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Fuzzy Inference System Model Suggestion for Evaluating Voter Preferences: A Research for General Local Elections

Seçmen Tercihlerinin Değerlendirilmesinde Bulanık Çıkarım Sistem Modeli Önerisi: Mahalli İdareler Seçimleri İçin Bir Araştırma

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Keywords:

Election Prediction, Fuzzy Logic, Fuzzy Inference System, General Local Elections.

ABSTRACT

Many factors such as cultural, economic, regional, political, psychological and sociological that affect voter preferences determine the results of the General Parliamentary Elections and General Local Elections. Therefore, analyzing the factors affecting voters' preferences will positively improve the work of political parties. In the scientific studies on elections in Turkey in the last 20 years, evaluations have been mostly statistical analysis. This research, to evaluate voter preferences in General Local Elections from a different perspective, proposed a General Local Elections-Fuzzy Inference System (GLE-FIS) model by using Fuzzy Inference Systems. In the proposed model, "Candidate's Projects", "Candidate's Party", "Fulfillment Level of Current Mayor's Promises", "Party Leader's Charisma", and" Candidate's Communication" were accepted as input variables, "Candidate's Election Status" was accepted as output variable and fuzzy rules were defined using these variables. An illustrative example was then made for testing the proposed model. Additionally, based on the rules of the proposed model, pairwise comparisons of the variables affecting the Candidate's Election Status were made and a priority ranking was achieved among the factors affecting the voting behavior of the voters.

Anahtar Kelimeler:

Seçim Tahmini, Bulanık Mantık, Bulanık Çıkarım Sistemi, Genel Yerel Seçimler.

ÖZET

Seçmen tercihlerine etki eden kültürel, ekonomik, bölgesel, siyasi, psikolojik, sosyolojik gibi birçok faktör Milletvekili Genel Seçimlerinin ve Mahalli İdareler Genel Seçimlerinin sonucunu belirlemektedir. Bu sebeple seçmenlerin tercihlerine etki eden faktörlerin analiz edilmesi siyasi partilerin çalışmalarını olumlu yönde geliştirecektir. Son 20 yılda Türkiye'de seçimler üzerine yapılan bilimsel çalışmalarda çoğunlukla istatistiksel analizlerle değerlendirmeler gerçekleştirilmiştir. Bu araştırmada, Mahalli İdareler Genel Seçimlerinde seçmen tercihlerinin farklı bir bakış açısıyla değerlendirilebilmesi amacıyla Bulanık Çıkarım Sistemleri kullanılarak Mahalli İdareler Genel Seçimleri-Bulanık Çıkarım Sistem (MİGS-BÇS) modeli önerisi yapılmıştır. Önerilen modelde "Adayın Projeleri", "Adayın Partisi", "Mevcut Belediye Başkanının Vaatlerini Gerçekleştirme Düzeyi", "Parti Liderinin Karizması" ve "Adayın İletişimi" girdi değişkenleri olarak, "Adayın Seçilme Durumu" çıktı değişkeni olarak kabul edilmiş ve bu değişkenler kullanılarak bulanık kurallar tanımlanmıştır. Daha sonra önerilen modelin test edilmesi için açıklayıcı bir örnek yapılmıştır. Ayrıca, önerilen modelin kurallarına bağlı olarak Adayın Seçilme Durumunu etkileyen değişkenlerin ikili karşılaştırmaları yapılarak seçmenlerin oy verme davranışına etki eden faktörler arasında bir öncelik sıralaması gerçekleştirilmiştir.

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1. INTRODUCTION

In democratic societies, political parties that come to power through elections try to reach and influence voters by using different tools. Political propaganda tools, which are used extensively by political parties during the election process, have an important role in establishing the bond between voters and political parties (Çavuşoğlu & Pekkaya, 2015). In order for political parties to be successful, they need to know their voters closely by analyzing voter behavior, as well as principles such as informing the public properly, acting transparently and honestly (Ercins, 2007). Studies on voter preference and voter behavior are categorized under three main headings: "Sociological Approach", "Socio-psychological Approach" and "Economic Approach" (Akgün, 2002). The basis of these approaches is “The People Choice” by Lazarsfeld, Berelson and Gaudet (1948), “The American Voter” by Campbell, Converse, Miller and Stokes (1960) and “An Economic Theory of Democracy” by Downs (1957). Although researchers use different concepts for voter behavior, "voter choice" is explained according to one of the three basic approaches listed (Kalender, 2005).

The Sociological Approach starts from the assumption that people will become politicized within the social structure, and those who leave the group due to group norms while voting will be punished within the group with different methods (Başarır, 2016). In the sociological approach, it is argued that variables such as family, socio-economic status, group belonging and religion are effective in the voter's decision (Aydın-Kılıç, 2013). The voting decision is not individual, but is determined by the collective action (Kalender, 2005). According to the sociological approach, voter behavior is determined by the social division in society. Voters' party preferences are defined as religious affiliation and indispensable habits. Voters confirm this immutable identity with the votes they cast in elections (Gökçe, 2002). The Socio-Psychological Approach focuses on individuals rather than groups and focuses on the attitudes and orientations that voters acquire during the political socialization process at an early age under the influence of their families and environments. The most important concept that this approach brings to the literature is party affiliation (Akgün, 2016). Since it is assumed that voters vote based on party identity and proximity to the political party, ideological voting and ideological identity reflection can also be evaluated within the framework of this model (Temizel, 2012). Individuals feel close to a certain party from an early age due to the influence of their immediate environment, and loyalty can strengthen over time and continue throughout life. Even if voters vote for another party for different reasons, they may still vote for their old party in the future (Yıldırım, 2019). The Economic Approach

(Rational choice school), which has become widespread in recent years, focuses on economic voting. According to this approach, voters vote for the party they deem most appropriate to achieve their goals in each election (Akgün, 2016). Among some of the economic variables that change the behavior of voters, the increase or decrease in unemployment rates, the amount of income per capita and fluctuations in inflation values are quite effective. Moreover, although individuals' economic incomes vary according to country conditions, it is also a fact that voters generally focus on the entire economic order (Ercins, 2007). According to this approach, voters take party actions, leaders, promises and competitors into consideration when voting (Başarır, 2016). Elections are important not only in determining the government, but also in determining who the voters themselves will govern. This decision-making process is shaped by factors affecting voters' preferences. Thus, political parties, leaders or individuals who aspire to govern focus on the decision-making processes of voters in their campaigns (Güllüpınar et al., 2013).

In Turkey, voters determine their preferences and vote according to different factors in General Local Elections and General Parliamentary Elections. General Local Elections, in addition to electing local administrators, should also be considered as a way for voters to send a message to the central government. For this reason, it is not possible to think of these two choices as very different from each other. Considering the Turkish political tradition, the General Local Elections, held immediately after the General Parliamentary Elections, are seen as a complement to the General Parliamentary Elections. In terms of General Parliamentary Elections, it is considered as an opinion poll (Doğan and Göker, 2010). From this perspective, General Local Elections are seen as a political activity on the axis of national politics within the scope of both the election propaganda carried out and the meaning attributed to the elections (Akbulut, 2004). However, studies on voter behavior have revealed that voter behavior may differ specifically in General Local Elections and General Parliamentary Elections and may be affected by different variables (Boyraz, 2017). On the other hand, when this process is considered as a cycle, the results of the elections can be partially determined proportionally when there is no economic, political or social break. An important factor that determines the change in election results is voter behavior (Yıldırım et al., 2019).

This study made a model proposal using Fuzzy Inference Systems in the evaluation of voter preferences in General Local Elections. In the proposed model, "Candidate's Projects", "Candidate's Party", "Fulfillment Level of Current Mayor's Promises", "Party Leader's Charisma" and "Candidate's Communication" were accepted as input variables, and

"Candidate's Election Status" was accepted as the output variable. Fuzzy rules were defined using these variables. An illustrative example was provided to test the proposed model. In addition, pairwise comparisons of the variables (factors) affecting the Candidate's Election Status were made. Then, a priority/importance ranking was created among the factors affecting the voters' behavior.

2. LITERATURE REVIEW

There are different variables in voter behavior and the effects of these variables vary according to the political, economic and social characteristics of the countries. (Karagöl and Dama, 2015). While the voters' profession directs the individual to be effective or stay away from political life in line with other socio-economic variables and the qualifications of the profession, the statuses provided by the professions to the individual also affect their voting and support of the political parties that mediate this (Özgül, 2017). Considering the unique processes and characteristics of local election processes, voters show rational voting behavior. Apart from the factors related to the candidate during the voting process, many factors such as social, psychological, economic and cultural can directly or indirectly affect the decision-making process (Damlapınar and Balcı (2005). There are many studies on General Local Elections. A literature review of the studies conducted between 2005 and 2019 investigating the voting behavior of voters is given below.

Based on the survey conducted by Damlapınar and Balcı (2005) in the center of Konya for the 2004 General Local Elections, Frequency Analysis was implemented to specify demographic characteristics and Friedman Test was applied to determine the variables that play a role in the formation of the candidate image. Güllüpınar (2010) used Factor Analysis, Anova and T-Test to identify the candidate characteristics that were effective on the voting behavior of Konya voters in the 2009 General Local Elections. Doğan and Göker (2010) defined the relationship between the demographic variables and the factors that the voters in Elazığ were affected by when determining their political party preferences in the 29 March 2009 General Local Elections, applying the Chi Square ($\chi 2$) Test. Canöz (2010) used Frequency Analysis, T-test and Anova in the analysis of a research on candidate image in Konya voter preference in the General Local Election held on 29 March 2009. Negiz and Akyıldız (2012) applied Kruskal Wallis and Mann Whitney U tests in their study investigating the effect of the candidate's image on the voter's choice in the Mayoral elections in Uşak and the voter's image perception towards the current mayor. Güllüpınar (2013) implemented T-Test and Anova in the analysis of his research to determine the candidate image perception of Gümüşhane voters.

Çağlar and Gelir (2014) applied T-Test, Anova, Tukey Test and chi-square independence test in the evaluation of the survey conducted by voters in the center of Isparta regarding the image of the candidate before the 2014 General Local Elections. Avcı (2015) evaluated the voting behavior of voters in Ankara in the 2014 General Local Elections according to the Chi Square *(χ2)* test in the analysis of the survey. Chi Square *(χ2)* and T-test were used for the analysis of the survey applied by Canöz and Bakan (2015) to Konya Selçuk University Faculty of Communication students. Teyyare and Avcı (2016) used One-Sample t-Test, One-Way Anova and t-test to find out the factors affecting the voting preferences of voters in Zonguldak in the 2014 General Local Elections. Çavuşoğlu and Pekkaya (2016) evaluated the survey on the voting behavior of Bülent Ecevit University students in the General Local Elections using the Chi Square *(χ2)* test, t-test and F-Test. Karahan Uslu et al., (2017) conducted a survey in Kocaeli and analyzed the effects of the individual characteristics of the candidate and the perceptions of the candidate's party on the preferences and the level of education in the General Local Elections using Anova. Miman and Miman (2018) conducted the analysis to investigate the priorities and voting tendencies of voters in the 2014 General Local Elections using Pearson chi-square and Fisher's exact chi-square tests. Considering this literature review, it has been detected that statistical regulations are used in the analysis of general local elections in Turkey. Unlike the studies given in the literature research, Gökşen et al., (2009) examined voter behavior in Izmir in the 2009 Local Government Elections using the Game Theory method.

In this research, in order to show that General Local Elections can be discussed in terms of Fuzzy Inference Systems (FIS), a narrow literature research was conducted using the keywords "voting behavior", "election prediction" and "fuzzy inference system" at the international level. As a result of the research, four scientific studies were reached. Among studies, Singh et al., (2012) calculated the percentage of a candidate winning and losing by using the FIS. Rehman (2017) used the Mamdani-type FIS to evaluate the candidate's chance of being elected in the elections. Gabriel (2019) proposed Adaptive Neuro-Fuzzy Inference System based model for predicting a credible candidate in elections. Dash et al., (2023) designed a fuzzy inference supportive framework to study crowds' preference on social media platforms to make campaign strategies by the political parties in national-level elections.

3. FUZZY INFERENCE SYSTEMS

The basis of the fuzzy set theory put forward by Lotfi A. Zadeh (1965) is that it contains uncertain, ambiguous and imprecise data in real world problems. The main difference between fuzzy logic and classical logic is that it enables rational decision-making by developing models and systems that enable reasoning in uncertain environments. After Zadeh's work, Mamdani (1974) laid the foundations of the Fuzzy Inference System (FIS) with his work in which he proposed Fuzzy Rule Based Systems for the first time regarding real inputs and outputs. Fuzzy systems are numerical prediction processes that have a model structure and can model highly complex and nonlinear behaviors that connect fuzzy sets with fuzzy rules. Fuzzy systems are a method based on the concept of "if-then" rules and fuzzy reasoning, and can be easily adapted to many fields due to its interdisciplinary structure. "If-then" rules are important in terms of their suitability for human behavior and the precise evaluation of the linguistic result depending on the situation in the decision-making process (Şen, 2009). Fuzzy inference is a process that formulates the mapping from a given input to output with the help of fuzzy logic. The basic structure of a FIS consists of three conceptual components: a rule base containing a set of fuzzy rules, a database that defines membership functions for the rules, and a reasoning mechanism that performs the inference procedure (Jang, 1997). The block diagram of the Fuzzy Inference System is shown in Figure 1.

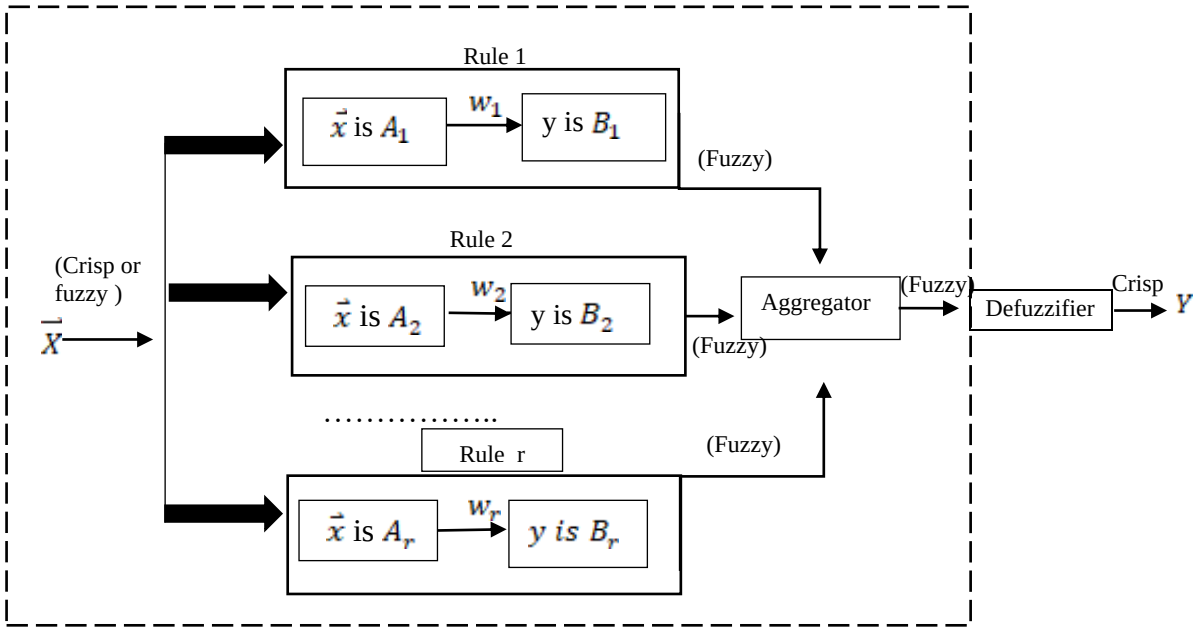

Figure 1: Block diagram of a Fuzzy Inference System

There are a lot of fields in which one can find successful applications of Fuzzy Inference Systems (automatic control, data classification, decision analysis, expert systems, and

computer vision). With a reference to multidisciplinary fields, Fuzzy Inference Systems can also be named as fuzzy-rule-based systems, fuzzy expert systems, fuzzy modelling, fuzzy associative memory, fuzzy logic controllers, and simply fuzzy systems (Behret et al., 2012).

Although there are various fuzzy FIS in the literature, Mamdani-type FIS and Sugeno-type FIS are the most important. Later, the Mamdani-type FIS was developed by Mamdani and Assilian (1975). The most common rule structure of Mamdani-type FIS includes the concept of linguistic variables by Zadeh (1975). Sugeno-type FIS was developed through studies by Sugeno (1985), Takagi and Sugeno (1985) and Sugeno and Kang (1988). The main difference between these two methods stems from the combination and defuzzification of the output (Yardımcı and Karpuz, 2017). Mamdani-type FIS can provide a highly intuitive knowledge base that is easy to understand and apply (Öztayşi et al., 2013). Mamdani-type FIS is the first control system developed based on fuzzy set theory (Sivanandam, et al., 2007). Mamdani-type FIS includes “fuzzy rule base, “fuzzy inference engine”, “fuzzification interface, and, if needed, a defuzzification interface”. The fuzzy rule base has the fuzzy rules with defined membership functions of the fuzzy antecedents and consequents. The fuzzy inference engine operates the procedure based on these rules and facts to reach conclusions or obtain output. The data manipulation in the Mamdani FIS is based on fuzzy sets. Therefore, the data should be converted into fuzzy sets (Gorzalczany, 2002). The steps for Mamdani-type Fuzzy Inference System are summarized below.

Step 1: (Fuzzification) In this process, membership functions of quantitative and/or qualitative input variables are defined.

Step 2: (Fuzzy Rules) Fuzzy rules are linguistic expressions that explain how the Fuzzy inference system can categorize an input or control an output. In Mamdani-type Fuzzy Inference System, rules are created as:

IF x_1 is A_1,…,and x_k is A_k ,THEN y is B.

Step 3 (Fuzzy Inference): Fuzzy inference is an inference procedure applied to determine a conclusion based on "If-then" rules. Mamdani-type inference system considers fuzzy inputs and transforms fuzzy outputs. The output of the Mamdani inference method is a fuzzy set that requires conversion to a crisp value through fuzzing.

Step 4 (Defuzzification): By evaluating the rules with the defuzzification process, the final output of a fuzzy system is converted into a crisp number. Centroid of Area (COA), Bisector, Mean of Maximum (MOM), Smallest of Maximum (SOM), and Largest of Maximum (LOM) methods are used in the defuzzification process. According to Mogharreban and Dilalla

(2006), no difference is observed in the outputs of these different methods. However, the COA method has slightly higher correlation.

When given two crisp inputs, x and y, a two-rules Mamdani-type FIS determines the overall output, z, as shown in Figure 2.

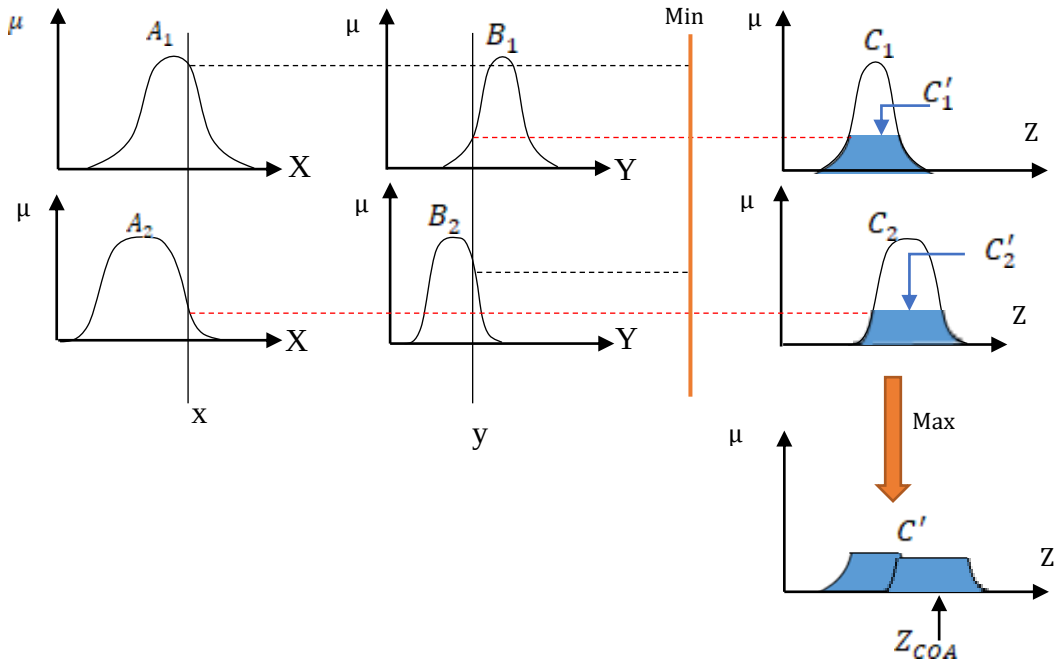

Figure 2: Graphical Mamdani (Centroid of Area) inference method.

3.1. Model Recommendation for General Local Elections

The main purpose of the model proposed in this study is to show that it can be used to predict the results of General Local Elections. In the proposed model, first of all, among the factors that "affect voter behavior" determined in the literature review, "*Candidate's Projects*", "*Candidate's Party*", "*Fulfillment Level of the Current Mayor's Promises (FLCMP)*", "*Party Leader's Charisma (PLC)*" and "*Candidate's Communication (CC)*" were accepted as input variables. . Multi-Input and Single-Output (SIMO) system was used by accepting "*Candidate's Election Status (CES)*" as the output variable. Linguistic information for these variables is described using the Gaussian membership function in the range [0;100]. Gaussian membership function is given below.

$$gaussian(x;\ \sigma, c) = exp\left(-\left|\frac{x-c}{2\sigma}\right|^2\right)$$

Where;

c : the membership function's center,

σ: the membership function's width.

Linguistic variables for Input and Output are given in Table 1 in the range of $[\sigma; c]$.

Table 1: Ranges for Input and Output variables

		Linguistic Variables			
INPUTS	Project	Poor: [25;0]	Average [15;50]	Perfect [20;100]	
	Party	Insignificant: [30;0]	Significant:[30;100]		
	FLCMO	Fairly: [10;0]	Average: [14;30]	Successful:[14;60]	Perfect:[23;100]
	PLC	Low: [18;0]	Average:[18;50]	High:[18;100]	
	CC	Weak:[17;0]	Average:[11;35]	Good: [14;71]	Strong: 17;100]
OUTPUT	CES	Impossible:[15;0]	Weak:[10:30]	Possible:[10:57]	High:[15:100]

First, Input and Output variables were created and shown in Figure 3. Figure 3 shows the variables as well as the methods used in the fuzzification and defuzzification process.

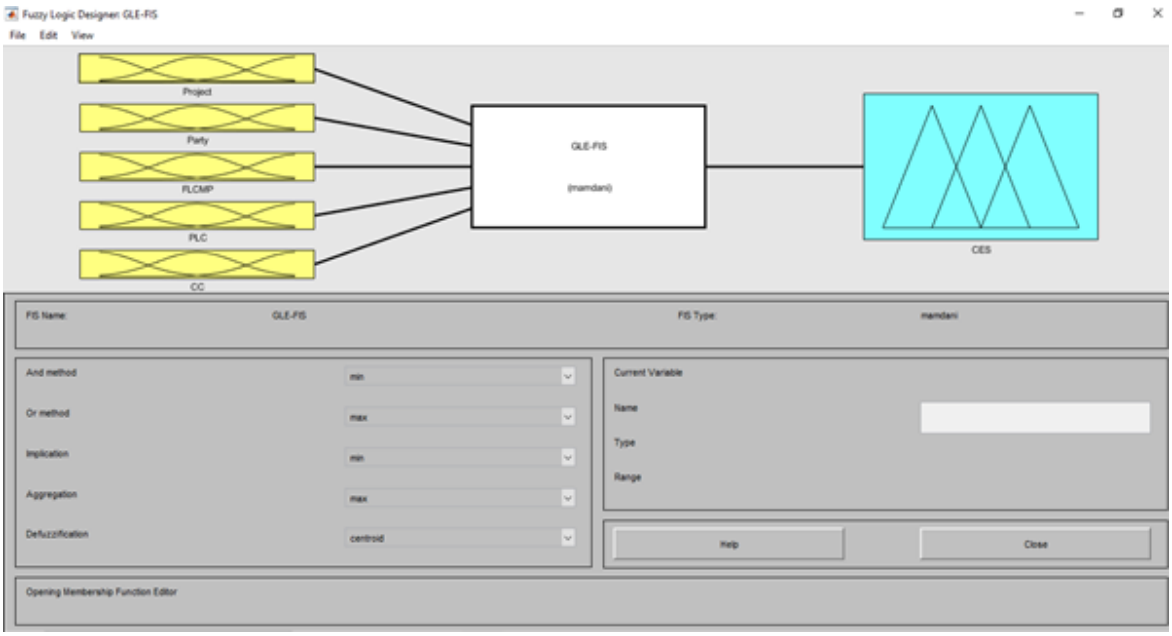

Fig. 3: Input and Output Variables

The membership function editor screenshot for "candidate's projects", one of the defined input variables, is shown in Figure 4.

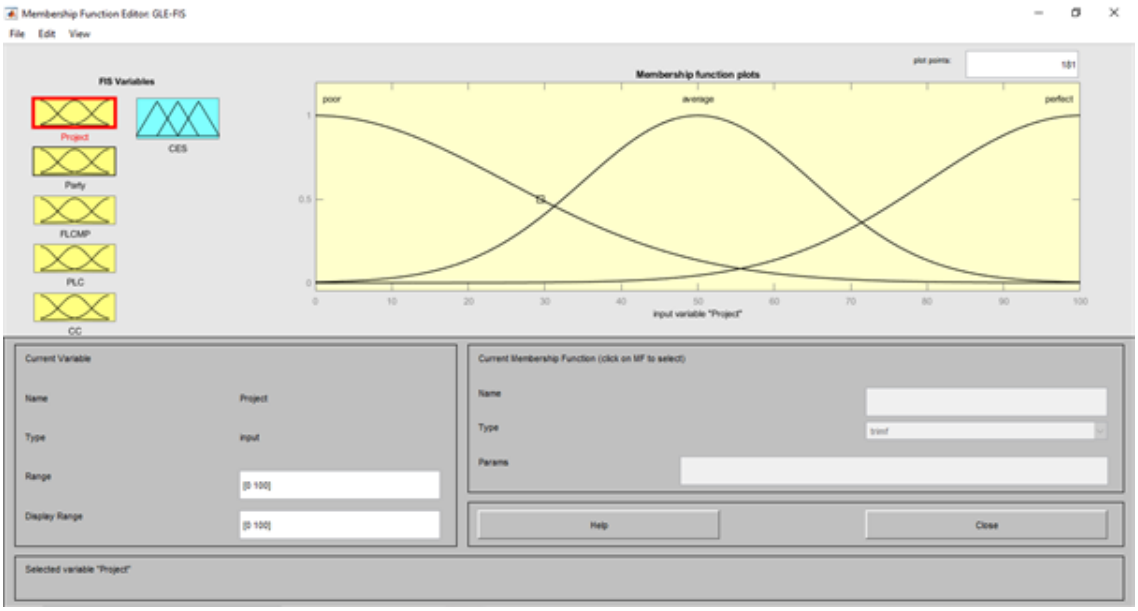

Fig. 4: "Candidate's project"

The membership function editor screenshot for the output variable "Candidate's Election Status" is shown in Figure 5.

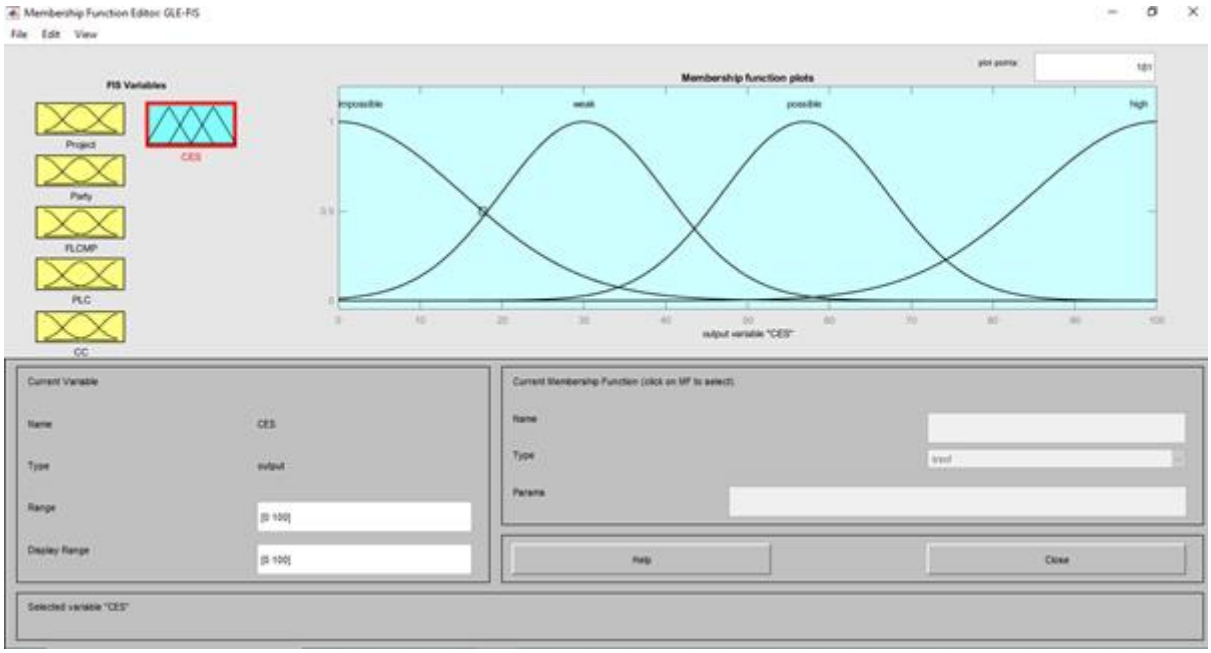

Figure 5: "Candidate's Election Status"

"68" rules were defined to test the model using the defined Input and Output variables. 4 of these rules are given below.

- Rule 1. If (Project is poor) and (Party is insignificant) and (FLCMP is fairly) and (PLC is low) and (CC is weak) then (CES is weak) (1)

- Rule 33. If (Project is perfect) and (Party is significant) and (FLCMP is successful) and (PLC is low) and (CC is average) then (CES is weak) (1)
- Rule 59. If (Project is poor) and (Party is significant) and (FLCMP is average) and (PLC is high) and (CC is average) then (CES is possible) (1)
- Rule 63. If (Project is perfect) and (Party is significant) and (FLCMP is successful) and (PLC is average) and (CC is strong) then (CES is high) (1)

The screenshot of the rule editor for the rules created for the proposed model is given in Figure 6.

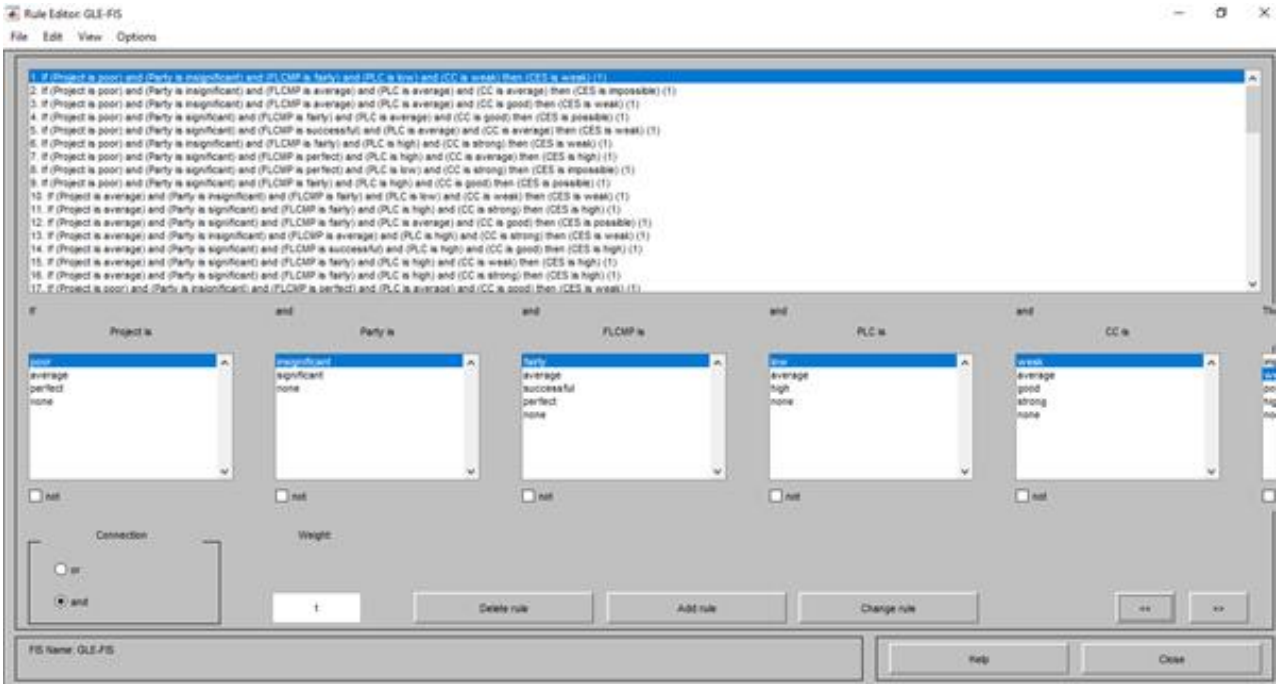

Figure 6: Rule Editor

Rule Viewer, which explains the images of the rules after these arrangements, is shown in Figure 7.

Figure 7: Images of the Rules

4. ILLUSTRATIVE EXAMPLE

A simple scenario was written to see the results of the proposed model. In this scenario, the scores of each candidate of the X-party in 7 different cities in an election district are given. All of this information is accepted as "%".

Table 2: 7 Input Variable Scores of the Mayoral Candidate

	INPUT VARIABLES				
Cities of the ELECTION DISTRICT	Candidate's Projects	Candidate's Party	FLCMP	PLC	CC
City A	90	65	75	80	30
City B	80	55	40	60	75
City C	60	75	80	90	80
City D	90	55	40	90	90
City E	90	55	40	50	50
City F	50	55	60	50	70
City G	50	55	80	90	90

The results obtained by evaluating the information in Table 2 and the "Rule Viewer" in Figure 6 are shown in Table 3.

Table 3: Election Levels of 7 Mayoral Candidates

	INPUT VARIABLES					OUTPUT VARIABLE	
ELECTION DISTRICT MUNICIPALITIES	Candidate's Project	Candidate's Party	FLCMP	PLC	CC	Candidate's Election Status	
City A	90	65	75	80	30	18.9	impossible
City B	80	55	40	60	75	63.2	possible
City C	60	75	80	90	80	61.2	possible
City D	90	55	40	90	90	72.3	high

City E	90	55	40	50	50	55.4	possible
City F	30	30	50	70	30	49	weak
City G	50	55	80	90	90	67.4	possible

In addition to the evaluations above, from a different perspective, a priority/relative importance ranking can be made among the input variables used when creating the rules. To do this, one can use 3-dimensional graphics. Firstly; the effect of the input variables "Candidate's Projects" and "Candidate's Party" on the output variable "Candidate's Election Situation" was examined. The 3-D graph of these variables is shown in Figure 8.

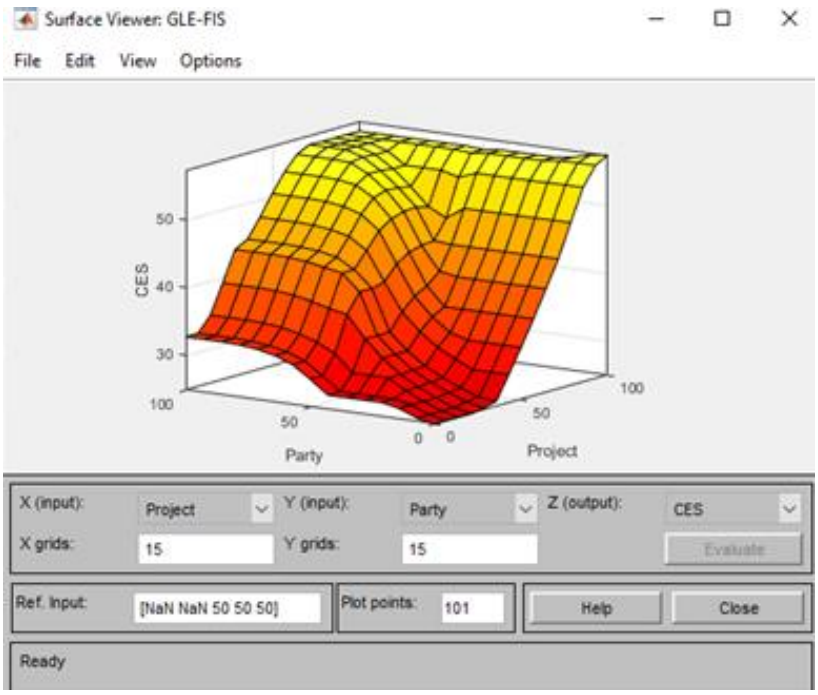

Figure 8: Election Status Depending on the Variables of “Candidate's Projects” and “Candidate's Party”

In Figure 8, the score of the Candidate's Projects being in the range of 0-40 and the importance of the candidate's party being in the range of 0-50 reduces the candidate's election score. In addition, if the candidate's party is in the range of 40-100, the candidate's election score increases slightly. On the other hand, having a candidate's project score between 40 and 100 directly increases the candidate's election score. For this reason, voters care more about the Candidate's Projects than the Candidate's Party. Similar comments can be made for the graphs given below and the importance of the variables can be ranked. Below are other 3-dimensional graphs showing the effects of input variables on the output variable. Figure 9 shows the Candidate's Election Status chart according to the "Candidate's Projects" and "FLCMP " input variables.

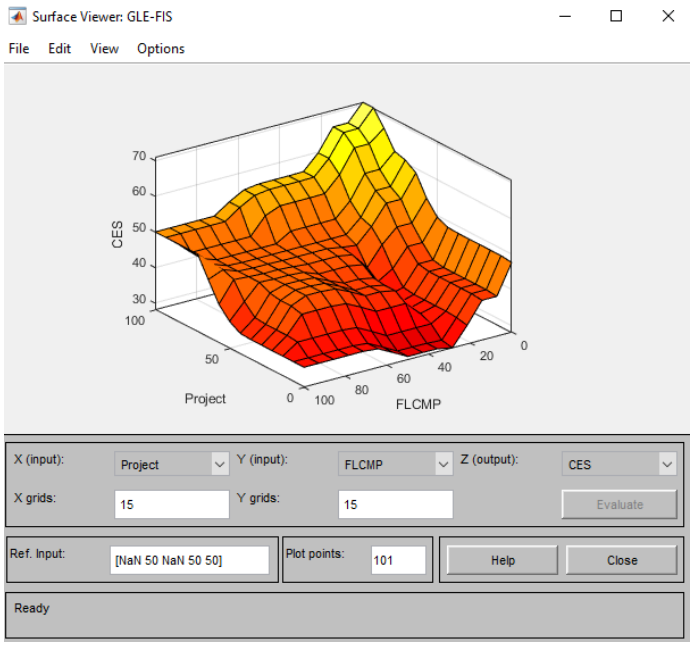

Figure 9: Election Status Based on “Candidate's Projects” and “FLCMP” variables

Figure 10 shows the Candidate's Election status graph according to the "Candidate's Projects" and "Party Leader’s Charisma" input variables.

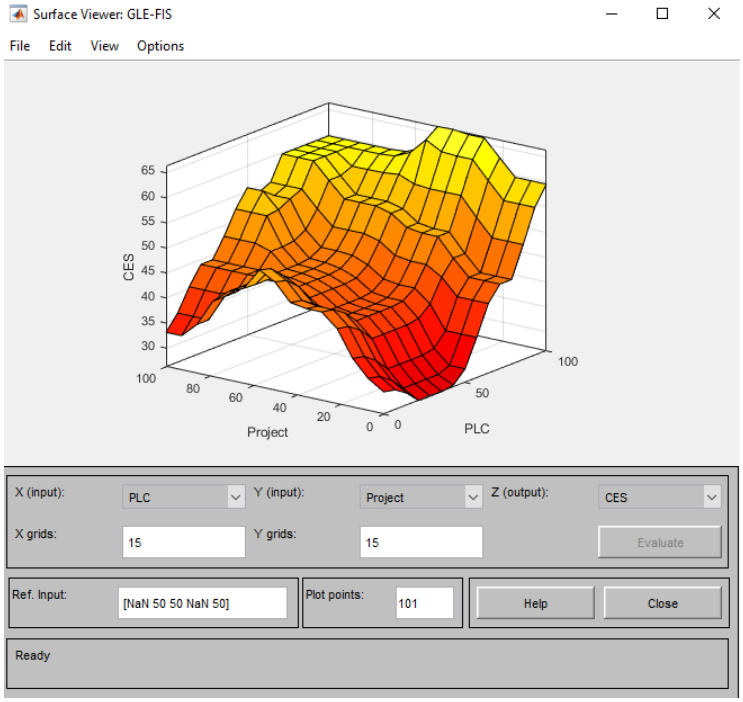

Figure 10: Election Status Based on the "Candidate's Projects" and "Party Leader's Charisma" variables

Figure 11 shows the Candidate's Election Status chart according to the "Candidate's Projects" and "Candidate's Communication" input variables.

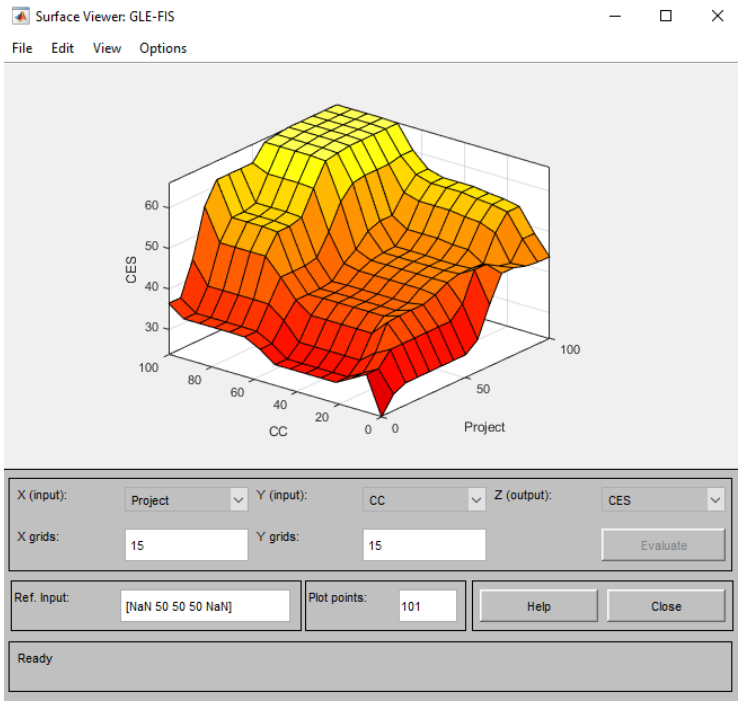

Figure 11: Election Status Based on the Variables of "Candidate's Projects" and "Candidate's Communication"

Figure 12 shows the Candidate's Election Status graph according to the "Candidate's Party" and " FLCMP " input variables.

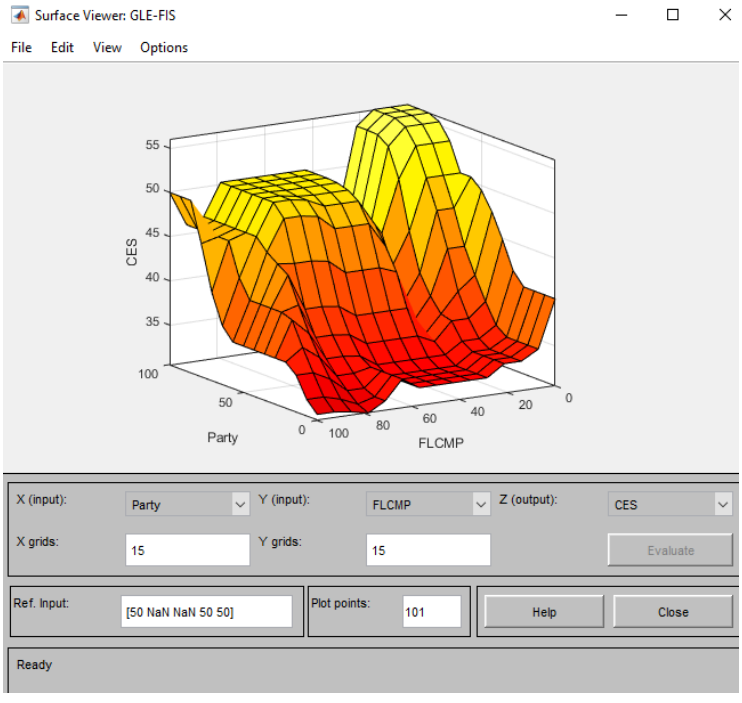

Figure 12: Election Status Based on the "Candidate's Party" and "FLCMP" Variables

Figure 13 shows the Candidate's Election Status graph according to the "Candidate's Party" and "Party Leader's Charisma" input variables.

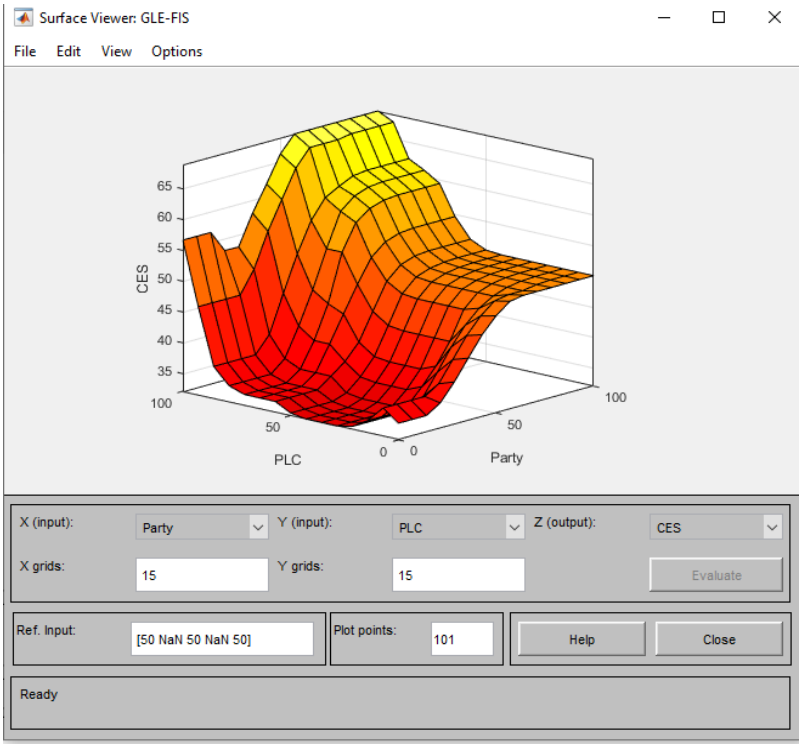

Figure 13: Election Status Based on the Variables "Candidate's Party" and "Party Leader's Charisma"

Figure 14 shows the Candidate's Election Status graph according to the "Candidate's Party" and "Candidate's Communication" input variables.

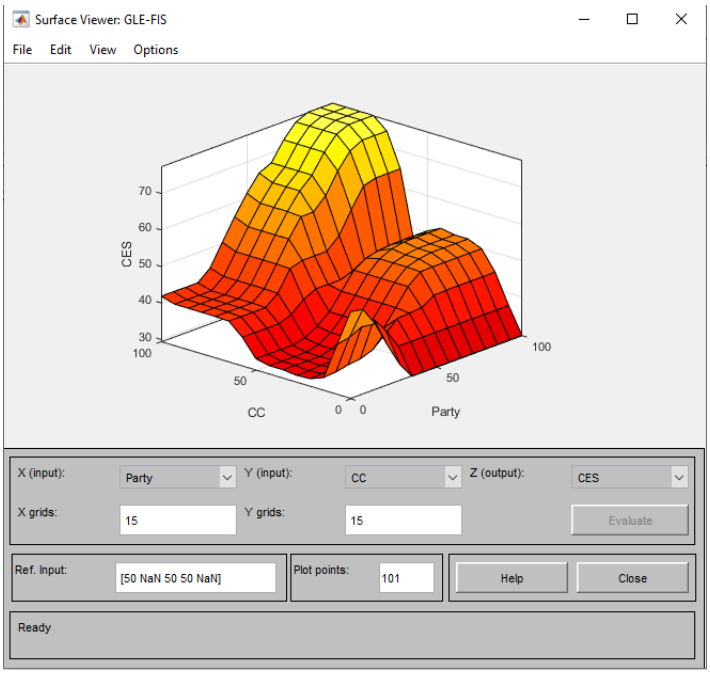

Figure 14: Election Status Depending on the “Candidate's Party” and “Candidate's Communication” Variables

Figure 15 shows the Candidate's Election status graph according to the "Party Leader's Charisma" and " FLCMP " input variables.

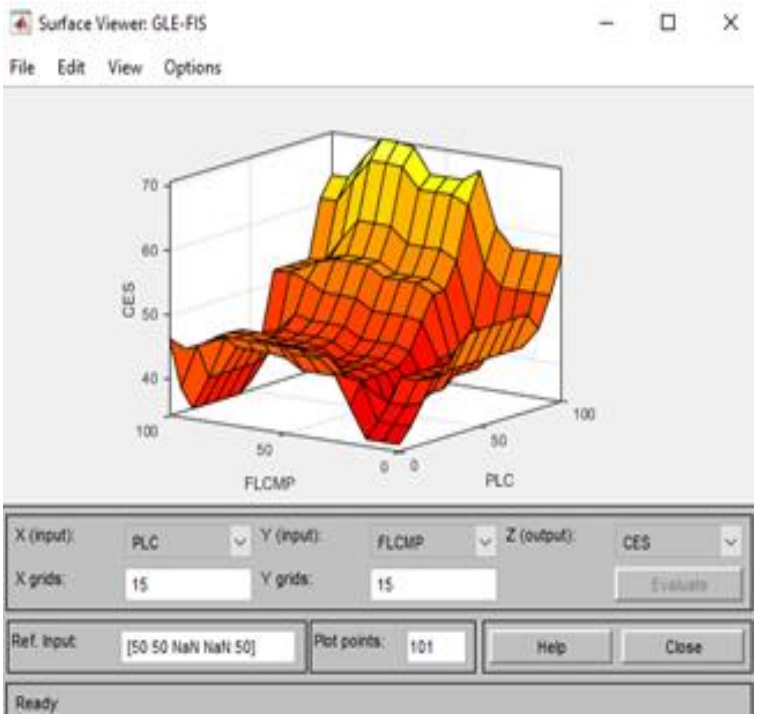

Figure 15: Election Status Based on “Party Leader's Charisma” and “FLCMP” variables

Figure 16 shows the Candidate Election Status graph according to the "Candidate's Communication" and " FLCMP " input variables.

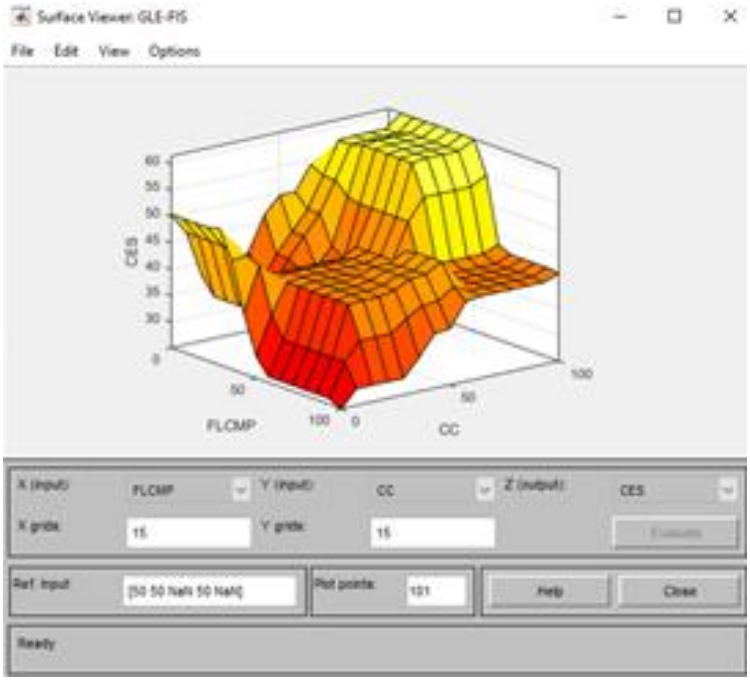

Figure 16: Election Status Based on "Candidate's Communication" and "FLCMP " Variables

Figure 17 shows the Candidate Election Status chart according to the "PLC" and "CC" input variables.

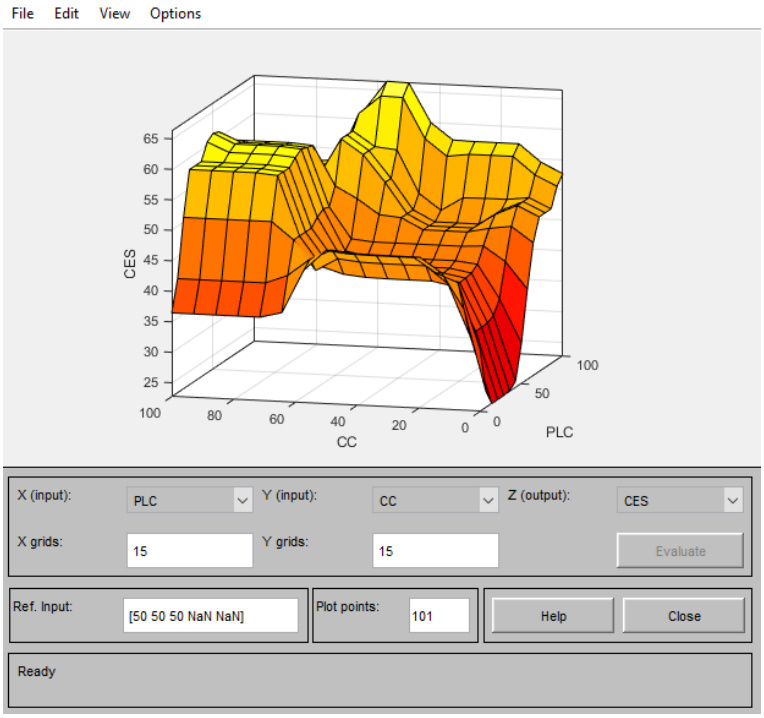

Figure 17: Election Status Based on "Candidate's Communication" and "Party Leader's Charisma " Variables

Considering the 3-dimensional graphics given above, the following importance ranking can be made among the factors affecting the candidate's election level.

Party Leader's Charisma >> Candidate's Projects >> FLCMP >>Candidate's Communication >> Candidate's Party

5. CONCLUSION AND SUGGESTIONS

To achieve success in the elections, it is important for both Political Parties and candidates to know the voters very well, and it is also very important to know the factors that affect the voting behavior of the voters. In Turkey, in the body of research based on General Local Elections, the Survey method is mostly used to determine the factors affecting voter behavior. In evaluating the data collected with the help of the survey, statistical methods are preferred to analyze the factors affecting the voters' demographic characteristics, preferences, decision-making process and behavior. Additionally, the surveys applied in studies on elections are generally similar to each other. Using the same or similar surveys in different constituencies may lead to misinterpretation of the results. Because of social, economic and cultural differences between electoral districts, it is possible for voters to behave according to at least one of the "Sociological Approach", "Socio-psychological Approach" and "Economic Approach" models. For this reason, different surveys can be prepared for each electoral region and analyzes can be made.

In this study, a Mamdani-type Fuzzy Inference model is proposed to demonstrate the applicability of FISs in elections, and the usability of the model is demonstrated on an illustrative example for General Local Elections. Proposed model applied Mamdani-type FIS as in the models of Singh et al. (2012) and Rehman (2017). The input variables used in the modeling process were selected from studies in the literature and the result was achieved using 68 defined rules. Based on these rules, the election status score of the candidate of the X-party in 7 cities and the linguistic expression corresponding to this score were determined. Additionally, a ranking was made among the factors (inputs) affecting voter preferences with the help of 3-dimensional graphics. This revealed which inputs voters care about in their preferences. Although the rules defined in the study are used for each city, results can be achieved by using different inputs in each city, as voter behavior may vary depending on the city. On the other hand, increasing the number of input variables and the membership functions of these variables will cause the number of rules to increase exponentially. For future studies, the results of the Presidential and Parliamentary elections in Turkey can be predicted with the help of the proposed model or a modular Fuzzy Inference System model to be developed.

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