

# Forecasting Enrollment using Fuzzy Time Series

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**Abstract** — This freebie presents a exemplar to transpire forecasting approach based on by fuzzy time series. In friction to true hearted predicting techniques, fuzzy anticipate series can besides be give problems, in which yesteryear data are acceptable values. It is discovered that the future approach improves pursue of predicting process. Further, confirm of using disparate number of fuzzy sets is accomplished like fine. To do a take off the forecasting practice to approach student info in *M.Kumarasamy* College of Engineering is used.

**Keywords** — Forecasting, fuzzy time series, Centroid point, linguistic values, student admission. Mathematics Subject Classification: 60G25, 62M20

#### **1. INTRODUCTION**

Actual environment are very frequently not brittle and deterministic, and they cannot be defined accurately. The total explanation of an actual scheme often would need outlying additional complete data than a person being could ever identify concurrently, process, and understand. This state was previously renowned by thinkers in the past. In 1923 the philosopher B. Russell [1923] referred to the first point when he wrote: All conventional logic usually assumes that exact symbols are being engaged. It is therefore not appropriate to this earthly life but only to a probable space continuation. L. Zadeh referred to the second point when he wrote, "As the complexity of a system increases, our ability to make precise and yet significant statements about its behavior diminishes until a threshold is reached beyond which precision and significance (or relevance) become almost mutually exclusive characteristics." [Zadeh 1973][8].

Forecasting plays a remarkable role in making both vital and daily decisions about the upcoming. Warm guess, faculty arrangement, trade, manufacture arrangement and supervision decision analysis are amongst distinct examples of predictable points wherever populace want to predict, in accessible limits, as directly as likely. The fuzzy time series are classified in to time-variant and time-invariant. Song and Chissom [4,6,7] introduced for forecasting time-invariant time series. In the previous year's predicting problems are solved using time series was studied by many authors [1,2,3] and [5,6,7].

Fuzzy anticipate series F(t) by all of finite integer of fundamentals is called time-variant, if for any breath of anticipate t, F(t) = F(t - 1); or else it is called a time-variant fuzzy time series [1]. Song and Chissom secondhand the University of Alabama trade statistics to verify the predictable behavior based on model: F(t) = F(t - 1) o T, to what place F(t - 1) is the trade of year t -1, F(t) expressed by fuzzy sets of year t, R is a composite of first-order fuzzy relations.

Consequently, Chen eventual a new epitome to derive simpler the arithmetic complication of predicting behavior by approach of using easily done arithmetic procedure rather of max-min design hand on the equal set of past trade statistics [1]. Apart from the specific that the test obtained betterment a comparable draw of Song-Chissom's time-variant exemplar [7], it seems more feasible as compared to both predate invariant and time-variant models of Song and Chissom mutually

esteem to extra easily done calculations. This freebie is related to the reveal of a learner admission by all of predicting problems.

Distinct Song-Chissom and Chen methods, the projected approach use variations of the existing yesteryear data as fuzzy predate series as a selection of concern usage of freezing numeric values. Besides, the changes in the number of fuzzy sets in the exemplar are examined. Consequences obtained are compared by all of those of Chen and Song-Chissom models for the goal of predicting exactness. The freebie is progressive as follows. Section2 form basic concepts and definitions [5, 6]. Section3 is focused on eventual time-invariant means by illustrating the academic admission. Finally, the closing remarks are depleted in the Section 4.

#### 2. FUZZY TIME SERIES DEFINITIONS

This section provisionally summarizes basic fuzzy time series ideas [5, 6] provided for the subsequent text.

**Definition 2.1.** Suppose  $Y(t) \subset T$  (real line), t = ..., 0, 1, 2, ..., to be a universe of discourse defined by the fuzzy set  $f_i(t)$ . F(t) consisting of  $f_i(t)$ , i = 1, 2, ..., is defined as a fuzzy time series on Y(t). At that, F(t) can be understood as a linguistic variable, whereas  $f_i(t)$ , i = 1, 2, ..., are possible linguistic values of F(t).

**Definition 2.2.** Denoting F(t - 1) by Ai and F(t) by Aj, the relationship between F(t - 1) and F(t) can be defined by a logical relationship Li Lj.

**Definition 2.3.** If F(t) is a time-invariant fuzzy time series, then the logical relationship F(t - 1) F(t) is called a first order logical relationship.

**Definition 2.4.** In the mainly general technique, all of these trapezoids are then superimposed one upon a different, form a single geometric shape. Then, the **centroid** of this shape, called the fuzzy **centroid**, is calculated. The x coordinate of the **centroid** is the **defuzzified** value.

### 3. A NEW METHOD OF FORECASTING ENROLLMENTS

#### 3.1. Forecasting

The desire of this design is to ask for the hand of an approach that is intended to retrieve better predicting certainty by for time-invariant fuzzy anticipate series. Based on certain yesteryear disclosure of admissions of the University of Alabama, Song and Chissom subsidize models, i.e. relationships inserted values of interests at contradictory moments of predate [5, 6, 7]. Method extended by Chen [1] further provides for interpretation of fuzzy sets Ei as a result of values of the allowable variable (actual) admissions. We court modifications that especially deal by all of two key aspects; (i) nature of variations of past data or not exactly of certain admission distinctiveness, and (ii) projection of affair R utilized for the fascination of future admissions. In debut, the approach is experienced on different number of fuzzy sets for the final cause of analysis of predicting exactness. Finally, step-by-step predicting process looks as follows:

- 1: Identify the universal (set S) from deviation of the past admission information,
- 2: S takes into equal intervals,
- 3: Form fuzzy sets Ai,
- 4: Fuzzily the difference of the past admission information,
- 5: Establish fuzzy logical affairs Ai Aj,
- 6: Convert fuzzy to crisp outputs,
- 7: Find the predicted admissions.

Hence, the move toward that uses admissions in the M.Kumarasamy College of Engineering can be displayed more far in the following way:

Step 1: In accord with the problem area, universal set *S* is defined – on this juncture yearly variations of the admissions are used. Actual data and corresponding variations are listed in Table I (minimum and maximum variations are *Rmin* = -37 and *Rmax* =78, correspondingly). With the purpose of eliminating partition of *S* into similarly length intervals, accept *S* as [*Rmin* -  $R_1$ , *Rmax* +  $R_2$ ], where  $R_1$  and  $R_2$  are positive numbers 3 and 22, consequently. As a result, S = [-400, 100].

student admissions and variations of Historical Data			
Years	Tangible	Variations	
2012	911		
2013	980	+69	
2014	822	-58	
2015	1000	78	
2016	963	-37	

Table I	
Student admissions and Variations of Historical Da	ata

Step 2: We use fuzzy set that is S is partitioned into three equal parts, namely:  $s_1 = [-40, -20]$ ,  $s_2 = [-20, 40]$ ,  $s_3 = [40, 100]$ 

Step 3: We assume that linguistic variable variations of admissions can take fuzzy values:  $A_1$  (Low),  $A_2$  (Middle),  $A_3$  (High),

 $A_1 = \{1/s_1, 0.5/s_2, 0/s_3\}$ 

 $A_2 = \{0.5/s_1, 1/s_2, 0.5/s_3\}$ 

 $A_3 = \{0/s_1, 0.5/s_2, 1/s_3\}$ 

where  $s_i \approx S$  are elements of the universal set, and the number that follows slash symbol "/" is the membership degree  $\mu(s_i)$  to relevant  $L_i$ , *j*=1,3.

Step 4: Fuzzification values given in Table II.

Step 5: The relationship of two values are given in Table III.

Step 6: Deployed fuzzy relationships into groups in Table IV.

Step 7: Identify fuzzy reliable association group based on well-known deviation  $L_{i\uparrow}$  of the previous year.

For example, consider forecasting of deviation for the year 2012 (M.Kumarasamy College of Engineering data) in the presence of known variation of 2013. Data of the Table II makes it clear that  $T_i = T_2$ . From  $Ai = A_{i+1}$   $T_i$  it follows that  $F(2013) = A_2$   $T_2$ , or  $F(2013) = [0.5 \ 1 \ 1]$ . Lasting predicted fuzzy outputs are intended in a like mode (third column of the Table V).

	Fuzzified Past data			
Years Variat		Variations	<b>Fuzzified Variations</b>	
	2012			
	2013	+69	A <sub>2</sub>	
	2014	-58	A <sub>3</sub>	
	2015	+78	A <sub>1</sub>	
	2016	-37	A <sub>2</sub>	

Table II

	Table III
Fuzzy	Relationships

A	2 A2
A	3 A3

A <sub>1</sub>	A <sub>1</sub>
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Table IV Relationships Groups

A <sub>1</sub>	A2 ,A3
A <sub>2</sub>	A <sub>1</sub> , A <sub>3</sub>
A <sub>3</sub>	$A_1,A_2$

Step 8: Results an earlier step are given to attain crisp numeral value for each year under reflection.

This practice is called as defuzzification, In this freebie centroid move toward is secondhand to predict the defuzzification values. When the fuzzy diversification is obtained, it is summed up with unassailable engagement in activity application of the get along (previous) year. For illustration, if the proposed predicted diversification (year 2014) is 60, and the certain admission (year 2015) is 1000, before the predicted enrollment (year 2015) is 1000 60= 1060. The results for the M.Kumarasamy College of Engineering are supposing in Table V.

Forecasted Outputs and Admissions from 2012 To 2017

Year	Actual data	Fuzzy Outputs	Forecasted data
2012	911	0.5 1 1	
2013	980	0 0.5 1	971
2014	822	0.5 1 0.5	1040
2015	1000	0 0.5 1	882
2016	963	0.5 1 1	1060
2017		1 0.5 1	1023





## 4. CONCLUSION

In this paper, we offered a narrative time-invariant fuzzy time series method for forecasting college admissions. To illustrate the predicting procedure, past statistics of M.Kumarasamy College of Engineering were used. This paper aims to study the impact of this method significantly to achieve better forecasting accuracy. The Table V and the Figure.1 shows the actual admission data and forecasting admission data, the forecasting data is very closer to actual data. Therefore the time invariant fuzzy time series forecasting method is accurate to predict the forecasting.

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