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Inferring Fuzzy Mapping Concept for Rotifer Species Occurrence from Species Expression Data

E. Venukhaa[1], T. Jenifer[2]
[1,2]*PG Student, Dept. of Computer Science & Engineering, DMI Engineering College, Kanya Kumari, India*

***Abstract*: Rotifers are pseudo coelomate invertebrates; rotifers play role in many water ecosystems. We are predicting the Monogonota rotifers by using the fuzzy logic mapping concept with big data. Monogonota is found in the freshwater, moist soil and mainly in the marine environment. The fuzzy concept is used in Gene regulatory networks, Rhagoletis pomonella species group using digitized wing structures, also in weather forecasting and temperature prediction. In the mapping concept for rotifer species, "Trend Surface Analysis ", is used for the prediction of binary input values which represents "presence" or "absence" of data to get the fuzzy version. TSA is based on low-order polynomials of spatial coordinates for estimating a regular grid of points from scattered observations. The result is predicted in the form of a hit map. The hit map represents in Jaccard Similarity. By using Big Data, we can able to detect them accurately.**

***Keywords*: Data set, Fuzzy mapping, Heat map, Rotifers, Trend surface analysis.**

1. Introduction

Rotifers are pseudo coelomate invertebrates; rotifers play role in many water ecosystems. Three classes are Monogononta, Bedelloidea, and Sesionidea. Monogononta is the First largest group of 1500 species it presents in fresh water, moist soil, and in marine environment. Bdelloidea is the Second Largest group of 350 species it is available only in Fresh water pools. Sesisonidea has only two primitive species it presents only in marine environment. Rotifers are important in aquatic food chains. Rotifers are consumed by small crustaceans, among other animals.

A. Characteristics of Rotifers

- Rotifers are smallest animals on earth, made up of about thousand cells. It size is about 0.1 to 0.5 mm size (0.004 to 0.002). It is present anywhere in a thin flims of water.
- Body wall is colorless, and therefore all organs are visible. It is easy to identify the food present in the digestive what color the animal's takes on temporarily. Rotifers cleanup the waste in aquatic bodies.
- Rotifers are unique, which grow by increasing the size of their cells. It consumes dead and decomposition substance algae, bacteria.

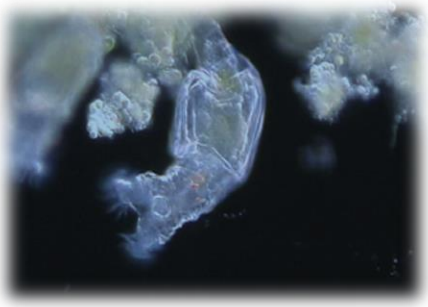

Fig. 1. Rotifers

B. Applications of Inferring Rotifers

In many aquatic food webs, rotifers serve as important species provide food to many other animals. As plank tonic animals, adult rotifers and their eggs serve as prey to many large animals including birds, insects and insect larvae, bugs, beetles, water fleas, copepods and other rotifers.

Plants:

Desiccation tolerance in the absence of high intra cellular sugar concentration.

Sludge:

Lecane inermis rotifers introduced in to the mud from diary waste water treatment plant are able to survive and multiply in it.

Aquaculture:

Clown fish feeding and popular feed for fish larvae in agriculture.

Economic importance:

Rotifers are food for common eiders. Eider duck Feathers have produced multimillion industries in Some part of the word.

C. Fuzzy Logic Topologies

Fuzzy topology is among the fundamental disciplines of fuzzy mathematics whose development was stimulated from the very beginning of the invention of fuzzy sets. Following the role of topology in classical mathematics, fuzzy topology should capture the notations of openness, neighbourhood, closure, etc… within the fuzzy set theory. A set U<R is called open, If for each X£U there exists and €>0 Such that the interval (X-£,

X+£) is contained in .U, such an interval is often called on. £-neighbourhood of X.A set F is called closed, if the complement of F, R\F, is open.

Union of open sets, intersection of closed sets

- Every union open sets in again open.
- Every intersection of closed sets again is again closed.
- Every finite intersection of open sets is again open.
- Every finite union of closed sets is again closed

D. Security of Fuzzy Logic System

Fuzzy logic is a relatively new paradigm which may radically impact computer security. It can be used in formal methods, in trusted system analysis and design, is measuring the security of systems, and in representing the imprecise human world of policies and inference. The fuzzy logic paradigm sheds light on many traditional difficulties in computer security and suggests new directions to follow. The implications are challenging and complicated. Viewed through the fuzzy logic paradigm even computer security's clearest concepts, such as the Trusted Computing Base, turn out in practice to be fuzzier and less clear-cut than we supposed. This vagueness is both disturbing and rich and is the rationale for introducing fuzzy set theory," useful in those complex situations where either some variables are inherently ill-defined or the relationship between many variables is ill-defined". This paper reviewed basic fuzzy logic concepts, such as crisp and fuzzy sets, prototypes, fuzzy goals, constraints and decisions, fuzzy logical and mathematical operators, linguistic variables, hedges, and fuzzy voting. It illustrated with simple examples how each of these could be used in the security community, and specifically in the multi policy paradigm. Fuzzy logic can be useful in bridging the human/machines security interface, intrusion detection modelling nontraditional policies, policy conflict resolution, defining security profiles, and controlling database inference. All of the possibilities mentioned merit additional research. Although mathematical precision has long been a goal in the security community, computer security is and always has been fuzzy, it is easier to acknowledge this and use tools designed to deal with fuzziness than search in vain for the illusive perfectly secure system.

E. Advantages of Fuzzy Logic

Fuzzy logic allows us to model in a more intuitive way complex dynamic system. There are some advantages of fuzzy logic algorithm can be summarized as follows:

1) Comprehensibility

- Well-crafted fuzzy rules are easy to understand.
- Makes a fuzzy expert system a "white box".

2) Modularity

- Rules can be added and removed as needed.
- Remove redundant rules to improve execution speed.

3) Explain ability

- Execution trace.
- Explain how system reached conclusion.

4) Uncertainty

- Can deal with inexact concepts smaller, faster etc...
- Each rule corresponds to a wider range of inputs values.

5) Parallel execution of rules

- Output calculated once at end of cycle.
- Order does not matter.
- Rules are evaluated in parallel no need for execution selection methods.

2. Literature survey

In [1] Africa Gomez, Eloisa Ramos-Rodriguez, Javier Montero, Manuel Serra proposed "Long-term Co-existence of Rotifer Cryptic Species" deals with cryptic species often coexist in aquatic habitats presenting a challenge in the framework of niche differentiation theory and coexistence mechanisms rotifer species. We show that both species have co-occurred in a stable way in one lake, with population fluctuations in which no species was permanently excluded. The seasonal occurrence patterns of the plankton in two lakes agree with laboratory experiments showing that both species differ in their optimal salinity. These results suggest that stable species coexistence is mediated by differential responses to salinity and its fluctuating regime.

In [2] Agnieszka pochiecha (2008) "Rotifers as climate change in The Antarctic environments" Rotifers are one of the most important components of the invertebrate fauna of the Antarctic freshwater and terrestrial ecosystems. 176 species of rotifers were found, including the endemic and cosmopolitan species. Scientists still have poor knowledge about the occurrence of rotifer species in recently studied habitats. Rotifers are organisms well adapted to harsh Antarctic environments and successfully colonize its various ecosystems, so for this reason could be good indicators of climate changes in Antarctica. Inverted rates from Antarctic terrestrial habitats are particularly sensitive to human disturbance and climate change (Kennedy 1995, Virginia and Wall 1999). There is only limited information on these communities, particularly at the most extreme latitudes, which are considered being particularly susceptible to change (Sinclair 2001).

3. System Analysis

A. Existing system

Fuzzy concept is used in Gene regulatory networks, Rhagoletis pomonella species group using digitized wing structures, also in weather forecasting and temperature prediction. Forest species discrimination in an alpine mountain area using a fuzzy classification of multi –temporal spot, data management on pores arrangement for tropical wood species recognition system. Mapping is done in the form of pixel representation in forest species discrimination.

B. Disadvantages of Existing system

- Rotifer research is done particularly in marine water and in specified lake.
- Operator's experience required.
- System complexity.

4. Proposed System

In the mapping concept for rotifer species, "Trend Surface Analysis (TSA)", is used in this concept for the prediction of binary input values which represents "presence" or "absence" of data to get the fuzzy version (continuous between 0 and 1). TSA is based on low-order polynomials of spatial coordinates for estimating a regular grid of points from scattered observations The continuous values representing the spatial trend in species occurrence.

A. Advantages of Proposed System

- Its advantage is its ability to deal with vague systems and its use of linguistic variables.
- Uses imprecise language.
- Fails safely.
- Mimicks control logic.
- Modified and tweaked easily.
- Mimicks human control logic.

5. System Design

The problem of aggregating data to calculate fuzzy versions of species occurrence patterns based on presence absence data including inverse distance interpolation, trend surface analysis and prevalence independent favorability GLM and pair-wise fuzzy similarity, based on fuzzy versions of commonly used similarity indices among those occurrence patterns. Includes also functions for model comparison and for data preparation such as obtaining unique abbreviations of species names, converting species lists to presence-absence tables, transporting a part of a data frame, assessing the false discovery rate, or analyzing and dealing with multi collinearity among variables.

A. System Architecture

The rotifer species data represents the monogonota species which is gathered and organized in the form of Tax Anomic Database Working Group. Species is mapped in the form of fuzzy concept using Trend Surface Analysis including Multi GLM, hit map, and Jaccard similarity scale distribution which is predicted in the form of percentage expression.

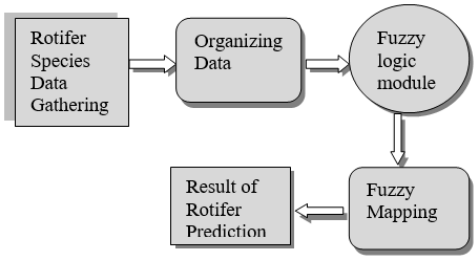

Fig. 2. System Architecture

6. System Implementation

A. Module

- Rotifer Species Data Gathering
- Organizing Data
- Fuzzy Logic
- Fuzzy Mapping
- Result of Rotifer Prediction

B. Rotifer Species Data Gathering

These data were extracted from a database of monogononta rotifer species presence records on the Geographical units used by the Biodiversity Information Standards (formerly Taxonomic Database and a few environmental (including human and spatial) variables on the same spatial units. The data's were in long (narrow, stacked) format. It presented in wide or untracked format (presence -absence table, obtained with the splits Presabs function in the reduced form the species recorded in at least 100 different TDWG level 4 units and with Abbreviations of the species' names obtained with the spCodes function.

C. Organizing Data

The organized data represents the identifiers of spatial units with sub species names of TDWG4 Species which includes level name, region name, continent, area altitude, altitude range, habitat diversity, human population, latitude, longitude, precipitation, precipitation seasonality, temperature, temperature annual range, temperature seasonality, urban area.

D. Fuzzy Logic

1) Fuzzification

In the fuzzification process, a real scalar value changes into a fuzzy value. Arrangements of fuzzy variables ensure that real values get translated into fuzzy values. After translating those real values into fuzzy values, the possible outcome is called linguistic terms. Linguistic variables are the input or output variables of the system whose values are words or sentences from a natural language, instead of numerical values. A linguistic variable is generally decomposed into a set of linguistic term.

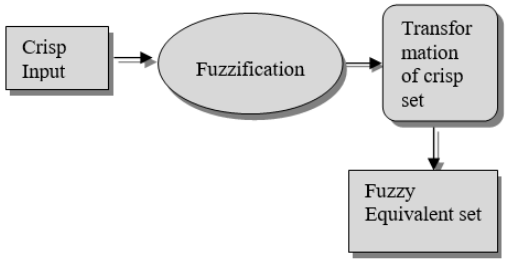

Fig. 3. Fuzzification

2) Defuzzification

After the inference step, the overall result is a fuzzy value. This result should be defuzzified to obtain an original crisp output. This is the purpose of the defuzzifier component of a FLS.

Defuzzification is performed according to the membership function of the output variable. For instance, assume that we have the result in at the end of the inference. The purpose is to obtain a crisp value, represented with a form in this fuzzy result.

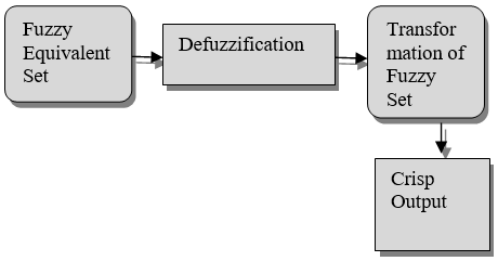

Fig. 4. Defuzzification

E. Fuzzy Mapping

The mapping concept use Trend surface analysis represents spatial coordinates which clearly shows the nearest presence of locality for each rotifer species.

F. Result of Rotifer Prediction

The result is predicted in the form of hit map. The hit map represents in Jaccard Similarity. The color red specifies the presence of both species in the same location. The color orange specifies the presence of both species and yellow specifies the less possibility of species in the same location.

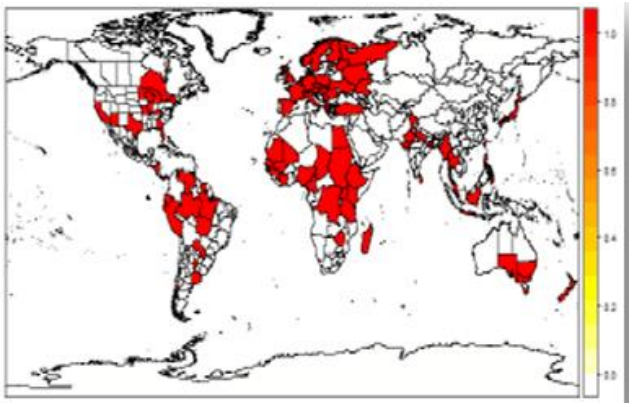

Fig. 5. Rotifer species occurrence

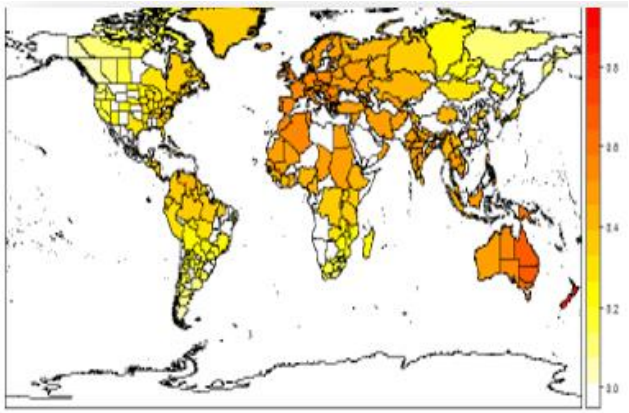

Fig. 6. Based on Fuzzy Output TSA

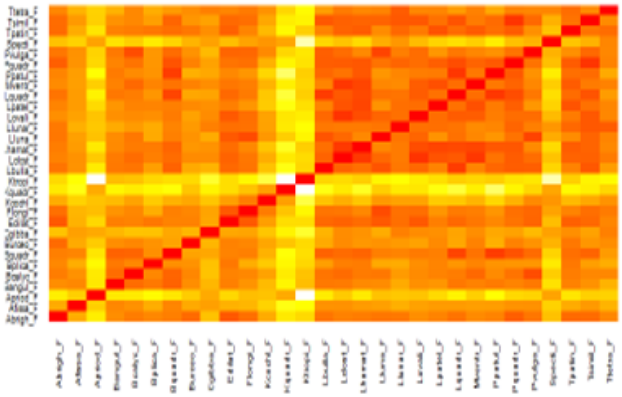

Fig. 7. Heat Map Representation

7. Conclusion

This paper presented an overview of Inferring Fuzzy Mapping Concept for Rotifer Species Occurrence from Species Expression Data. The Trend Surface Analysis depicts a general spatial trend in species occurrence. Trend surface analysis is a method based on low-order polynomials of spatial coordinates for estimating a regular grid of points from scattered observations.

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