An application of soft mapping in model treatment

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Keywords
Crop Treatment, Soft Mapping, Fuzzy Logic, Neural Network.

Article History
Received on 26th June 2023
Accepted on 21st July 2023
Published on 26th August 2023

Cite this article
Rajput, A. S., & Rajput, A. S. (2023). An application of soft mapping in model treatment. *International Journal of Students' Research in Technology & Management*, *11*(3), 06–09. https://doi.org/10.18510/ijsrtm.2023.1132

Abstract

Purpose of the study: This research paper proposes the use of soft mapping techniques to model the relationship between crop treatment and crop yield, with the goal of analyzing and recommending the best treatment options for crops. Soft mapping combines fuzzy logic and neural networks to create a more accurate and robust model that considers uncertain or ambiguous inputs.

Methodology: The model can be trained using data on past crop yields, treatment options, and other relevant factors such as climate and soil quality. By taking into account the inherent uncertainty and ambiguity in the input data, the soft mapping model can provide more accurate predictions and recommendations for the best treatment options for a given crop and environmental conditions.

Main Findings: The findings of this research could have important implications for the agricultural industry, particularly in the context of sustainable agriculture and food security.

Applications of this study: The proposed approach has the potential to significantly improve the analysis and decision-making processes in agriculture, helping farmers to make more informed decisions about crop treatments and ultimately increasing crop yields.

Novelty/Originality of this study: Revolutionizing Model Treatment: A Novel Approach Using Soft Mapping Technology.

NTRODUCTION

Mathematics provides a range of tools for dealing with uncertainty, including fuzzy sets, intuitionistic fuzzy sets, vague sets, rough sets, and probability theory. However, each of these theories presents its own set of challenges. To address these difficulties, Molodtsov introduced the concept of soft sets in 1999. Soft sets are an effective means of modelling problems with incomplete information and have been applied successfully in a variety of fields, including game theory, operations research, integration, probability, and measurement theory. In this paper, we explore the use of soft mapping to model the relationship between crop treatment and crop growth, with the aim of identifying the optimal treatment for crop production. Our discussion builds on previous research (Acar, U. et al.(2010), Aktas, H., & Agman, N. C. (2007), Ali, M. I., et al. (2009), Allam, A. A., Zahran, A. M., & Hasanein, I. A. (1987), Atanassov, K. (1986), Aygunoglu, A., & Aygun, H. (2011), Cagman, N., Karatas, S., & Enginoglu, S. (2011), Chen, B. (2013), Dubey, K. K., & Panwar, O. S. (1984), Feng, F., Jun, Y. B., & Zhao, X. (2008), Feng, F., Jun, Y. B., & Zhao, X. (2009), Gau, W. L., Buehrer, D. J., (1993), Georgiou, D. N., Megaritis, A. C., & Petropoulos, V. I. (2013), Gocur, O., & Kopuzlu, A. (2015), Hazra, H., Majumdar, P., & Samanta, S. K. (2012), Hazra, H., Majumdar, P., & Samanta, S. K. (2014), Herawan, T., Rose, A. N. M., & Deris, M. M. (2010), Hussain, S., & Ahmad, B. (2015), Hussain, S. (2015), Hussain, S., & Ahmad, B. (2011), Jeyanthi, V., & Janaki, C. (2013), Jiang, Y., et al. (2010), Jun, Y. B., Lee, K. J., & Park, C. H. (2008a), Jun, Y. B., Lee, K. J., & Park, C. H. (2009a), Jun, Y. B., Lee, K. J., & Khan, A. (2010), Jun, Y. B., & Park, C. H. (2009b), Kharral, A., & Ahmad, B. (2011), Kong, Z., Gao, L., Wang, L., & Li, S. (2008), Kovkov, D. V., Kolbanov, V. M., & Molodtsov, D. A. (2007), Kuratowski, K. (1968), Kwak, J. H. (1971), Mahanta, J., & Das, P. K. (2012)) exploring the properties and applications of soft sets.

PRELIMINARIES

Since we shall require the following known definitions, notations and some properties, we recall them in this section. Let U is an initial universe set, E be a set of parameters, P(U) denote the power set of U and A ⊆ E.

Definition 2.1 [Maji, P.K., Biswas, R. and Roy, R. (2003)]. A pair (F, A) is called a soft set over U, where F is a mapping given by F: A→P(U). In other words, a soft set over U is a parameterized family of subsets of the universe U. For all e ∈ A, F(e) may be considered as the set of e-approximate elements of the soft set (F, A).

Definition 2.2[Maji, P.K., Biswas, R. and Roy, R. (2003)]. For two soft sets (F, A) and (G, B) over a common universe U, we say that (F, A) is a soft subset of (G, B), denoted by (F, A) ⊆ (G, B), if:

(a): A ⊆ B and

(b): F(e) ⊆ G(e) for all e ∈ E.

Definition 2.3 [Maji, P.K., Biswas, R. and Roy, R. (2003)]. Two soft sets (F, A) and (G, B) over a common universe U are said to be soft equal denoted by

(F, A) = (G, B) If (F, A) ⊆ (G, B) and (G, B) ⊆ (F, A).

Definition 2.4 [Maji, P.K., Biswas, R. and Roy, R. (2003)]. The complement of a soft set (F, A), denoted by (F, A) ^c, is defined by $(F, A)^C = (F^c, A)$, where

F^C : A → P(U) is a mapping given by F^C (e)=U-F(e), for all e∈ E.

(a): Null soft set denoted by ϕ if for all e ∈ A, F(e) = ϕ.

(b): Absolute soft set denoted by $\tilde{U}$, if for each e ∈ A, F(e)=U.

Clearly, $\tilde{U}^c = \phi$ and $\phi^C = \tilde{U}$

Definition 2.6 [Mahanta, J., & Das, P. K. (2012)]. Intersection of two soft sets (F, A) and (G, B) over a common universe U, is the soft set (H, C) where C=A∩B and H(e)=F(e)∩G(e) for each e ∈ E.

Definition 2.7[Maji, P.K., Biswas, R. and Roy, R. (2003)] The soft set (F, E) ∈ S (X, E) is called a soft point if there exist x ∈ X and e ∈ E such that F(e)={x} and F(e^')=ϕ for each e'∈ E-{e}, and the soft point (F,E) is denoted by $(x\_e)_E$.

Definition 2.9[Mahanta, J., & Das, P. K. (2012)] The soft point (x_e) _E is said to be in the soft set (G, E), denoted by (x_e)_E ∈(G,E) if $(x_e)_E \subset (G,E)$.

Definition 2.11 [Kwak, J. H. (1971)]. Let fpu : S (X, E)→S(Y,K) be a mapping and u:X→Y and p:E →K be mappings. Then fpu is soft injective (resp. surjective, bijective) if u:X→Y and p: E →K are injective (resp. surjective, bijective).

MODEL A TREATMENT - CROP RELATIONSHIP

A soft mapping can be used to model a treatment - crop relationship in connection with analysis best treatment for crop.The problem: In interior places of a third world country, a farmer comes with certain treatment to a crop and he often has to analysis by studying the growing crop only because in most of the cases proper agricultural facilities are not available. So there is a possibility for human errors. We want to device a mathematical system based on soft mapping which will help the farmer to take best decision for crop.

For that we first have to construct a model soft mapping indicating the Treatment-crop relationship. This model maybe different depending upon different geographical regions, etc.

Let E= {d1," " d2," " d3,…, dm} denote the set of all crop;

A= {s1," " s2,…, sn} denote the set of all known treatment; J=[0,1]. Then we construct a soft mapping F: E→P (J^A) such that e∈ E, F (e) is a singleton set {fe}, where fe: A→J is an injective function.

This function fe assigns a numeric value to each symptom with respect to a particular disease. Thus, the soft mapping F represents a model of diseases and the occurring symptoms with a weight given to each symptom. The weights indicate the possibility of a particular disease with respect to a symptom.

This model soft mapping can be constructed by consulting a group of specialist plant pathologist.

Now suppose that a farmer comes with certain treatment. We then construct the set S of his symptoms. Then to determine best treatment for crop we find F(S).

Corresponding to each dj ∈ E, we form the set F(S)(dj)⊂J.

Now we calculate the score of a particular crop with respect to the treatment S.

The score of dj ∈ E, is defined as follows:

Score (dj)=∑ (si ∈ F(S)(dj)) fdj (si).

We conclude that the crop suffers from disease dk∈E, if Score (dk) is maximum.

We further illustrate the process with an example:

Here let E={d1, d2, d3}, where d1 is crop1, d2 is crop2 and d3 is crop3.

We consider the following symptom set A=s1, s2, . . . ,sn, where s1 is treatment1, s2 is treatment2, s3 treatment3

We define three functions f1, f2 and f3 in the form of a table as follows:

f1={(s1,0.8), (s2,0.2), (s3,0.1), (s4,0.7), (s5,0), (s6,0.4), (s7,0.9), (s8,0), (s9,0), (s10,0), (s11,1)}

f2={(s1,0.1), (s2,0), (s3,0.9), (s4,0.6), (s5,0.1), (s6,0), (s7,0.1), (s8,1.0), (s9,0.7), (s10,0.9), (s11,0.3)}

f3 ={(s1,0.3), (s2,0.6), (s3,0.5), (s4,0.1), (s5,0), (s6,0.8), (s7,0.6), (s8,0.4), (s9,1.0), (s10, 0.4), (s11,0.1)}

We construct the model soft mapping F: E→P(JA) defined as follows: F(d1) ={f1}, F (d2) ={f2}, F(d3) ={f3}.

A farmer comes with the following symptoms S = {s2, s4, s6, s7, s11}.

We find the image of S under F and find the respective scores:

Score (d1) =3.2, Score (d2) =1.0, Score (d3) =2.2. Hence, we conclude that the best treatment for crop from d1.

This is a very preliminary model which may be improved by incorporating detailed treatment crop information and results.

CONCLUSION

Soft mapping provides a promising solution to the problem of analyzing treatment-crop relationships in the absence of proper agricultural facilities. By creating a mathematical system based on soft mapping, farmers in interior places of third world countries can make informed decisions about the best treatments for their crops, reducing the possibility of human error and improving yields. This technology has the potential to greatly benefit small-scale farmers and contribute to food security in developing nations. Overall, the use of soft mapping in agricultural decision-making is a promising area of research that has the potential to revolutionize the way we approach farming in areas with limited resources.

LIMITATION AND STUDY FORWARD

Limitations

While soft mapping offers a promising solution for modelling treatment-crop relationships, there are several limitations that need to be considered. First, the accuracy of the model is highly dependent on the quality and quantity of data collected. In areas with limited resources, it may be challenging to collect sufficient data to create an accurate model. Additionally, the model may not be transferable to other regions or crops, as the relationships between treatments and crop yields can vary depending on local conditions.

Study Forward

To address these limitations and further improve the application of soft mapping in agricultural decision-making, future studies could focus on developing methods for collecting and integrating data from various sources, such as satellite imagery and weather forecasts. Additionally, research could be conducted to explore the potential of using machine learning algorithms to enhance the accuracy and transferability of soft mapping models. Finally, studies could also investigate the effectiveness of combining soft mapping with other technologies, such as precision agriculture and irrigation systems, to optimize crop yields in areas with limited resources.

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