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A Fuzzy Logic Model to Forecast Stock Market Momentum in India's Power Sector

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Abstract

Stock Market is veritably protean and fluctuates with time, that's why it becomes delicate to prognosticate movement of the stock, there are colorful approaches and tools through which the price of stock is determined by the once patterns. Fuzzy sense is used to collude the quality as well as volume valuation factors. The fuzzy model issues the stock value which is used to give stock worth. The capital request plays an important part in India's frugality. It doesn't only support the frugality of India but also becomes an index of India's frugality enhancement commodity that has been traded in the capital request is stock (Stock request). Because of query in stock request, query values make prognosticating stock request is all that we've to do before we make a decision in the stock request. one that can be prognosticated in the stock request is instigation. To read stock request instigation. It can use fuzzy sense model. In the process of modeling, It'll be used 14 days literal data that conforming the value of open, high, low and close to prognosticate the coming 5 days instigation orders. There are three instigation orders videlicet Bullish, Neutral and Bearish. To illustrate the fuzzy sense model, We'll use stocks data from several companies that listed on India stock exchange in power sector.

Key words :- Stock market, Fuzzy logic, Momentum, Economy, Capital market, Power sector.

INTRODUCTION :-

Sense is the study of the styles and principles of logic in all its possible forms. Classical sense deals with propositions that are needed to be moreover true or false. Each proposition has its contrary, which is generally called a negation of the proposition. A proposition and its negation are needed to assume contrary verity values. The abecedarian difference between classical propositions and fuzzy propositions is in the range of their verity values. The propositions of fuzzy sets and fuzzy sense were developed to enable computers to truly imitate the way humans suppose. They can be regarded as formal fine propositions for the representation of nebulosity, which is important for the operation of real – world structures because it mimics the mortal mind's vital capability to epitomize data and concentrate on decision – applicable details.

Stock Market is veritably protean and fluctuates with time, that's why it becomes delicate to prognosticate movement of the stock, there are colorful approaches and tools through which the price of stock is determined by the once patterns. Fuzzy sense is used to collude the quality as well as volume valuation factors. The fuzzy model issues the stock value which is used to give stock worth. As India is a

developing country, it's in need of substantial capital which is similar to growth rates that have been targeted. In the present case, the capital requests have an important part in the Indian frugality. Stock request isn't only supporting the Indian frugality but also an index of frugality progress of India. In capital requests, one that has been traded in stock. Stock can be defined as a sign of power of a person or company (reality) within a pot or limited liability company.

In India, numerous people are investing in power sector because demand of power tend to rise each time. Electric vehicles is the future of India in transportation. This is because a stock of antique energies (Petrol and Diesel) is limited and the demand of electric power is adding from public. In the power sector, design backing is a major problem that must be answered. So the company in power sector should seek the stock investor for the entire design to run easily.

In conducting deals in capital requests, especially in the areas of powers sector, stock investors should gather information as important as possible. One of that information is the stock request instigation. Stock request instigation can be described as the movement of the stock can be describe as the movement of the stock price. (1) The stock price is one index of the success of acompany.However, also implicit investors can assess that the company is successful, If a company's stock price always goes up. So that implicit investors want to invest finances in the company. The stock request instigation is divided into three orders, videlicet bearish, neutral and bullish. Bearish stock can be interpreted merchandisers dominate the request and drive prices lower. Neutral means buyers and merchandisers of stock requests and prices are still within the limits. Bullish can be interpreted stock buyers dominate the request and drive prices higher.

(2) To find out information about stock request instigation in power sector in the unborn fuzzy set can be used. Working system of fuzzy sets is detected uncertainly and lack of clarity in every day's life. Each member of this fuzzy set will have class value, so it can use the fuzzy set with the help of fuzzy sense to gain conclusion. Fuzzy sense is defined as a system of sense that play a part in approximate logic. Approximate Logic is a process that aims to get a possible conclusion. (3) Fuzzy sense has been applied in colorful fields including healthcare, transportation, and numerous other fields.

In the present exploration, the use of fuzzy sense in prognosticating stock request instigation due to is important. Fuzzy sense can handle deficient data and also uses the conception of a verbal variable so it can fluently be understood. (4) This study used the data from several companies in power sector that listed in India stock Exchange. Data that demanded in this exploration is 14 major data of the companies high, low, open and close stock value in 2021. By using fuzzy sense, output is expected that the result will be in stock market. Momentum categories, which are bearish, bullish and neutral for the next 5 days.

PROPOSED METHODOLOGY

In this paper, mathematical methods that will be used is part of fuzzy logic, which is membership function. Here are the steps of fuzzy logic model to forecast stock market momentum.

INITIALIZING VARIABLES

In processing fuzzy logic model, there are variables that will be used. Table 1 describe all of the variables that will be used in this fuzzy logic model.

DETERMINATION OF MOMENTUM VALUES

With 14 historic data of open and close values, it can be calculated the difference between those values. The difference of open and close values if i –th day is $\Delta_i = v_i^{cl} - v_i^{op}$ where i = 1,2,...,14. Momentum value is the value of direction power of stock price movement. Momentum value of i-th day is defined as $x_i = |\Delta_i|$.

MEMBERSHIP FUNCTION

Instigation values divided into several orders. There are three orders that will be bandied in general, which are bearish, neutral, and bullish. In hunt of the class function will be added in the form of barricade. Barricade serves to modify the values of fuzzy. Hedge knew as an adjective which is combined with a noun. (1) So there will be five orders instigation interval, including the Very Bearish, Bearish, Neutral, Bullish, and Veritably Bullish. The limits that will be used to limit the interval there's a, b, c, d, and e. The values of a to e are calculated as chance values of maximum value of the instigation xi which are a = 15, b = 30, c = 45, d = 60, and e = 75. (2).

TABLE 1. Variables of Fuzzy Logic Model

No.	Variable	Definition
1	v_i^{op}	Open value of i-th day
2	v_i^{cl}	Close value of i-th day
3	v_i^{lo}	Lowest value of i-th day
4	v_i^{hi}	Highest value of i-th day
5	Δ_i	The difference of v_i^{op} and v_i^{cl} in i-th day
6	x_i	Momentum value of i-th day
7	$\mu(x_i)$VBR	Very bearish fuzzy momentum value of the i th day
8	$\mu(x_i)$BR	Bearish fuzzy momentum value of the i th day
9	$\mu(x_i)$N	Neutral fuzzy momentum value of the i th day
10	$\mu(x_i)$BL	Bullish fuzzy momentum value of the i th day
11	$\mu(x_i)$ VBL	Very bullish fuzzy momentum value of the i th day
12	δ_i	fuzzy momentum value of the i th day
13	φ	Fuzzy momentum value that will be predicted in next 5 days
14	γ	Fuzzy linguistic interpretation

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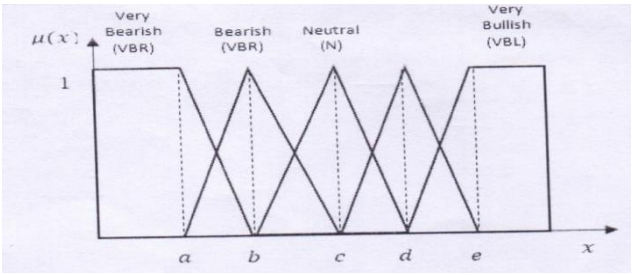

Figure 1 Triangular and Trapezoidal Membership Function

Membership Function of fuzzy sets can be determined its shape according to what it wants as long as it meets the rules of the conditions of membership function should be [4]. To get the momentum membership value, it will be used triangular and trapezoidal shapes. This Fig. 1 is a picture of the triangular and trapezoidal membership function that will be used.

Triangular and trapezoidal membership function is defined according to this Equation (1.1)

$$\mu(x)_{VBR} = \begin{cases} 1, & x \le a \\ \frac{b-x}{b-a} & a \le x \le b \\ 0, & x \ge b \end{cases} \qquad \mu(x)_{VBR} = \begin{cases} 0, & x \le a \\ \frac{x-a}{b-a}, & a \le x \le b \\ \frac{c-x}{c-b}, & b \le x \le c \\ 1, & x \ge c \end{cases}$$

$$\mu(x)_{N} = \begin{cases} 0, & x \le b \\ \frac{x-b}{c-b} & b \le x \le c \\ \frac{d-x}{d-c} & c \le x \le d \\ 1, & x \ge d \end{cases} \qquad \mu(x)_{BL} = \begin{cases} 0, & x \le c \\ \frac{x-c}{d-c} & c \le x \le d \\ \frac{e-x}{e-d} & d \le x \le e \\ 1, & x \ge e \end{cases}$$

$$\mu(x)_{VBL} = \begin{cases} 1, & x \le d \\ \frac{x-d}{e-d} & d \le x \le e \\ 0, & x \ge e \end{cases} \qquad (1.1)$$

FUZZY MOMENTUM VALUES

To obtain fuzzy momentum values in each day can be defined as Equation (1.2) follows;

$$\delta i = \begin{cases} \max\{\mu(x_i)_{VBR}, \mu(x_i)_{BR}, \mu(x_i)_{N}, \mu(x_i)_{BL}, \mu(x_i)_{VBL}\}, & \Delta \ge 0 \\ \text{Second max}\{\mu(x_i)_{VBR}, \mu(x_i)_{BR}, \mu(x_i)_{N}, \mu(x_i)_{BL}, \mu(x_i)_{VBL}\}, & \Delta < 0 \end{cases} \qquad (1.2)$$

ESTIMATED VALUE OF FUZZY MOMENTUM

Estimated value of fuzzy momentum φ will be evaluated on 14 days of historical data. Estimated value of fuzzy

TABLE 2. Stocks Data of Tata Power 3 September to 23 September 2021.

Date	Open (v_i^{op})	High (v_i^{hi})	Low (v_i^{op})	Close (v_i^{cl})
Sep 3, 2021	134.05	135.45	133.25	133.85
Sep 6, 2021	134.4	134.6	132	132.2
Sep 7, 2021	132.4	132.55	129.25	130.05
Sep 8, 2021	130.6	133.5	129.5	133.25
Sep 9, 2021	133.2	134.3	131.75	132.75
Sep 13, 2021	132.75	132.75	130.4	131.05
Sep 14, 2021	131.5	133.3	131.3	133
Sep 15, 2021	133.1	142.3	132.8	140.05
Sep 16, 2021	140	142	138.5	140.25
Sep 17, 2021	140.85	141.5	136.1	137.9
Sep 20, 2021	137.6	139.35	133.2	134.3
Sep 21, 2021	134.75	136.3	131.2	135.85
Sep 22, 2021	136.95	139.65	136.4	137.85
Sep 23, 2021	139.2	144.9	138.75	143.65

TABLE 3. Stocks Data of Tata Power 24 September to 30 September

Date	Open (v_i^{op})	High (v_i^{hi})	Low (v_i^{op})	Close (v_i^{cl})
Sep 24, 2021	145	145.35	138.7	139.1
Sep 27, 2021	140.3	140.4	136.75	138.75
Sep 28, 2021	140	142.85	139.05	140.05
Sep 29, 2021	139.8	158.75	138.9	151.6
Sep 30, 2021	152.5	161.2	151.3	158.75

momentum is momentum that will predict market movements in the next 5 days. Fuzzy momentum value that is estimated or can be expressed as φ be defined as Equation (1.3) follows:

$$\varphi = \frac{[\sum_{i=1} \delta i]}{14} \quad (1.3)$$

Linguistic Interpretation of Fuzzy Momentum Value

The important concept of fuzzy logic is linguistic variables. After getting the fuzzy values or degrees of membership, it will be the interpretation of these values. The equation (1.4) are linguistic interpretations of the estimated value of fuzzy momentum.

$$\gamma = \begin{cases} \text{Bearish} & 0 \leq \varphi \leq 0{,}5 \\ \text{Neutral} & 0{,}5 < \varphi \leq 0{,}6 \\ \text{Bullish} & 0{,}6 < \varphi \leq 1 \end{cases} \quad (1.4)$$

IMPLEMENTATION

The company that will be used as an illustration is Tata Power. Stock data that will be used is 14 days in to prognosticate the coming 5 days instigation. Table 2 is Tata Power shares in September 2021 (5).

After the modeling process with the data table over, followed by verbal interpretation. The benefits of this interpretation is to determine orders of the fuzzy instigation values, are Bearish, Neutral, and Bullish, Because the values that attained from Tata Power in September 2021 is0.54, also the lingustic interpretation is Bullish.

To check whether it's right for the coming 5 days will be distributed into Bullish, it can be seen from the stock values data when the open and close values for 24, 27, 28, 29 and September 30, 2021. Checking from the table below that the close value on 30 September 2021 was 163 open value on September 24 was145.00. It can be seen in the difference of the those values is 18. From this difference, we can draw conclusions that Tata Power on 30 September 2021 distributed as Bullish instigation. This is a table of data Tata Power shares for coming 5 days after 5 days after 14 days are used as literal data.

It can be considered by using fuzzy sense model, on August 23 and September 30, it can also be distributed Bullish instigation. On September 30, close value was158.75 and open value on September 28 was159.60, performing in a difference of18.75. On September 27, close value was140.30 and open value on September 27 was148.30, So the difference is worth19.30.

CONCLUSIONS

The conclusions that can be deduced from this exploration is fuzzy sense model can be applied to prognosticate the coming 5 day instigation of the stock request by using literal data for 14 days. In addition, the fuzzy sense modeling can't only be applied to prognosticate the stock request's instigation in the power sector but can also be applied in other sectors listed in India Stock Exchange.

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