An evolutionary-based adaptive neuro-fuzzy expert system as a marriage counsellor using astrology science

[1] Seyed Muhammad Hossein Mousavi
[1]Independent Researcher, Tehran, Iran
Email: [1]mosavi.a.i.buali@gmail.com

ABSTRACT

Divorce rate is increasing around the globe. The result of such a phenomenon could be a criminal one for coming generations. Too many ways, to decrease this phenomenon, are employed during times and some of them lead to success and some of them to failure. By using expert systems, human errors reduce. In this paper a new way to divorce rate reduction is proposed. Combining astrology science with artificial intelligence techniques could make a decent automatic expert system for this purpose. The main idea is just to order everything based on couples' birthday chart but according to Vedic astrology. Using such an expert system as an assistant or even replacement for family counsellor could have good effects. In this approach wealth and money and other things doesn't matter and the only thing which matters is the way of thinking that is achievable through astrology. This expert system proposed three classes of "do marry" in the case of (+60 %) compatibility, "do not marry" in the case of (-40 %) compatibility and "marriage with caution" class in the case of (50 ± 10 %) compatibility. The data has been trained and tested with different Meta-heuristic optimization algorithms like (ACO, DE, PSO and GA) and neural network training methods like (Hybrid and back-propagation). Error factors like (MSE, RMSE, Error Mean and Error STD) are calculated for each one of these approaches as validation results. Very satisfactory results were achieved. Dream to a perfect life for all couples in the globe and decreasing divorce rate into zero.

Keywords: divorce; expert system; astrology; optimization algorithm; neural network;

1. INTRODUCTION

Automatic expert systems could lift heavy burden from our shoulders. But what kind of automatic expert systems? In this case, we need to reduce divorce rate through couple's thoughts and behaviours. Thus, is it a Psychologist expert system or a doctor or even family counsellor? Well each one of them has their pros and cons. For example, Psychologist and family counsellor works well in this case, especially before marriage. But is it not better to set everything properly from the first? Psychologists and doctors act based on what the patient says, but what if patient not to say everything or say something wrong or not precise or even forgot something to say. But using an automatic astrologist expert system, there is exist a general picture of the subject's mind which is comparable with someone else to check the compatibility between couples. More details on this subject is in parts below but in a general perspective, there are exist four important structural elements for each one of us which each one of these elements are compatible with each other's. Fire, Earth, Air and water are those four main elements. Each element is compatible with itself and some of the other elements, but not with its antithetic. Thus, in this method a water sign is not going to be compatible with a fire sign and result of such a combination, leads to divorce. Need to mention that it is not voodoo or black magic. Because in black magic you will contact with demons and speaking about future, but here you just speak about present time and someone's attributes and also you just work on bunch of numbers. Even you can use the name of god at the start. In Introduction or section 1, all the necessary fundamentals will be defined. Section 2 includes some of the other researcher's works on expert systems with the subjects of family counsellor, marriage counsellor and divorce rate reduction. As it is a novel work on this subject, we could not find much works. Section 3 and 4 includes our proposed evolutionary ANFIS expert system based on astrology science on acquired results from dataset using different evolutionary optimization algorithms as learning algorithms respectively. For validating results, a dataset from a human expert (astrology expert) has been received, which described thoroughly in section 4 in details. Finally, in section 5, pays to conclusion on the paper and some suggestions to making even a better system. According to a research in 2012 (United Nations World Demographic Report) [11], for 70 countries, reporting on divorce rate, in which first five were: Russia, Aruba, Belarus, Latvia and Lithuania, with respectively divorce rate of 4.5, 4.4, 4.1, 3.6 and 3.5, of which Iran was at 31th place with divorce rate of 2. Figure 1 shows statistical chart of divorce for (year vs

number of divorce) and the average age of marriage for (year vs age) in Iran, among 1975-2016. This plot shows that number of divorces is increasing through years.
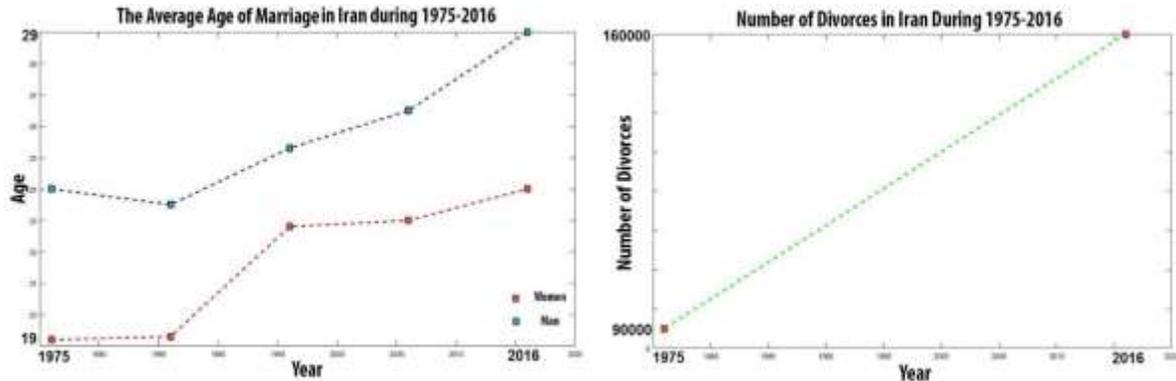
Figure. 1 Statistical chart of divorce and the average age of marriage in Iran among 1975 – 2016 [12]

1.1 Evolutionary computation

The fundamental metaphor of evolutionary computing relates this powerful natural evolution to a particular style of problem solving – that of trial-and-error [1]. In artificial intelligence, an evolutionary algorithm (EA) is a subset of evolutionary computation, a generic population-based meta-heuristic optimization algorithm. An EA uses mechanisms inspired by biological evolution, such as reproduction, mutation, recombination, and selection. Candidate solutions to the optimization problem play the role of individuals in a population, and the fitness function determines the quality of the solutions. Differential evolution algorithm is one of the popular evolutionary algorithms, which is used here to find best initial cluster centers. Differential Evolution (DE) is a relatively recent heuristic (it was created in the mid-1990s) proposed by Kenneth Price and Rainer Storn [2-4], which was designed to optimize problems over continuous domains. This approach originated from Kenneth's Price attempts to solve the Tchebycheff Polynomial fitting Problem that had been posed to him by Rainer Storn [5]. Another example is, genetic algorithm (j.holland, k. dejong, 1960) [6], which is a perfect example of them leads initial population to evolution for optimization problems. The operators of this algorithm are inspired of natural genetic changes and natural generation selection. Also, PSO [7] which became formulized by Edward and Kennedy in 1955, based on social behavior of animals such fish and birds [8]. In computer science and operations research, the ant colony optimization algorithm (ACO) is a probabilistic technique for solving computational problems which can be reduced to finding good paths through graphs. This algorithm is a member of the ant colony algorithms family, in swarm intelligence methods, and it constitutes some meta-heuristic optimizations. Initially proposed by Marco Dorigo in 1992 in his PhD thesis, [9, 10] the first algorithm was aiming to search for an optimal path in a graph, based on the behavior of ants seeking a path between their colony and a source of food. The original idea has since diversified to solve a wider class of numerical problems, and as a result, several problems have emerged, drawing on various aspects of the behavior of ants.

1.2 Expert system

An adaptive neuro-fuzzy inference system or adaptive network-based fuzzy inference system (ANFIS) is a kind of artificial neural network that is based on Takagi–Sugeno fuzzy inference system. The technique was developed in the early 1990s [13]. Since it integrates both neural networks and fuzzy logic principles, it has potential to capture the benefits of both in a single framework. Its inference system corresponds to a set of fuzzy IF–THEN rules that have learning capability to approximate nonlinear functions [14]. Hence, ANFIS is considered to be a universal estimator [15].

1.3 Astrology

Astrology is the study of the movements and relative positions of celestial objects as a means for divining information about human affairs and terrestrial events [18-20]. Astrology has been dated to at least the 2nd millennium BCE and has its roots in calendrical systems used to predict seasonal shifts and to interpret celestial cycles as signs of divine communications [21]. Many cultures have attached importance to astronomical events, and some – such as the

Indians, Chinese, and Maya – developed elaborate systems for predicting terrestrial events from celestial observations. Western astrology, one of the oldest astrological systems still in use, can trace its roots to 19th–17th century BCE Mesopotamia, from which it spread to Ancient Greece, Rome, the Arab world and eventually Central and Western Europe. Throughout most of its history astrology was considered a scholarly tradition and was common in academic circles, often in close relation with astronomy, alchemy, meteorology, and medicine [22].

1.4 Vedic astrology

Jyotisha (or Jyotishyam from Sanskrit jyotiṣa, from jyótis- "light, heavenly body") is the traditional Hindu system of astrology, also known as Hindu astrology, Nepalese Shastra, Indian astrology, and more recently Vedic astrology. The term Hindu astrology has been in use as the English equivalent of Jyotiṣa since the early 19th century, whereas Vedic astrology is a relatively recent term, entering common usage in the 1980s with self-help publications on Āyurveda or Yoga. Vedanga Jyotisha is one of the earliest texts about astronomy within the Vedas [23-25]. However, some authors have claimed that the horoscopic astrology in the Indian subcontinent came from Hellenistic influences, post-dating the Vedic period [26]. In epics Ramayana and Mahabharata, only electional astrology, omens, dreams and physiognomy are used.

1.5 Natal astrology

Natal astrology, also known as genethliacal astrology, is the system of astrology based on the concept that each individual's personality or path in life can be determined by constructing a natal chart for the exact date, time, and locations of that individual's birth. Natal astrology can be found in the Indian or Jyotish, Chinese and Western astrological traditions. In horoscopic astrology an individual's personality is determined by the construction of the horoscope or birth chart for the particular individual involved (known as the native), showing the positions of the sun, moon, planets, ascendant, midheaven, and the angles or aspects among them.

1.6 Astrological signs

In Western astrology, astrological signs are the twelve 30° sectors of the ecliptic, starting at the vernal equinox (one of the intersections of the ecliptic with the celestial equator), also known as the First Point of Aries. The order of the astrological signs is Aries, Taurus, Gemini, Cancer, Leo, Virgo, Libra, Scorpio, Sagittarius, Capricorn, Aquarius and Pisces. The concept of the zodiac originated in Babylonian astrology and was later influenced by Hellenistic culture. According to astrology, celestial phenomena relate to human activity on the principle of "as above, so below", so that the signs are held to represent characteristic modes of expression [27].

When we born, there are coordinates on the earth for us. These coordinates are normalized on other planets, sun, moon, and other celestial bodies in the solar system. Each one of this celestial bodies creates a part of our personality. Having all of these part, it is possible to know someone completely which help a lot in marriage issue.

Figure 2 represents 12 sigs of Zodiac in details. Based on Vedic astrology which is the most accurate one, there are 12 signs (lion, scorpion, and goat …), 12 date partitions, 12 Lords (Aries, Scorpio, and Libra …), 12 Planets for each Lord, 4 structural elements of (Fire, Earth, Air and Water), 12 Houses, 12 Constellations and each sign has its own traits (good and bad). This science has been discovered 2000 years ago and in that time planet's rotation was faster. But when mankind discovered space and starts to search it, discovered that planet's speed is slowed down. Thus, using tropical astrology which is based on 1 to 30 days of months in each season is wrong. But Vedic astrology fixed this problem and it is based on planets position and rotation speed around the sun. Moreover, in astrology two satellites (Moon and Chiron) are so important. In the other hand, Pluto from dwarfs and Sun from stars family and Rahu, Ketu from celestial bodies are so important to discover someone's personality in astrology. As it is clear each planets and other mentioned space materials are related to something in a persons' characteristics. As it is mentioned before peoples all around the world from ancient time till now are using this science for better relationships. This science is spread in USA, China and Europe more. There are clinics and doctors, counsellors and even a university branch for this science in a lot of countries.

Note that in a lot of countries and for fun peoples use this science but they just use Sun sign, which is just 25% of person characteristics and even they use tropical astrology which make it so wrong. They do not calculate moon, mercury, mars and ascending signs. That is normal because they do not know anything about it and it is just for fun. Thus, if this matter is so important to you, just use the right, precise knowledge, which is astrology and it is harder than you think.

For eliminating confusion, the word of "planet" is used for celestial bodies in the sky, even the sun. Figure 3 represents someone's chart based on Vedic astrology. At the left-hand side of the figure, planets are clear with their respective degree. Each planet could be in 1-30 degree, which shows how this planet is affected from that lord. Also, each planet has its own lord, which if the lord be in its respective planet, it is a good sign of power in that specific part of personality. Signs are in the third column. But in these planets, there are 8 important and four most important planet which could presents a good percentage of characteristics from the subject. Those 8 are (Ascending, Sun, Moon, Mercury, Mars, Venus, Rahu and Ketu) and 4 most important are (Moon, Sun, Ascending and Mercury). In fact, Moon sign is the most important sign of all zodiac sign (and its degree). In that previews paragraph it is mentioned those people using this science for fun and wrong. It should be mentioned that even if they calculate it science according to Vedic astrology and even for all planets, still a problem exists and that is the degree. Imagine moon sign which is most important sign of all zodiac. Because moon control the mind. Moon's orbit is almost in three days on around the earth. If moon be in Libra but in 26 degree, then this person mind is not working based on Libra and that is because Libra's constellation is almost done in 28 degree and this person's mind is based on 26 degree of Scorpio and just 4 degrees in Libra. Thus, most of the actions of this person will be based on Scorpio personality in the life. In the other hand, some of the planets like Uranus and Neptune are not so important because their orbit length is so big which covers a whole generation. Figure 3 presents a subject's personality and for other 146 combinations it can be referred to [28-32]. This person is born in 30 of July, 1990. Ascending or rising sign shows a general view of whole chart and some of the body shape. He is Pieces ascendant which means, he is intelligent and so quiet. He will think about something so much without speaking. Also, because Pieces is a water sign, he is so calm and relax. This personality likes other dimensions facts and could be a good employee. Sun sign shows the inner personality which is not shown so much to other people. In this case sun sign is in 13 degree of cancer which is a water sign just like pieces. Thus, relaxation is vivid in this personality but cancer is most well-rounded sing in zodiac, which means they can learn everything but with having enough time. In the other hand cancer is the fourth house's lord which is called mother of zodiac. Thus, these people are good parents too. They are so emotional and they just care about their loved ones and they are so loyal. Also, like other water signs they are tend to know other world or dimensions sciences. As it is clear sun is in 13 degree, which means cancer is 13 and Leo in 17 degrees. Thus, these people may show some show off and aggressiveness like a lion from their selves but mostly cancer because crab constellation is still vivid in the sky. And of curse moon sign, which as it mentioned before is most important sign of the zodiac. Moon represents emotions, habits, behaviour with other and way of thinking. Moon is third house and is occupied with Libra lord, but because it is in 26 degree, it is not Libra anymore. It is Scorpio which is next lord. This problem is a common mistake in astrology, so degree is so important. Again, like other water signs Scorpio is so calm but most dangerous, especially in moon. They are secretive, loyal, powerful, dominant, hard workers and wealthy. Scorpio is controlled by eight house which is the house of underworld. They like to know about the other dimensions so much. It is better to not joke with these guys. They could be very harmful and dangerous. Mars is in Aries which is its perfect planet. Mars shows our aggressiveness, actions and desires. Sadly arises are the most violet sign in the zodiac. But in this position, they could be for example a perfect commander in army or police officer. They are dominant like Scorpio but with more aggressiveness. Mercury represents communication, logic and speaking. We have mercury in Leo which means, this person has good ability in speaking as a leader and strong absorption power and this will happen if they be in center of crowed as a leader. Because Mercury is related to busyness, Leo in this place could be a creative and powerful leader. Also, they are so faithful and the world will provide for them, because they are so generous. By the way Leo is controlled by the only star in the planet which is sun and sun is center of everything and other planets are depending to it. Venus represents passion, art, beauty and love. Best place for it, is Gemini, which in this example Gemini is in this planet with 19 degree, which will be affected by cancer too. After Gemini we have Scorpio, Aries and Leo in passion power. Rahu and Ketu are in their perfect place in this example. Rahu in the tenth house or Capricorn and Ketu in the fourth house or cancer. Also, Capricorn and cancer are father and mother of the zodiac. When Rahu and Ketu will be placed in this house, then fame and wealth comes toward that person. It should be mentioned that combination of this planets, houses and lord with their degrees represents the whole personality but may some of them change the others with a low effect. For example, if you have Leo in moon and Pisces in mars or ascending, Pisces power will reduce aggressiveness of Leo which is a good balance. But sometimes it is bad like Hitler's birth chart which is based on Aries completely. He has too much planet in Aries and Jupiter expanded the power of Aries too. Aries is leader like Leo and Scorpio but and it is fire sign. They will fire up so fast and vice versa. But if there be no main planet to fire down and worse fired up more, then that is a disaster, which could be a good example of Hitler. Other planets are not so important and for more information about them can be referred to [28-32]. According to my

experience combinations of Aries, Leo, Scorpio, Cancer, Capricorn and Gemini and in proper houses could make a perfect person. These characteristics sums with year sign, family and friends' environment and beliefs and makes persons personality, but birth chart calculated with Vedic astrology consists 70 % of it and could influence the other parts too.

Table 1 shows the 17 important factors in consultation before marriage which will be extracted from couples' birth chart. The values will be used in our proposed system. First 10 factors are so important. If they be compatible with each other, it is a good sign for marriage. System works with two approaches (with planet-based and birth date-based). Data for 98 couples is received from astrology human expert and based on Table 1, which will be used in section 4.

Table. 1 Astrology factors in consultation before marriage

First Approach (Planet-Based)	Variable Name	Value Range	Degree Range
1	Ascending	[1 12]	[1 30]
2	Sun	[1 12]	[1 30]
3	Moon	[1 12]	[1 30]
4	Mars	[1 12]	[1 30]
5	Mercury	[1 12]	[1 30]
6	Jupiter	[1 12]	[1 30]
7	Venus	[1 12]	[1 30]
8	Saturn	[1 12]	[1 30]
9	Rahu	[1 12]	[1 30]
10	Ketu	[1 12]	[1 30]
11	Uranus	[1 12]	[1 30]
12	Neptune	[1 12]	[1 30]
13	Pluto	[1 12]	[1 30]
14	Chiron	[1 12]	[1 30]
15	X	[1 12]	[1 30]
16	Y	[1 12]	[1 30]
17	Z	[1 12]	[1 30]
Second Approach (Birth Date-Based)	Day	Month	Year
1	[1 31]	[1 12]	[1900 2018]
2	[1 31]	[1 12]	[1900 2018]
3	[1 31]	[1 12]	[1900 2018]

2. PRIOR RELATED WORKS

Unfortunately, there is not much works on marriage counselor or family counselor expert system. Just two cases is founded, but some of the other evolutionary based ANFIS expert systems in other areas will be discussed.
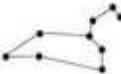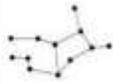
In 2017 Mousavi, S. M. H., MiriNezhad, S. Y., & Lyashenko made an evolutionary-based adaptive neuro-fuzzy expert system as a family counselor before marriage with the aim of divorce rate reduction. They used evolutionary algorithms and neural networks for learning and classification process [33].

In 2017 Hamidreza Saghafi and Milad Arabloo succeeded to make an expert system for estimation of carbon dioxide equilibrium adsorption isotherms using adaptive neuro-fuzzy inference systems (ANFIS) and regression models [34].

Also, Kemal Polat and Salih Güneş made an expert system approach based on principal component analysis and adaptive neuro-fuzzy inference system to diagnosis of diabetes disease [35].

Servet Soyguder and Hasan Alli made an expert system for the humidity and temperature control in HVAC systems using ANFIS and optimization with Fuzzy Modeling Approach [36].

In 2009, Melek Acar Boyacioglu and Derya Avci made An Adaptive Network-Based Fuzzy Inference System (ANFIS) for the prediction of stock market return: The case of the Istanbul Stock Exchange [37].

Figure. 2 12 signs of Zodiac in details and their corresponding traits, figures, date range, constellation and symbols
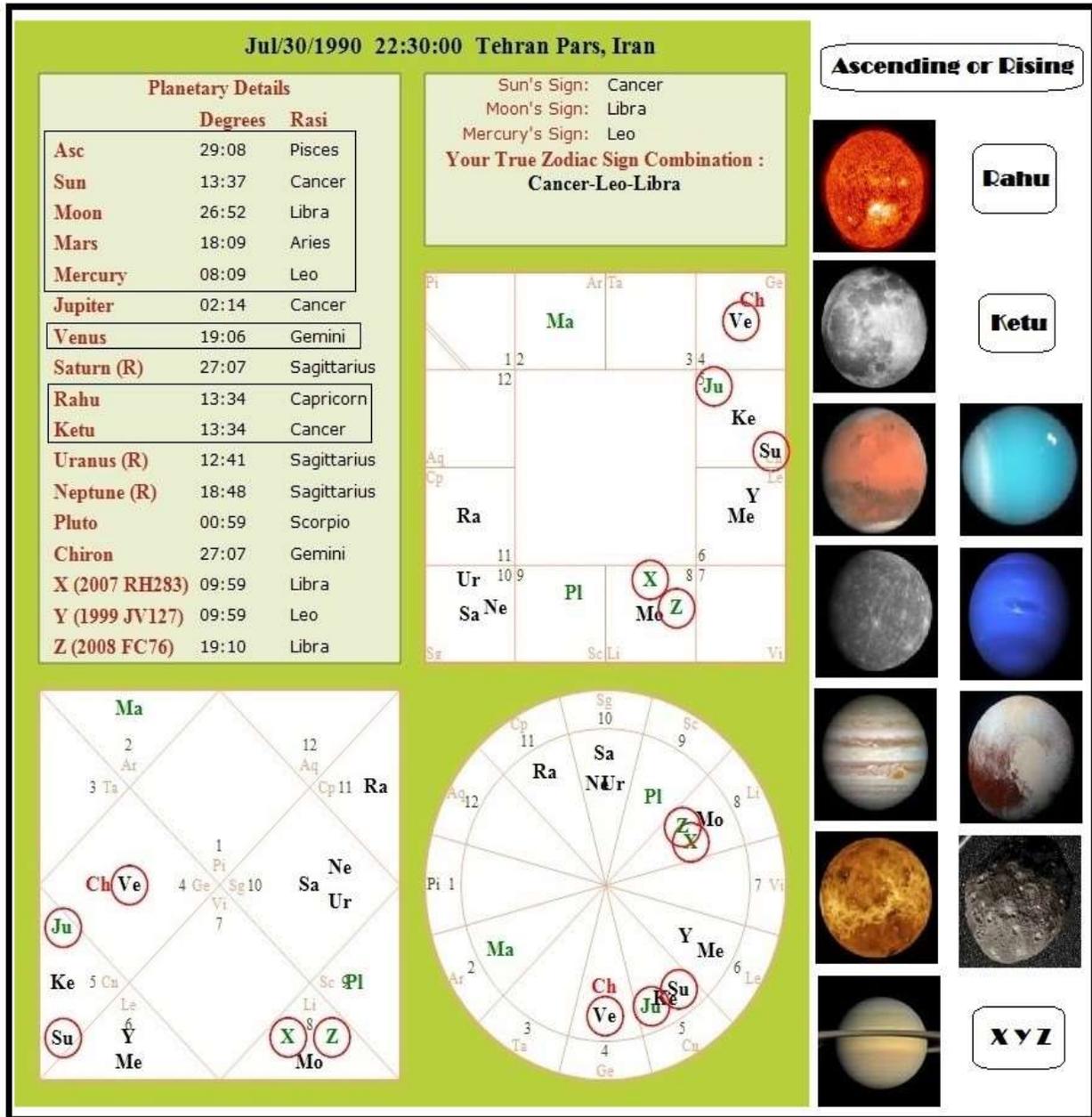

**Figure. 3** Someone's chart based on Vedic astrology

3. PROPOSED METHOD

In this paper, an evolutionary-based Adaptive Neuro-Fuzzy Expert System as an astrology marriage counselor before marriage with the aim of reducing divorce rate is proposed. The main goal is to combine evolutionary algorithms with fuzzy logic and inferring nature inspired results for this kind of natural event (divorce). In fact, learning process Takes place for (Hybrid, back-propagation, GA, PSO, DE and ACO) learning algorithms, and the results will be compare with each other. Figure 4 represents the flowchart of proposed method. For generating FIS, FCM [38] [39] clustering method is used to decreasing fuzzy rules and output membership functions. As it is clear, there are 17 inputs or neurons or variables and input membership functions. Also, there are 5 rules and output

97

membership functions and just one output variable. Training FIS using hybrid learning and testing train and test data for respective dataset is shown in Figures 5, 6, 7 respectively. Figure 8 represents train and test errors for our dataset (DE learning). These plots are just for DE learning algorithm and merely for representing proposed method procedure. As Figure 8 indicates, train and test errors are close to zero.
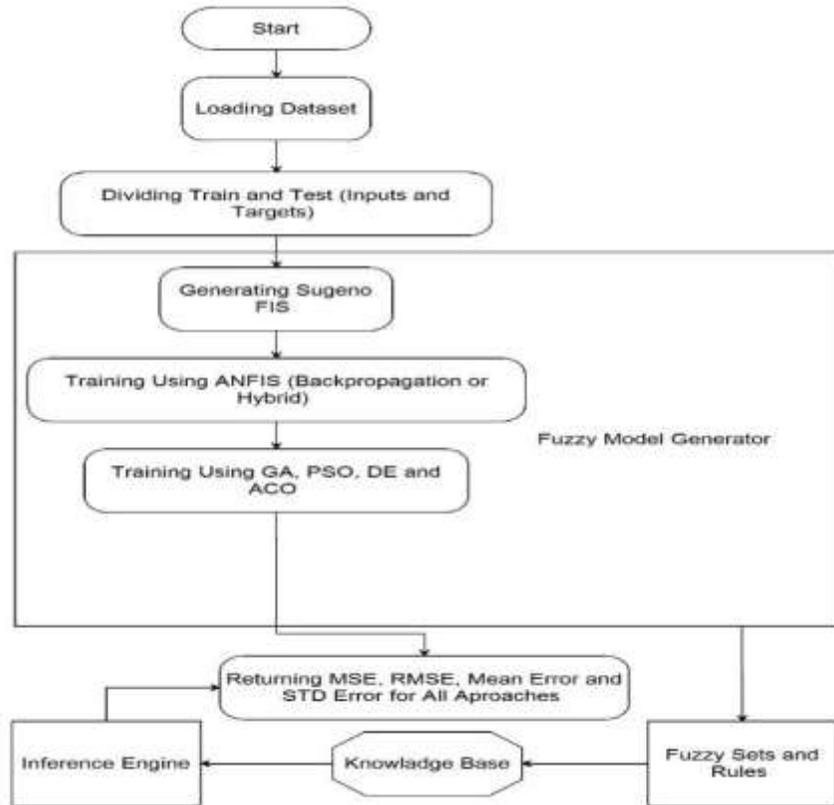
Figure. 4 Proposed Method's procedure
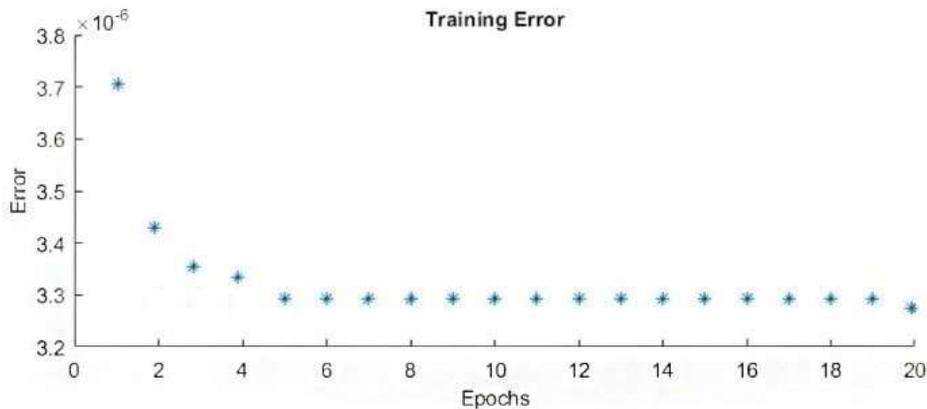
Figure. 5 Training FIS using hybrid learning in 20 epoch
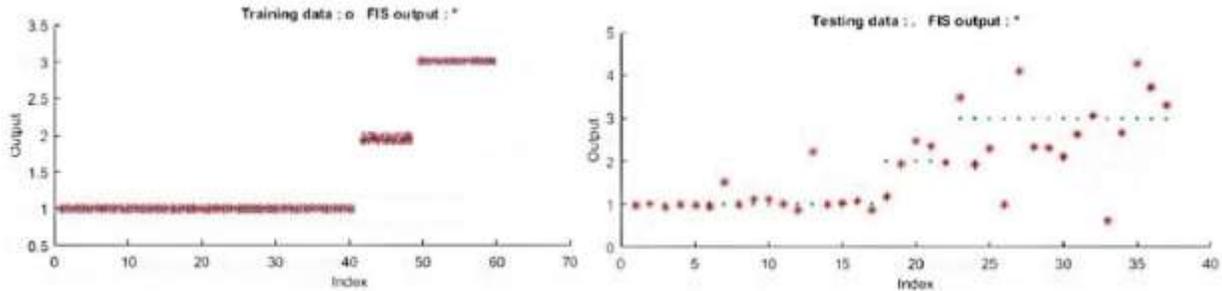
Figure. 6 and 7 Testing train data-Testing test data

Figure. 8 Train and test errors for our dataset (DE learning)

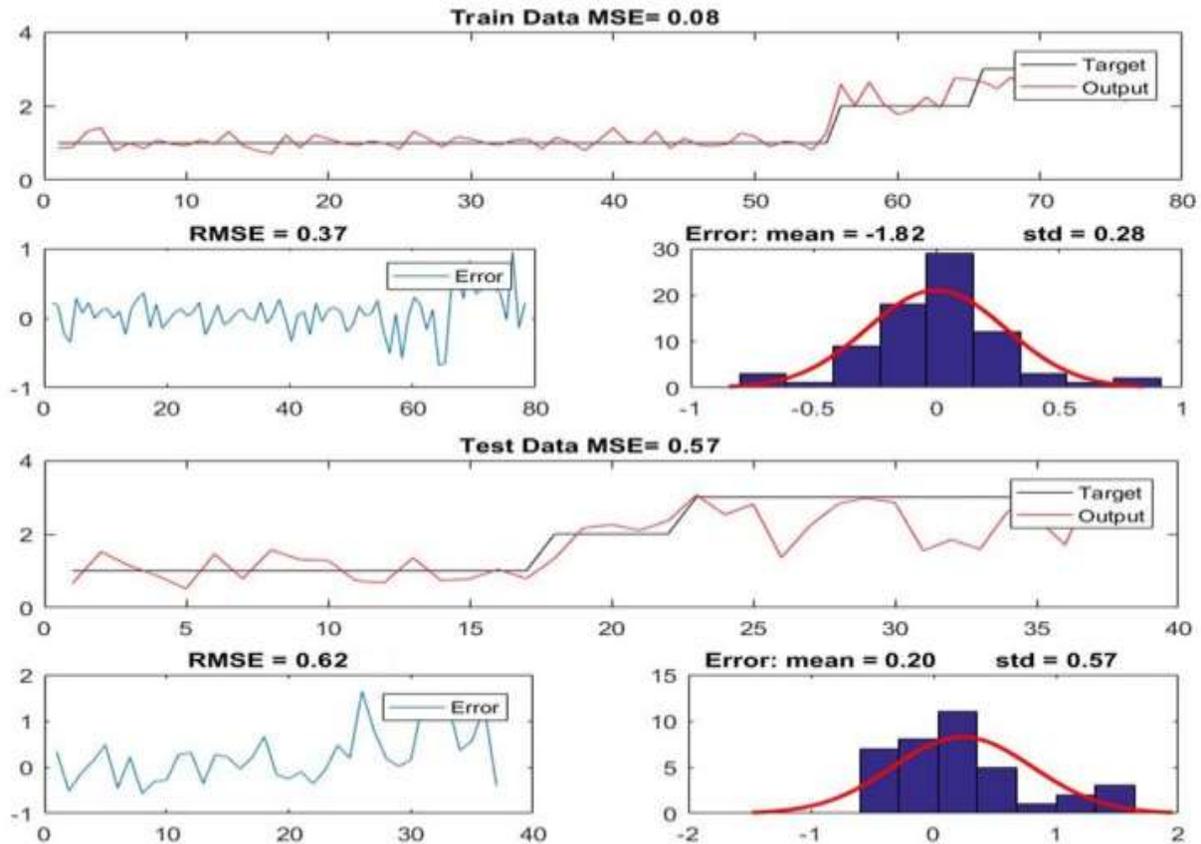## 4. EVALUATIONS AND RESULTS

4.1 Data

Results are acquired from a dataset, collected during 2 years from 98 subjects. Next, 17 of most important consultation factors selected as features or variables. There are three classes in the dataset (do marry, do not marry, marriage with caution).69 subjects as do marry class, 9 subjects as do not marry class and 19 subjects as marriage with caution class are collected. This dataset is achieved from human expert (Astrology expert).

4.2 MSE, RMSE, Mean error and STD error

Table 2 and Table 3 indicate calculated errors such (MSE [40], RMSE [41], Mean Error [42] and STD Error [42]) for different learning algorithms which has been used (Train and Test). Dataset splitted into 62% train data and 38%

test data; number of hidden neurons are 10. Table 4 represents evolutionary learning algorithms parameters. The Mean Squared Error (MSE) or Mean Squared Deviation (MSD) of an estimator (of a procedure for estimating an unobserved quantity) measures the average of the squares of the errors or deviations; that is, the difference between the estimator and what is estimated.

If $(Y^{\wedge})$ is a vector of n predictions, and Y is the vector of observed values corresponding to the inputs to the function which generated the predictions, then the MSE of the predictor can be estimated by:

$$MSE = \frac{1}{n}\sum_{i=1}^{n}(Y_i^{\wedge} - Y_i)^2 \tag{1}$$

The root-mean-square deviation (RMSD) or root-mean-square error (RMSE) is a frequently used measure of the differences between values (sample and population values) predicted by a model or an estimator and the values actually observed. The RMSD represents the sample standard deviation of the differences between predicted values and observed values. The RMSD of predicted values $y_t^{\wedge}$ for times t of a regression's dependent variable yt is computed for n different predictions as the square root of the deviation's squares mean:

$$(2)$$

$$RMSE = \sqrt{\frac{\sum_{t=1}^{n}(y_t^{\wedge} - y_t)^2}{n}}$$

Or simply RMSE is sqrt of (MSE). Mean Error and STD Error are mean and standard deviation of train and test error. Train and test errors are subtraction of targets from output in dataset.

Table. 2 (MSE, RMSE, Mean Error and STD Error) for different learning algorithms (train)

TRAIN	MSE	RMSE	Mean Error	STD Error
Hybrid	0.03	0.01	-0.03	0.02
Back Propagation	0.08	0.31	-0.27	0.31
GA	0.003	0.37	-0.004	0.23
PSO	0.007	0.06	-0.0007	0.18
DE	0.08	0.37	-1.80	0.28
ACO	0.05	0.34	-0.0027	0.20

Table. 3 (MSE, RMSE, Mean Error and STD Error) for different learning algorithms (test)

TEST	MSE	RMSE	Mean Error	STD Error
Hybrid	0.38	0.37	0.02	0.63
Back Propagation	0.22	0.48	-0.008	0.55
GA	0.41	0.58	0.44	0.51
PSO	0.31	0.90	0.30	0.61
DE	0.57	0.62	0.20	0.57
ACO	0.29	0.24	0.31	0.46

Table. 4 Evolutionary learning algorithms parameters

PARAMETERS	GA	PSO	DE	ACO
Number of Decision Variables	800	800	800	800
Size of Decision Variables Matrix	[1,800]	[1,800]	[1,800]	[1,800]
Lower Bound of Variables	-5	-5	-5	-5
Upper Bound of Variables	10	10	10	10
Maximum Number of Iterations	700	1000	400	350
Population Size	100	40	20	20
Crossover Percentage	0.6	-	0.2	-
Number of Offspring's (Parents)	75	-	-	-

Mutation Percentage	0.4	-	-	-
Number of Mutants	45	-	-	-
Mutation Rate	0.2	0.3	0.1	0.3
Selection Pressure	7	-	-	-
Inertia Weight	-	1	-	-
Inertia Weight Damping Ratio	-	0.98	-	-
Personal Learning Coefficient	-	1	-	-
Global Learning Coefficient	-	2	-	-
Lower Bound of Scaling Factor	-	-	0.3	-
Upper Bound of Scaling Factor	-	-	0.8	-
Sample Size	-	-	-	55
Intensification Factor (Selection Pressure)	-	-	-	0.3
Deviation-Distance Ratio	-	-	-	1

5. CONCLUSION AND DISCUSSION

Using evolutionary algorithms as learning algorithm, and combining them with fuzzy logic produces perfect results, which resulting in not only being able to compete with neural network learning algorithms, but also sometimes being better. These kind of evolutionary learning algorithms worked well on our data and returned satisfactory results. The main goal was combining A.I techniques with astrology science to decrease divorce rate and making an expert system as an astrological marriage counsellor. As it is clear in Table 3, back propagation and ACO gained good results on this data and PSO gained weaker results, but all of them worked well. It is suggested to combine other evolutionary algorithms like bat [43], ICA [44] and GGO [45] algorithms, as learning algorithm for achieving different or maybe better results.

ACKNOWLEDGEMENT

REFERENCES

1. Eiben, Agoston E., and James E. Smith. "*Introduction to evolutionary computing*". Vol. 53. Heidelberg: springer, 2003.
2. R. Storn and K. Price. Differential Evolution: "*A Simple and Efficient Adaptive Scheme for Global Optimization over Continuous Spaces*". Technical Report TR-95-012, International Computer Science Institute, Berkeley, California, March 1995.
3. R. Storn and K. Price. "*Differential Evolution - A Fast and Efficient Heuristic for Global Optimization over Continuous Spaces*". Journal of Global Optimization, 11:341–359, 1997.
4. K. V. Price, R. M. Storn, and J. A. Lampinen. Differential Evolution. "*A Practical Approach to Global Optimization*". Springer, Berlin, 2005. ISBN 3-540-20950-6.
5. Coello, Carlos A. Coello, Gary B. Lamont, and David A. Van Veldhuizen. "*Evolutionary algorithms for solving multi-objective problems*". Vol. 5. New York: Springer, 2007.
6. Mitchell, Melanie (1996). "*An Introduction to Genetic Algorithms*". Cambridge, MA: MIT Press. ISBN 9780585030944.
7. J. Kennedy and R. Eberhart, "*Particle swarm optimization*". «Proc.» IEEE International Conf. on Neural Networks (Perth, Australia), IEEE Service Center, Piscataway, NJ, 1995 (in press).
8. Eiben, Agoston E., and James E. Smith. "*Introduction to evolutionary computing*". Vol. 53. Heidelberg: springer, 2003.
9. A. Colorni, M. Dorigo et V. Maniezzo, Distributed Optimization by Ant Colonies, actes de la première conférence européenne sur la vie artificielle, Paris, France, Elsevier Publishing, 134-142, 1991.
10. M. Dorigo, *"Optimization, Learning and Natural Algorithms"*, PhD thesis, Politecnico di Milano, Italy, 1992.

11. https://divorcescience.org/for-students/world-divorce-statistics-comparisons-among-countries/
12. http://www.afkarnews.ir/
13. Jang, J.-S.R. (1993). "*ANFIS: adaptive-network-based fuzzy inference system*". IEEE Transactions on Systems, Man and Cybernetics. 23 (3). doi:10.1109/21.256541.
14. Abraham, A. (2005), "*Adaptation of Fuzzy Inference System Using Neural Learning*", in Nedjah, Nadia; de Macedo Mourelle, Luiza, Fuzzy Systems Engineering: Theory and Practice, Studies in Fuzziness and Soft Computing, 181, Germany: Springer Verlag, pp. 53–83, doi:10.1007/11339366_3
15. Jang, Sun, Mizutani (1997) – *Neuro-Fuzzy and Soft Computing* – Prentice Hall, pp 335–368, ISBN 0-13-261066-3
16. Joseph, Giarratano, and Riley Gary. "*Expert systems principles and programming.*" PWS Publishing Company 2 (1998): 321.
17. J. Kennedy and R. Eberhart, "*Particle swarm optimization*". «Proc.» IEEE International Conf. on Neural Networks (Perth, Australia), IEEE Service Center, Piscataway, NJ, 1995 (in press).
18. "astrology". "*Oxford Dictionary of English*". Oxford University Press. Retrieved 11 December 2015.
19. "astrology". "*Merriam-Webster Dictionary*". Merriam-Webster Inc. Retrieved 11 December 2015.
20. Bunnin, Nicholas; Yu, Jiyuan (2008). "*The Blackwell Dictionary of Western Philosophy*". John Wiley & Sons. p. 57.
21. Koch-Westenholz, Ulla (1995). "*Mesopotamian astrology: an introduction to Babylonian and Assyrian celestial divination*". Copenhagen: Museum Tusculanum Press. pp. Foreword, 11. ISBN 978-87-7289-287-0.
22. Kassell, Lauren (5 May 2010). "*Stars, spirits, signs: towards a history of astrology 1100–1800*". Studies in History and Philosophy of Science Part C: Studies in History and Philosophy of Biological and Biomedical Sciences. 41 (2): 67–69. doi:10.1016/j.shpsc.2010.04.001.
23. Thompson, Richard L. (2004). *Vedic Cosmography and Astronomy*. pp. 9–240.
24. Jha, Parmeshwar (1988). *Āryabhaṭa I and his contributions to mathematics*. p. 282.
25. Puttaswamy, T.K. (2012). *Mathematical Achievements of Pre-Modern Indian Mathematicians*. p. 1.
26. Pingree(1981), p.67ff, 81ff, 101ff
27. Mayo (1979), p. 35.
28. Frawley, David. *The Astrology of Seers: A Comprehensive Guide to Vedic Astrology*. Motilal Banarsidass Publishe, 1992.
29. Harness, Dennis M. The Nakshastras: The Lunar Mansions of Vedic Astrology. Motilal Banarsidass Publ., 2004.
30. Dreyer, Ronnie Gale. Vedic astrology: *A guide to the fundamentals of Jyotish*. Weiser Books, 1997.
31. Charak, K. S. *Elements of Vedic astrology*. Institute of Vedic Astrology, 2002.
32. http://www.astrologykrs.com/
33. Mousavi, Seyed Muhammad Hossein, S. Younes MiriNezhad, and Vyacheslav Lyashenko. "*An Evolutionary-Based Adaptive Neuro-Fuzzy Expert System as a Family Counselor before Marriage with the Aim of Divorce Rate Reduction*." Education 1: 5. 2017.
34. Saghafi, Hamidreza, and Milad Arabloo. "*Estimation of carbon dioxide equilibrium adsorption isotherms using adaptive neuro-fuzzy inference systems (ANFIS) and regression models.*" Environmental Progress & Sustainable Energy (2017).
35. Polat, Kemal, and Salih Güneş. "*An expert system approach based on principal component analysis and adaptive neuro-fuzzy inference system to diagnosis of diabetes disease.*" Digital Signal Processing 17.4 (2007): 702-710.
36. Soyguder, Servet, and Hasan Alli. "*An expert system for the humidity and temperature control in HVAC systems using ANFIS and optimization with Fuzzy Modeling Approach.*" Energy and Buildings 41.8 (2009): 814-822.
37. Boyacioglu, Melek Acar, and Derya Avci. "*An adaptive network-based fuzzy inference system (ANFIS) for the prediction of stock market return: the case of the Istanbul stock exchange.*" Expert Systems with Applications 37.12 (2010): 7908-7912.
38. Dunn, Joseph C. "*A fuzzy relative of the ISODATA process and its use in detecting compact well-separated clusters.*" (1973): 32-57.

39. Bezdek, James C. "*Pattern recognition with fuzzy objective function algorithms*". Springer Science & Business Media, 2013.
40. Lehmann, E. L.; Casella, George (1998). "*Theory of Point Estimation*" (2nd ed.). New York: Springer. ISBN 0-387-98502-6. MR 1639875.
41. Hyndman, Rob J. Koehler, Anne B.; Koehler (2006). "*Another look at measures of forecast accuracy*". International Journal of Forecasting. 22 (4): 679–688. doi:10.1016/j.ijforecast.2006.03.001.
42. Everitt, B.S. (2003) "*The Cambridge Dictionary of Statistics*", CUP. ISBN 0-521-81099-X.
43. Yang, Xin-She. "*A new metaheuristic bat-inspired algorithm.*" Nature inspired cooperative strategies for optimization (NICSO 2010) (2010): 65-74.
44. Atashpaz-Gargari, Esmaeil, and Caro Lucas. "*Imperialist competitive algorithm: an algorithm for optimization inspired by imperialistic competition.*" Evolutionary computation, 2007. CEC 2007. IEEE Congress on. IEEE, 2007.
45. Mousavi, Seyed Muhammad Hossein, S. Younes MiriNezhad, and Mir Hossein Dezfoulian. "*Galaxy Gravity Optimization (GGO) An Algorithm for Optimization, Inspired by Comets Life Cycle*.", CSI 2017.

AUTHORS PROFILE

Seyed Muhammad Hussain Mousavi received his M.Sc. degree from Bu-Ali Sina University Hamadan- Iran. He received his M.Sc. degree in Artificial Intelligence in 2017. His research interests are Evolutionary algorithms, Pattern recognition, Image Processing, Fuzzy Logic, Human computer interactions, Classifications and clustering, Artificial intelligence, RGB_D data, Expert systems, Kinect, Data mining, Facial expression recognition, Face recognition, Age estimation and Gender recognition.