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Application Of Neuro – Fuzzy Systems In Gene Classification

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Abstract: *Neuro-Fuzzy Systems are one of the important research topics in computer science nowadays. They combine the approaches of Neural networks with the logics and calculations of Fuzzy. This paper demonstrates the applications of neuro – fuzzy systems in the classification of genes. Here the concepts of Fuzzy Matching will be applied in order to calculate the probabilities of occurrence of these gene traits in the future generations by studying the patterns of Gene Transfer in the previous generations. 'Classification of genes' will help in finding those genes which can be dominant in the future generations and can be the cause of some chronic hereditary diseases. These diseases if possible can be avoided by predicting the probability of its occurrence in the next generation and taking the required precautions and medical treatments.*

Keywords: Neuro – Fuzzy Systems, Neural Networks, Fuzzy Logic, Fuzzy Matching, Gene Classification

1. INTRODUCTION

1.1. Neuro – Fuzzy Systems

Neuro – Fuzzy Systems are the combination of artificial neural networks and fuzzy logics. It synergies these two techniques by combining the human reasoning style of fuzzy logics by using hybrid structure of neural networks.

1.2. Fuzzy Logic

Fuzzy Logic [1] is a logic system that is approximate rather than exact. The fundamental unit of fuzzy logic is the fuzzy set. Fuzzy logic defines a membership function A: X->[0,1] that maps element x of X into real number in [0,1]. 1 represents the complete membership in the set and 0 represents the non membership in the set. Apart from it, the intermediate values denote the partial memberships in the set. The concepts of fuzzy logics are applied in the gene classification process to determine the membership of particular traits found in sample generations into the future generations. These membership values will prove very helpful in the detection of the probability of the occurrence of dominant traits in the coming generations.

1.3. Neural Network

Neural Network or Artificial Neural Network [2] is an information processing paradigm that is inspired by the way biological nervous systems, such as the brain , process information . The key element of this paradigm is the novel structure of the information processing system. It is composed of a large number of highly interconnected processing elements(neurons) working in unison to solve specific problems. Their learning capacity is inspired with the human learning power. They learn with the help of the examples. Such neural networks are configured to analyze the patterns found in the transfer of gene traits . The learning capacity of neural networks will help to determine those traits which can show their occurrence in the coming generations.

1.4. Fuzzy Matching

The critical ingredient of a fuzzy match operation is the similarity function used for comparing tuples. In typical application domains, the similarity function must definitely handle string-valued attributes and possibly even numeric attributes. In this paper, we focus only on string-valued attributes, where defining similarity and performing fuzzy matching is more challenging. Given the similarity function and an input tuple, the goal of the fuzzy match operation is to return the reference tuple—a tuple in the reference relation—which is closest to the input tuple.[3]

2. PROPOSED IDEA

Fuzzy logic is a method to find the chances of occurrence of a value instead of just true or false. Neural network inspired by neurons of human brain speeds up the processing. In proposed idea of gene classification elementary concepts of Neuro–Fuzzy System and Fuzzy Matching are used. Firstly genes are taken of a pair and their gene traits and diseases are noted. Then the same gee's traits and diseases in the child are noted and percentage of repeating pattern is calculated. Same steps are followed for the next generation. Thus, fuzzy matching applied with neural network could be used to get the percentage. Thus expected percentage for transfer of traits and diseases for the next gene can be predicted.

3. PROPOSED ALGORITHM

1. Take the genes of consecutive three generations.
2. Note down the traits of various hereditary diseases and other common traits in all the three generations.
3. Classify the traits according to their similarities and dissimilarities

4. Analyze the hereditary patterns of gene traits by making all possible pairs of generations
5. Extract the traits and diseases from each pattern.
6. Classify the fields according to their similarities and dissimilarities.
7. Compare the gene classification of consecutive generations.
8. Calculate the percentage of transfer of traits and diseases using fuzzy logics.
9. Maintain a table regarding the traits and disease of the generations.
10. Analyze the probability of occurrence of common traits in future generations by using the concepts of Fuzzy Matching.

4. SAMPLE CLASSIFICATION

G1-M = { Black } G1-F = { Brown }

G2-M = { Black (0.4), Brown (0.6) }=> {Brown}
G2-F = { Golden }

G1-M = { Black (0.4 * 0.8 = 0.32),
Brown (0.6 * 0.1 = 0.06), Golden(0.01) }
=> {Black}

Figure 1: Trait 1 (Color of hairs)

G1-M = { Yes } G1-F = { No }

G2-M = { Yes (0.3), no (0.7) }=> {No}
G2-F = { Yes }

G1-M = { No (0.7 * 0.2 = 0.14),
Yes (0.3 * 0.6 + 1*0.2 = 0.20) } => {Yes}

Figure 2: Trait 2 (Occurrence of Dimples)

G1-M = {Tan} G1-F = {Light }

G2-M = {Light(0.6), Tan(0.4) }=> {Light}
G2-F = { Dark }

G1-M = { Light(0.6 * 0.1 = 0.06), T
an(0.4 * 0.3 = 0.12), Dark(0.60) }
=> {Dark}

Figure 3: Trait 3 (Complexion)

G1-M = { Yes } G1-F = { No }

G2-M = { Yes (0.3), no (0.7) }=> {No}
G2-F = { Yes }

G1-M = { No (0.7 * 0.2 = 0.14),
Yes(0.3 * 0.6 + 1*0.2 = 0.20) } => {Yes}

Figure 4: Disease 1 (Rheumatoid Arthritis)

G1-M = { Yes } G1-F = { No }

G2-M = { Yes (0.3), no (0.7) }=> {No}
G2-F = { Yes }

G1-M = { No (0.7 * 0.2 = 0.14),
Yes(0.3 * 0.6 + 1*0.2 = 0.20) } => {Yes}

Figure 5: Disease 2 (HIV AIDS)

G1-M = { No } G1-F = { Yes }

G2-M = { No(0.5), Yes(0.7) }=> {Yes}
G2-F = { No }

G1-M = { No (0.7 * 0.5 = 0.35),
Yes(0.3 * 0.6 + 1*0.2 = 0.20) } => {Yes}

Figure 6: Disease 3 (Thalassemia)

5. CONCLUSION

Gene classification has a variety of applications .It may b used in the health sector as it will help to check the probability of occurrence of different traits from one generation to another generation. It can also help in discovering medicines that can control the transfer of particular trait or disease among generations. Also it will help in reducing the occurrence of particular disease if predicted on time by fuzzy matching of genes using neural network with fuzzy logic. It can also help researchers to do further researches in this field.

From the above research study, we can conclude that the proposed idea of the gene classification using Neuro – Fuzzy systems can result in prediction, control and prevention of diseases and traits related to genes. This type of Gene analysis and classification may prove very useful for developing various control measures for many diseases.

6. REFERENCES

[1] M. Swapna , N. Usha Rani , " Document Retrieval by Using Fuzzy Keyword Search In XML Data" ,International Journal of Advanced Research in Computer Science and Management Studies, pp. 34-39, 2014.

[2] Sonali . B. Maind , Priyanka Wankar , " Research Paper on Basic of Artificial Neural Network" ,International Journal on Recent and Innovation trends in Computing and Communication, pp. 96-100, 2014

[3] Surajit Chaudhuri, Kris Ganjam, Venkatesh Ganti, Rajeev Motwani "Robust and efficient fuzzy match for online data cleaning", Association for Computing Machinery, Inc. pp. 313-324, 2003

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