with their current operational initiatives and long-term strategic plans. The field of artificial intelligence is one of these [6]. Artificial intelligence refers to the capacity of computer systems to simulate human intelligence in carrying out a variety of tasks, including (1) training (perception of information, its processing, and determination of rules of its use), (2) inference (application of these rules for drawing specific conclusions and decision-making), (3) self-correction (self-correction of errors taking into account accumulated experience), etc. Humans and artificial intelligence compete in terms of precision, strength, and speed. According to the loaded data and the goal (pattern identification, management, forecasting, etc.), it can swiftly structure enormous amounts of data, execute analysis on them, and output the appropriate result. The most widely used applications of artificial intelligence include text, image, speech, and face recognition, "computer vision," which enables computers to recognise, track, and categorise objects, machine translation, game engines, data processing and analysis, and many other things. The oil and gas sector uses artificial intelligence extensively in all aspects of its operations, from the interpretation of geological data to the actual production of hydrocarbons. Because of it, prices are reduced and production efficiency is increased [5].

II. AIMS AND OBJECTIVE

a) Aim

The use of science and engineering with the goal of creating intelligent machine composition is known as artificial intelligence (AI). It entails employing a tool that is inspired by human intelligence to solve complex problems. The tool is created to have computers carry out tasks that were previously regarded to require human intelligence. AI supports and permits time reduction based on staff demands and, most importantly, operational costs, in contrast to other forms of computational automation.

b) Objective

- A mathematical model of a biological neural network that replicates the function of the human nervous system and brain is called an artificial neural network (ANN).
- The main advantages of AI-based approaches over traditional econometric models.

III. LITERATURE SURVEY

Paper 1: Applications of Artificial Intelligence In Oil And Gas Development:

In this paper artificial intelligence has returned to the forefront of research projects in many fields, and the significant increase in AI-based work has demonstrated its potential to be a future direction for nearly all disciplines. AI technology is undoubtedly a new shining light in the oil and gas sector as well, attracting the attention of academics who have devoted their careers to it. An extensive amount of AI-based work has been documented in the literature, which has

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been investigated in this work to learn more about the uses of artificial intelligence in oilfield development and to get a glimpse of the future trend of this exciting technology in the oil and gas industry [2].

Paper 2: Application of Artificial Intelligence Methods In Drilling System:

In this paper the use of science and engineering with the goal of creating intelligent machine composition is known as artificial intelligence (AI). It entails employing a tool that is inspired by human intelligence to solve complex problems. The tool is created to have computers carry out tasks that were previously regarded to require human intelligence. AI supports and permits time reduction based on staff demands and, most importantly, operational costs, in contrast to other forms of computational automation. Artificial intelligence (AI) holds a great deal of interest for and importance in the industry of petroleum exploration and production [3].

Paper 3: A Relative Evaluation of Multiclass Image Classification By Support Vector Machines:

In this paper Support vector machines (SVMs) offer a lot of potential as remote sensing data classifiers. Due to their binary character, which forces multiclass classifications to be dependent upon numerous binary studies, their use in remote sensing has been constrained. Here, a method for classifying data from airborne sensors into many categories using a single SVM analysis is compared to a number of classifiers that are frequently employed in remote sensing, with special attention paid to the size of the training set's effect on classification accuracy. The same datasets were categorised in addition to utilising the SVM using discriminant analysis, decision trees, and multilayer perceptron neural networks. A statistically rigorous comparison was made between the accuracy assertions of the classifications produced from the various classifiers, accounting for the relevant[7].

IV. EXISTING SYSTEM

Since AI oilfield can significantly reduce the cost of oil production, increase average oil field recovery, increase management efficiency of enterprises, and simultaneously support both economic and social development, it is the future trend of oil firms and plays a leading and directing role in the informatization of oil fields at all levels. The main future growth route of the system for digital oil fields, which is on the cusp of maturity, is to combine digital platforms based on current digital oilfields and comprehensively examine the data related to oilfields [1].

V. COMPARATIVE STUDY

Sr. No.	Author	Project Title	Publication	Technology	Purpose
1.	Hong Li, Haiyang Yu, Nai Cao, He Tian, Shiqing Cheng.	Applications of Artifcial Intelligence in Oil and Gas Development.	IEEE,2019.	Support Vector Machine.	application of AI in important issues in oilfeld development including oilfeld production dynamic prediction, developing plan optimization, residual oil identifcation, fracture identifcation, and enhanced oil recovery are specifcally investigated and summarized, the backs and cons of existing AI algorithms has been compared.
2.	Opeyemi Bello, Javier Holzmann, TanveerYaqoob, CatalinTeodoriu.	Application Of Artificial Intelligence Methods In Drilling System Design And Operations.	IEEE,2019.	Random Search Algorithm.	This paper reviews and analyzes the successful application of artificial intelligence techniques as related to one of the major aspects of the oil and gas industry, drilling capturing the level of application and trend in the industry.
3.	Foody, G., and A. Mathur.	A relative evaluation of multiclass image classification by support vector machines.	IEEE,2020.	Machine Learning & End-to-End Deep Learning.	Here, an approach for multiclass classification of airborne sensor data by a single SVM analysis is evaluated against a series of classifiers that are widely used in remote sensing, with particular regard to the effect of training set size.

Table no.1: Comparative Analysis

VI. PROBLEM STATEMENT

In this stage, the project's viability is assessed, and a business proposal is presented with a very basic project plan and some cost projections. The proposed system's practicality must be investigated during system analysis. This will guarantee that the suggested solution won't burden the business. Understanding the main needs for the system is crucial for feasibility analysis.

VII. PROPOSED SYSTEM

The most effective linear classifying approach is support vector machine. The basic SVM method's main goal is to categorise items by projecting the original vectors that

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originally described the objects into a space of greater dimension and identifying a separating hyperplane that contains the biggest gap. The search for support elements, or class items that are situated on the class boundary, is carried out first. One coordinate is used to organise the elements, whereas the other coordinate's value is fixed. Supporting elements are a pair of items for which the class value changes. For the remaining element coordinates, this process is repeated[8].

VIII. ALGORITHM

Step 1: Start.
Step 2: User input
Step 3:

```
FILE_NAME = settings.MEDIA_ROOT + "\\" + 'oil_price.txt'
feature_list = []
target_list = []
with open(FILE_NAME, 'r') as f:
for line in f.readlines():
day, price = line.strip().split(' ')
feature_list.append([int(day)])
target_list.append(int(float(price) * 100)).
```

Step 4:

```
linear = LinearRegression().fit(feature_list, target_list)
svr_rbf = SVR(kernel='rbf', C=1e3, gamma=0.0001).fit(feature_list, target_list)
last_day = len(feature_list)
for i in range(1, 366):
feature_list.append([last_day + i])
target_list.append(np.nan).
```

Step 5:

```
linear_pred = list(map(lambda x: float(x) 100, linear.predict(feature_list)))
svr_rbf_pred = list(map(lambda x: float(x) / 100, svr_rbf.predict(feature_list)))
target = list(map(lambda x: float(x) / 100, target_list)).
```

Step 6:

```
print('==== Support vector regression  prediction ====')
print(' - 1 day : ', svr_rbf_pred[last_day])

print(' - 30 days : ', svr_rbf_pred[last_day + 29])
print(' - 365 days : ',svr_rbf_pred[last_day + 364]).
```

Step 7:

```
plt.plot(feature_list, target, color='black', label='Stock Price')
plt.plot(feature_list, linear_pred, color='blue', label='Linear Regressoin')
plt.plot(feature_list, svr_rbf_pred, color='red', label='Support Vector Regression FS')
plt.xlabel('A number of days since Jan 1, 2020')
plt.ylabel('Oil Price (USD)')
plt.gca().set_xlim(left=0).
```

Step 8: Stop.

IX. MATHEMATICAL MODEL

1. **SVM**
   Support Vector Manchines (SVMs) classify data by evaluating a hyperplane that raises the dividing line between classes in the training data. Hyperplane can be formulated as

$$f(x) = a^T x + c$$

   Where, a = dimensional coefficient, c = offset

2. **Artificial Neural Network(ANN)**
   The artificial neural network (ANN) model uses calculations and mathematics to imitate the workings of the human brain. Several of the most recent technological developments are in the field of artificial intelligence research, including robots, the use of ANNs, and picture and voice recognition[4].
   Formula for ann is

$$y = w_1 x_1 + w_2 x_2 + b$$

X. SYSTEM ARCHITECTURE

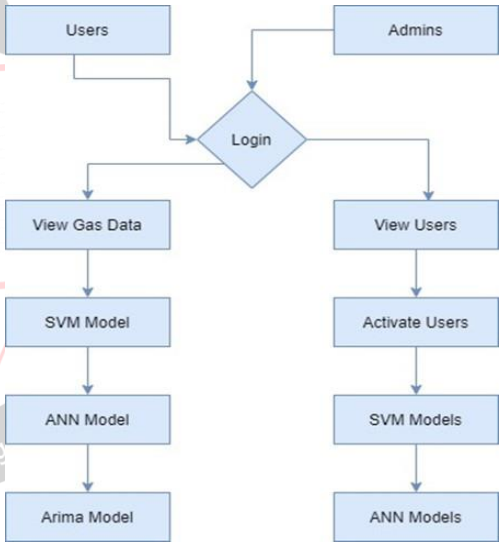

Fig 1: System Architecture

Description:

1) The user will register first if new user.
2) After logging in user's account will be activated by admin, only after getting activated user can access the features of website.
3) The system uses trained model and two algorithms which are SVM, ANN.
4) If u have access to admin side then u can insert new data sets and have more features then users account.
5) Oil price will be predicted as a final output.

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XI. ADVANTAGES

• The Arima Model, which uses learned data to forecast future values. data gathered from the Kaggle repository. This dataset's final date is used to determine 100 consecutive future prices.

• The ARIMA model's price predictions indicated that the price of crude oil will rise in the coming years as well as supply-side constraints.

XII. DESIGN DETAILS

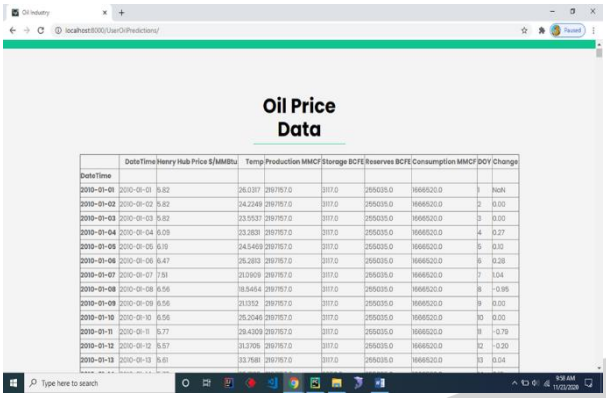

Fig 2: Result

The above figure shows the predicted oil price data using svm, ann and linear regression from a large amount of training data set given by admin.

XIII. CONCLUSION

Thus we have tried to implement the paper "Artificial Intelligence Methods Application in Oil Industry", Zayar Aung1; Ilya S.Mikhaylov; Ye Thu Aung,IEEE,2020 and the conclusion as follow: Thus in some cases ANN can achieve a result with a very high precision, but some cases can fail. The SVM method is intuitively clear, but it has a lot of computing complexity. The FS-SVM method was developed to eliminate disadvantage of SVM, by imposing a restriction on problem domain. It is shown that the considered restriction of the functional separability of classes is not critical for a large number of tasks, for example for some tasks, with have physical nature, such as oil production and oil-water-gas flow regime forecasting.

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