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Gold Price Prediction using Eight Neighborhood Non Linear Cellular Automata

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Abstract: *Gold price prediction is pronounced as one of the dynamic problems addressed by many researchers. Several researchers have proposed various methods to predict the gold price; still there is a potential room to a new novel method with more accuracy and precise prediction. This paper proposes a supervised classifier with an Eight Neighborhood -Non Linear Cellular Automata to predict the exact gold price. The input for this proposed classifier is taken from the time series data of the last ten years in India. The classifier is trained and tested to give daily predictions to the users, which helps many investors to decide the time to buy or sell gold. This classifier is trained to process large amount of statistical data, process the business decisions listed in news articles. Based on all these parameters it predicts the gold variations in future. The accuracy of the classifier tested with standard datasets was reported as 86.7%, which is considerably better when compared with the existing literature.*

Keywords: **Cellular Automata, Deep Learning, Gold P rice**

I. INTRODUCTION

Gold Price structure prediction is termed as a very important open problems addressed by common people. Gold is the major commodity in the economic and monetary market. India and china are the major importers among the world and consumes 60 % of the global gold. Every day, the value of the gold increases and cannot be controlled. Nowadays, people tend to invest in gold owing to huge profits in future. The gold prices are closely related with other commodities. A hike in oil prices will have positive impact on gold prices and vice versa. When there is a hike in equities, gold prices goes down. This is because when there is a boom in the stock market, the investors tend to invest the gold money in the equities. Hence, an accurate gold price forecasting is required to foresee the business trends in future.

Soft Computing techniques like Neural Networks, Fuzzy logic, Genetic Algorithms, Particle Swarm Optimization and Simulation Annealing can be used to forecast the gold price. Among the above, Artificial Neural Networks are very accurate and predicts the future very well. Some of the recent studies on gold price forecasting are discussed below.

In the section II summary of literature survey was provided, section III consists of the design of the classifier, section IV consists of implementation details with comparisons with the existing literature.

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II. LITERATURE SURVEY

Gary et al. [1] utilized neural systems for estimating Standard and Poor's 500 stock record and gold prospects costs. Their estimate depended on the recorded costs of the stock file and gold costs. Malliaris et al. [2] utilized occasions arrangement procedures and Artificial Neural Networks for gauging the costs of gold, oil and Euro. They gave an interrelationship among the three and proposed ANN procedure to estimate the individual factors. What's more, they reasoned that both present moment and long haul relationship exist between the three factors. Mehdi Bijari et al. [3] proposed a cross breed ARIMA model utilizing Fuzzy rationale and Artificial Neural system for anticipating trade rates and gold costs. Fluffy rationale and ANN was hybridized with the ARIMA model so as to get precise outcomes. The outcomes clarified that the proposed strategy predicts the future costs precisely than different strategies. Ali et al. [4] utilizes Multilayer perceptron neural arrange model for anticipating the adjustments in stock costs and gold costs. The information utilized in this study was Tehran's Stock Exchange (T.S.E). The outcomes demonstrated that the ANN models perform superior to the conventional factual systems. We have also examined many research articles [5][6][7][8] and concluded cellular automata with eight neighborhood will be best alternative to predict gold price. We have represented the parameters with 8-CA and process these with the corresponding rules (Complemented & Non Complemented)

III. DESIGN OF 8-MACA

3.1 Global Transition Function Representation

The MACA rules should be represented as a transition function to define transitions from one state to another state. Rules will be applied simultaneously over the cells, which induce a global transition function. Consider a k-cell MACA, the global transition function (T) is defined as a vector with k-tuple that is R=< R_1,R_2,… R_j ….R_k > where R_j represents the rule applied to j^{th} cell. This global transition function (T) can be represented uniquely by a k X k transition matrix, where k being the number of cells. In our study k =3, as we have assumed three neighborhood CA. So the global transition matrix will have at most three non- zero entries in a row. The next state can be obtained by multiplying the real vector with the corresponding row of the transition function as explained in example 1.

Example 1: Consider a three cell hybrid MACA simulated by the rule <254,170,240>. The general representation will be < (qi-1 + qi + qi+1), (qi+1), (qi-1)>. This rule is applied from left to right, which is characterized as a transition matrix as shown below.

$$T=\begin{bmatrix}1 & 1 & 1\\ 0 & 0 & 1\\ 0 & 1 & 0\end{bmatrix}$$

254 rule is applied to the first cell, 170 rule is applied to the second cell and 240 rule is applied to the third cell. In the above matrix presence of dependency with the neighboring cell is indicated as ‘1’.

3.2 Non Complemented MACA

In this subsection we describe, how the transitions from one state to another state are defined by using non complemented rules, where the rules are formulated with a combination of OR rules, leading to a non complemented MACA formation.

Let P(t) represents the assignment of cells at t^{th} instant of time. The next state P(t+1) is calculated by equation 1.

$$P(t+1)=T.P(t) \qquad (1)$$

The state of i^{th} cell at (t+1) instance is given by equation 2

$$P_i\,(t+1) = \min\{1, T.P\,(t) \sum_{j=1}^{n} T_{ij}.\, P_j\,(t)\} \qquad (2)$$

P_i (t) is present state of i^{th} cell, P_i (t+1) represent the next state.

Where T_{ij} = { 1, if the next state of i^{th} cell depends on the present state of j^{th} cell , where j=1,…….n. 0, otherwise}

Example 2:

Consider the rule <170,238,204> the corresponding transition matrix is shown below.

If P (0) is the initial state with real values (0, 0.25, 0.50) the successive three steps are defined below.

The transitions from one state to another state are defined as per equation 1 are shown in fig 1.

$$T=\begin{bmatrix}0 & 1 & 0\\ 0 & 1 & 1\\ 0 & 0 & 1\end{bmatrix}$$

P (0) = (0, 0.25, 0.50)

Step 1: Apply rule 170 to the first cell. Rule 170 says that the next state depends on the right neighbor.

P (1) = (0.25, 0.25, 0.50)

Apply rule 238 to the second cell. Rule 238 says that the next state depends on its state and the right neighbor.

P (1) = (0.25, 0.75, 0.50)

Apply rule 204 to the third cell. Rule 204 says the next state depends only on its state.

After applying the rule for all the cells in the state that is the resultant state after first iteration is (0.25, 0.75, 0.50).

P (1) = (0.25, 0.75, 0.50)

Similarly

Step 2: P (2) = (0.75, 1.0, 0.50)

Step 3: P (3) = (1.0, 1.0, 0.50)

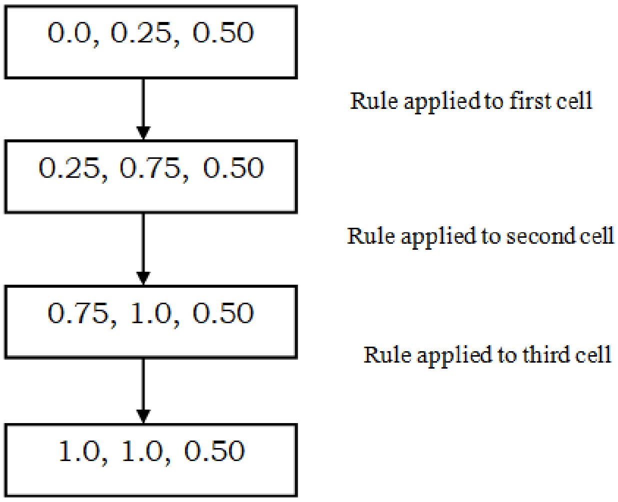

Figure 1: Transition of MACA with (0.25, 0.25, 0.50) as initial state with rule <170,238,204> applied.

3.3 Construction of k-cell, n-attractor, AIS-MACA

Table 1: Sample Atributes

Attribute 1	Attribute 2	Attribute 3	Class
1.0	0.6	0.6	Class II
0.6	0.6	0.6	Class II
0.8	0.2	0.6	Class II
0.2	0.2	0.8	Class I
0.2	0.6	0.8	Class I
0.8	0.8	0.8	Class I
0.2	0.2	0.0	Class I
0.8	0.6	0.0	Class I
1.0	0.8	0.0	Class I
0.2	0.6	1.0	Class I
0.2	0.2	1.0	Class I
0.4	0.4	1.0	Class I
0.2	0.6	0.2	Class I
0.2	0.2	0.2	Class I
0.8	0.8	0.2	Class I
0.4	0.4	0.4	Class II

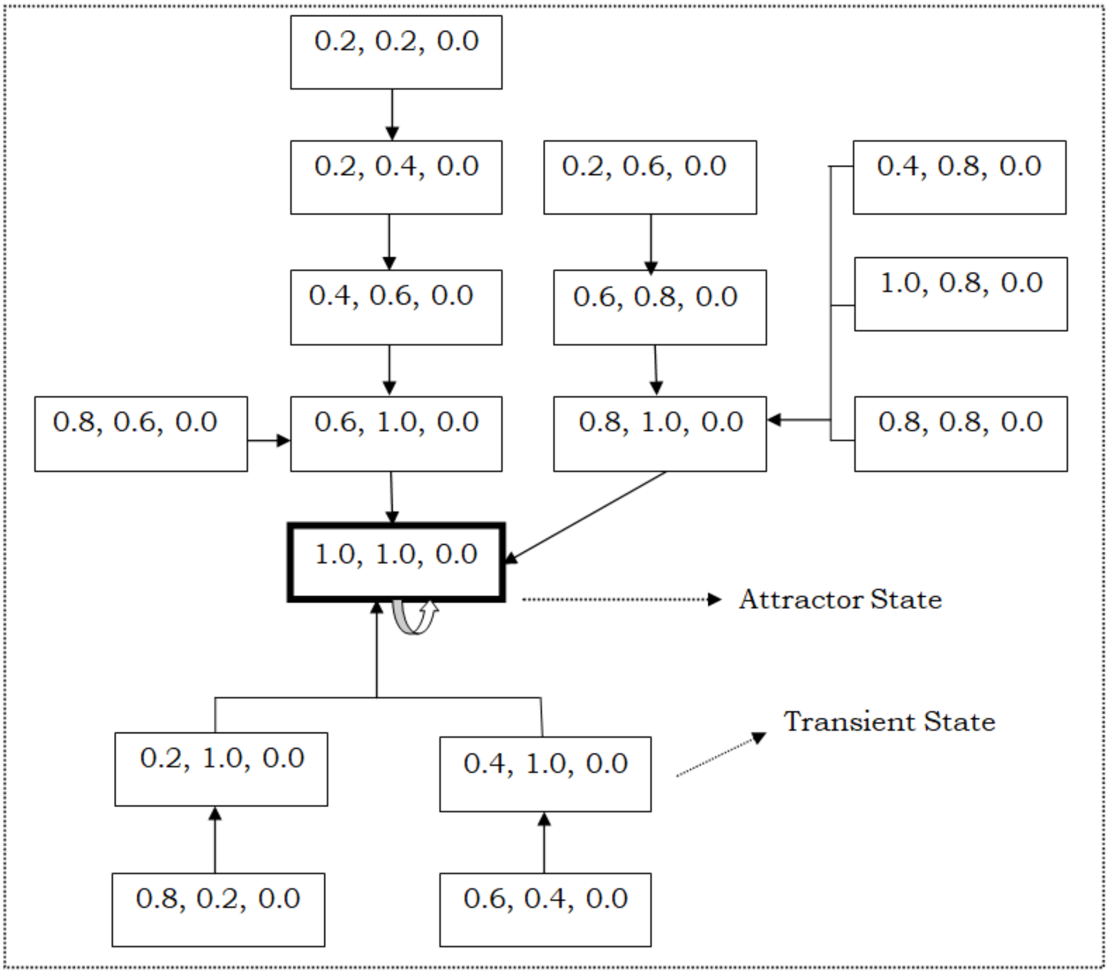

Figure 2: Attractor State Formed by New Rule

The trust vector represents the individual dependency relations that must be satisfied by all the patterns in the attractor basin. The bits of TV represent the variables <x1, x2, x3> in sequence; the presence of 1 in this TV indicates the dependency variable.So the trust vector for the example dataset in table 1 is <0, 0, 1>, x3 is the dependency variable. By using the trust vector we can predict the attractors uniquely.

The classifier is trained to process statistical data, process the business decisions from news articles and rumors. The standard data sets are taken from [12] gold.org. The news data and rumor analysis was done on the standard data sets. The three classifier outputs are taken 46% of the prediction of statistic data + 39% the prediction of news data+ 15% of the prediction of rumor data were taken as output of the classifier. Figure two show the sample classification of the NLCA classifier.

IV. EXPERIMENTAL RESULTS OF 8-NLCA

This section shows the detailed experimental results. Figure 3 show the latest gold price variations with actual price, predicted price with NLCA, Neural Network and ARIMA model. The price variation for each day is below 100 Rupees for NLCA classifier, which shows its precision to compute the gold price.

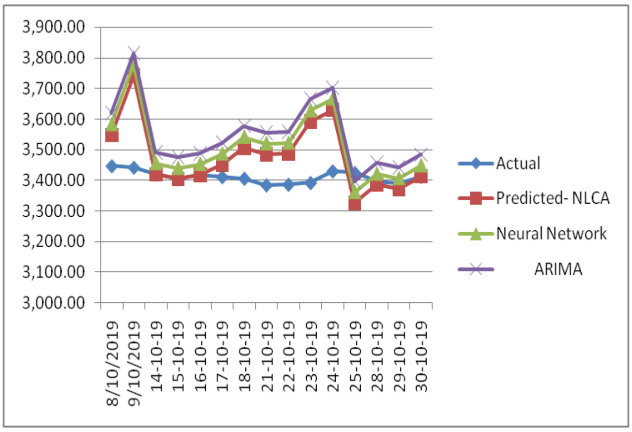

Figure 3: Actual and Predicted Gold Values with standard methods

Figure 4 shows the price prediction using NLCA . Figure 5 shows the percentage variations of gold price for twelve days. These results show the robustness and preciseness of the proposed classifier. The precision has been calculated by identifying the false positive, true positives , true negatives and false negatives.

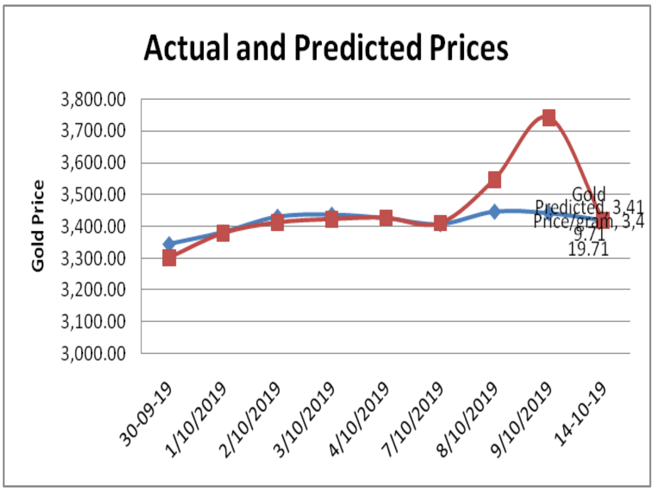

Figure 4: Actual and Predicted Gold Values for 9 days

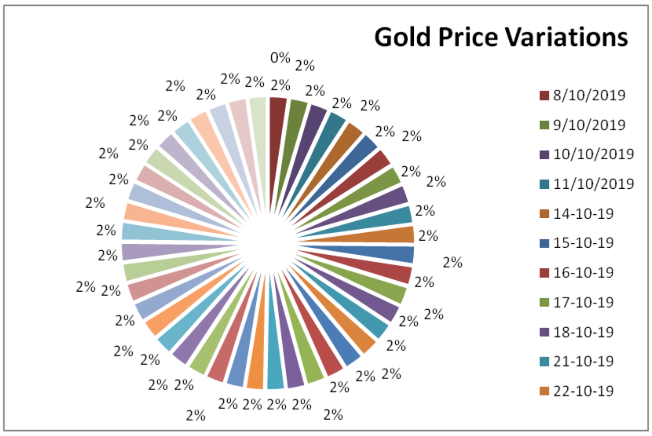

Figure 5: Percentage Variation of Gold Price

V. CONCLUSION

We have successfully developed a gold prediction system with 86.7% accuracy. It was tested thoroughly such that the prediction was more accurate and adoptable. The prediction has considered not only the static parameters, but also many dynamic parameters. The dynamic parameters considered are new items regarding the price variations and rumor identification. The classifier As this system has processed these many dynamic parameters it is more adaptable and the framework is robust to predict oil prices also with a different parameters set.

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REFERENCES

1. Gary Grudnitski, Larry Osburn, Forecasting S &P and Gold Futures Prices: An Application of Neural Networks, The Journal of Futures Markets, 13(6) : 631-643, 1993.
2. Hussein, Shamsul Faisal Mohd, et al. "Gold price prediction using radial basis function neural network." 2011 Fourth International Conference on Modeling, Simulation and Applied Optimization. IEEE, 2011.
3. A.G. Malliaris and Mary Malliaris, Time Series and Neural Networks Comparison on Gold,Oil and the Euro, Proceedings of International Joint Conference on Neural Networks, Atlanta,Georgia, USA, June 14-19, 2009.
4. KangaraniFarahani, Mahsa, and Soheil Mehralian. "Comparison between Artificial Neural Network and neuro-fuzzy for gold price prediction." 2013 13th Iranian Conference on Fuzzy Systems (IFSC). IEEE, 2013.
5. MehdiBijari, Gholam AliRaissi Ardali, Improvement of Auto-Regressive Integrated Moving Average models using Fuzzy logic and Artificial Neural Networks (ANNs), Neurocomputing, 72 : 956-967, 2009.
6. Askari, Mehdi, and Hadi Askari. "Time series grey system prediction-based models: Gold price forecasting." Trends in Applied Sciences Research 6.11 (2011): 1287-1292.
7. Ali ghezelbash, Predicting Changes in Stock Index and Gold prices to Neural Network approach,The Journal of Mathematics and Computer Science, 4 : 227-236, 2012.
8. Deepika M G, Gautam Nambiar and Rajkumar M, Forecasting price and analysing factors influencing the price of gold using ARIMA model and multiple regression analysis,International Journal of Research in Management, Economics and Commerce, 2(11) : Nov 2012.
9. Sree, P. Kiran, and Inampudi Ramesh Babu. "Identification of Protein Coding Regions in Genomic DNA Using Unsupervised FMACA Based Pattern Classifier." IJCSNS 8, no. 1 (2008): 305.
10. Sree, Pokkuluri Kiran. "AIS-INMACA: A Novel Integrated MACA Based Clonal Classifier for Protein Coding and Promoter Region Prediction." J Bioinfo Comp Genom 1 (2014): 1-7.
11. Sree, Pokkuluri Kiran, Inampudi Ramesh Babu, and Smt SSSN Usha Devi Nedunuri. "HMACA: Towards Proposing a Cellular Automata Based Tool for Protein Coding, Promoter Region Identification and Protein Structure Prediction."
12. https://www.gold.org/goldhub/data/gold-prices

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