₹ 200 ISSN - 2249-555X

Volume : 1 Issue : 6 March 2012

Journal for All Subjects

www.ijar.in

Listed in International ISSN Directory, Paris.

ISSN - 2249-555X

Indian Journal of Applied Research

Journal for All Subjects

Editor-In-Chief

Dr A Kumar
Director, College Development Council (CDC)
Director, Internal Quality Assurance Cell (IQAC)
Professor in Management,
Department of Business Administration, Faculty of Management,
Bhavnagar University,

Editorial Advisory Board

Dr. S. N. Pathan
Maharastra

Dr. SM. Ramasamy
Gandhigram

Dr. M. M. Goel
Kurukshetra

Dr. S. Ramesh
Tamil Nadu

Dr Ramesh Kumar Miryala
Nalgonda.

Dr. B. Rajasekaran
Tirunelveli

Dr. A. R. Saravankumar
Tamilnadu

Dr. Roy M. Thomas
Cochin

Dr. G. Selvakumar
Salem

Dr. Apurba Ratan Ghosh
Burdwan

Dr. Shrawan K Sharma
Uttarakhand

Dr. Sudhanshu Joshi
Uttarakhand

Prof. (Dr.) B Anandampilai
Pudhukottai

Advertisement Details

Position	B/W (Single Color)	Fore Color
Full Inside Cover	₹ 6000	₹ 12500
Full Page (Inside)	₹ 5000	-

Subscription Details

Period	Rate	Discount	Amount Payable
One Year (12 Issues)	₹ 2400	Nil	₹ 2400
Two Year (24 issues)	₹ 4800	₹ 200	₹ 4600
Three Year (36 issues)	₹ 7200	₹ 300	₹ 6900
Five Year (60 issues)	₹12000	₹ 600	₹ 11400

You can download the Advertisement / Subscription Form from website www.ijar.in. You will require to print the form. Please fill the form completely and send it to the **Editor, INDIAN JOURNAL OF APPLIED RESEARCH** along with the payment in the form of Demand Draft/Cheque at Par drawn in favour of **INDIAN JOURNAL OF APPLIED RESEARCH** payable at Ahmedabad.

1. Thoughts, language vision and example in published research paper are entirely of author of research paper. It is not necessary that both editor and editorial board are satisfied by the research paper. The responsibility of the matter of research paper/article is entirely of author.
2. Editing of the Indian Journal of Applied Research is processed without any remittance. The selection and publication is done after recommendations of atleast two subject expert referees.
3. In any condition if any National/International University denies accepting the research paper published in IJAR, then it is not the responsibility of Editor, Publisher and Management.
4. Only the first author is entitle to receive the copies of all co-authors
5. Before re-use of published research paper in any manner, it is compulsory to take written permission from the Editor-IJAR, unless it will be assumed as disobedience of copyright rules.
5. All the legal undertaking related to Indian Journal of Applied Research is subject to Ahmedabad Jurisdiction.
7. The research journal will be send by normal post. If the journal is not received by the author of research papers then it will not be the responsibility of the Editor and publisher. The amount for registered post should be borne by author of the research paper in case of second copy of the journal.

Editor,
Indian Journal Of Applied Research
8-A, Banans, Opp. SLU Girls College, New Congres Bhavan, Paldi,
Ahmedabad-380006**,** Gujarat, INDIA
Contact.: +91-9824097643 E-mail : editor@ijar.in

INDEX

Sr. No.	Title	Author	Subject	Page No.
1	Impact of Liquid biofertilizers, Chemical fertilizers and Vermicompost on the Growth and Yield of Chenopodium album (L.)	Dr. Sivgami Srinivasan, A. Sabitha	Biochemistry	1-3
2	Production Of Biodiesel From Microalgae Using Sodium Methoxide	M. R. Ananadhi Padmanabhan, Dr. Shaleesha A.Stanley	Biotechnology	4-6
3	Profitability Analysis Of Bharath Sanchar Nigam Limited (Bsnl)	Dr. M.Dhanabhakyam, Swapna Kurain	Commerce	7-9
4	Water Resource Management Through Community Initiatives	Dr. Mahalaxmi Krishnan	Commerce	10-11
5	IPO Grading – An Insight	Dr. Bheemanagouda	Commerce	12-14
6	Public Private Partnership (PPP) in West Bengal: A Study	Suvarun Goswami	Commerce	15-17
7	Factors Influencing Impulse Buying of Personal Care Products in Salem City	Dr. A. Vinayagamoorthy, P. kannan	Commerce	18-21
8	Employees Savings and Investment Behaviour of Selected Chemical Industries in Cuddalore District	Dr. G. Sasikumar, R. Punniyaseelan	Commerce	22-28
9	Object Oriented Mutation Applied to Java platform and C++ classes	Ravindra K. Gupta, Dr. Shailendra Singh,Titu Singh Arora	Computer Science	29-32
10	Estimating The Intravenous Fluid Resuscitation In Patients In The Intensive Care Units (A Fuzzy Logic Based Expert Advisory System)	Kamal Kumari Dadhirao, M. Surendra Prasad Babu, Mr. Suresh Kumar Maddila	Computer Science	33-36
11	An Evaluation of Women Construction Workers	T. Christy Chanchu, T. Christy Cresida	Economics	37-39
12	Carlson's Tropic State Index(CTSI) Used in Mandya Lakes	Nagarathna, Hosmani S P	Economics	40-42
13	A water pollution of metropolitan cities in India	Dr. Pawar A.S.	Economics	43-44
14	Urbanization & Pollution in India	Dr. Pawar Ashok Shankarrao	Economics	45-46
15	Motivational Strategies on Enhancing Competencies of LIC Professionals	Dr. K. Gunasekaran	Education	47-49
16	Awareness On Socio - Educational Rights Among Students Studying in Secondary School	Dr. A. Selvan, Dr. P. Paul Devanesan	Education	50-52
17	Major Approaches in Instiling Values Related to Human Rights	Dr. A. Selvan, P. Paul Devanesan	Education	53-54
18	A Study On Achievement In Mathematics of IXth Standard Students in Relation to Locus of Control and Test Anxiety	Dr. N .Rajashekara, Prathima .H.P, Narayana Swamy.Y.R	Education	55-58
19	Impact of value-orientation on Leadership Behaviour of Secondary School Teachers in Tumkur District	Dr. Umme kulsum, G.P.Nagaraja	Education	59-62
20	Performance Comparison between LMS and NLMS Algorithm	Baljit Kaur	Engineering	63-65
21	Overview of Speech Enhancement Techniques for Various Applications	N B Umashankar, Anand Jatti	Engineering	66-67

22	Hanford and Radioactive Tumbleweeds: A Case Study	Rajesh Gopinath	Engineering	68-69
23	Construction of a Knowledge Test for Tennis Players	Sanjay Singh, Sani Kumar Verma	Engineering	70-72
24	A Noval Switch Mode Power Supply for Flash Lamp Pumped Nd: Yag Laser	Kireet Semwal, S. C. Bhatt	Engineering	73-75
25	Uniform Price Electricity Market Model in Deregulated Power System	T. Nireekshana, Dr. G. Kesava Rao, Dr. S. Siva Naga Raju	Engineering	76-79
26	Effect of Notch Orientation, Temperature and Filler Material on Impact Toughness of GFRP Composites	M.C.Murugesh, Dr. K. Sadashivappa	Engineering	80-83
27	Prediction of Heat transfer rate for Indian coal slurry based on regression analysis	C.M. Raguraman, A. Ragupathy, L. Sivakumar	Engineering	84-86
28	A study of antimicrobial activity of the flavonoid-Kaempferol-3-rutinoside- from Gliricidia sepium (Jacq.) kunth.ex.Walp.	Anandhi, B., Sukumar. D, Arivudainambi. R	Engineering	87-88
29	Amitav Ghosh: Transfiguration of Memory and Imagination in the Shadow Lines	S.Kokila	English	89-90
30	Shareholder Activism in the U.S. and India	Ch. Chaitanya	Finance	91-93
31	Growth and Trends of Population in Nanded City, Maharashtra	Dr. Rathod S. B.	Geography	94-96
32	Regional Disparities of Ground water irrigation in Solapur District: A Geographical Analysis	Dr. G.U.Todkari, Shri B.D. Patil	Geography	97-99
33	Women and Employment in Textile Industries	Dr. S. S. Vijayanchali, Dr. E. Arumuga Gandhi	Home Science	100-102
34	Transition in Nutrition and Marketing of Agro Products	Dr. Anjali Rajwade	Home Science	103-104
35	Assessment of Knowledge About Effects of Inadequate Dietary Pattern on Mother and Child Health	Dr. Anjali Rajwade, Dr. Charuta Rajwade	Home Science	105-106
36	Job Enrichment	Kapil Dev Upadhyay, Dr. (Prof.) Vijay Kumar Soni	Human Resource Management	107-108
37	Quality of Work Life	Himani Avasthi, Dr. (Prof.) Vijay Kumar Soni	Human Resource Management	109-110
38	Understanding Security Requirement Engineering	Velayutham Pavanasam, Chandrasekaran Subramaniam	Information Technology	111-112
39	GENE Prediction	Er. Pankaj Bhambri,Dr. O.P. Gupta,Er. Meenakshi	Information Technology	113-114
40	Predictive Analysis In Data Mining Using Weighted Associative Classifier	Suwarna Gothane	Information Technology	115-119
41	Exchange Rate Forecasting	Dr. T. Koti Reddy	International Trade	120-124
42	Mass Media in India – New Trends	J. Ramanjaneyulu	Law	125-127
43	Right to Education Under the Indian Constitution	Mannava Muni Hemachand	Law	128-130
44	Criminal Law: A Tool for Consumer Protection in India	Aneesh V. Pillai	Law	131-132

45	Public Trust Doctrine: A Repository of Governmental Obligations to Protect the Environment	Dr. Kaumudhi Challa	Law	133-134
46	Application of Biometrics in the Investigation of Crime	Dr. R. Thilagaraj, Mr. G. Deepak Raj Rao	Law	135-137
47	Factors and Situations of Language Change	Dr. Syed Mohammed Haseebuddin Quadri	Literature	138-139
48	Omprakash Valmiki ke kahanio me chitrit dalitoki samajik stithi	Dr. V. P. Mahalinge	Literature	140-141
49	Fund Management in Pharmaceutical Industry in India	Dr. R. Perumal	Management	142-145
50	A study of Relationship management with customers in hospitality sector	Afreen Nishat A. Nasabi	Management	146-147
51	Outsourcing of Geriatric Services	Dr. V. Sreedevi	Management	148-150
52	Factor Analysis and Business Research	Dr. Kakali Majumdar	Management	151-154
53	Faculty Turnover Intention in Educational Institutions	K. R. Sowmya, Dr. N. Panchanatham	Management	155-156
54	Corporate Governance	Kalola Rimaben A., Chauhan Lalit R.	Management	157-159
55	Investment Avenues and Tax Implications for Small Investors	P. Menakadevi, Dr. V. Kumaravel	Management	160-163
56	Analyzing the IT Industry Progressions and Comprehensive Market Downfall Consciences through Deliberate Thinking	Dr. Venkatesh. J, Ms. Aarthy. C	Management	164-166
57	A Study On Problems and Prospects of Farmers in Cultivation of Paddy in Mahabubnagar District, A.P	Mr. M. Madhu Mohan	Management	167-170
58	An Analytical Study of Cash Management of IT Industries in Global Era	Bhavesh P Chadamiya, Mital R Menapara	Management	171-173
59	The Status & Performance of Registered Small Enterprises; A Study in Karnataka	Dr. D. Kumuda	Management	174-179
60	Malnutrition – A Business Opportunity for State Cooperative Dairy Federations (Scdfs)	Dr. N. Ramanjaneyalu	Management	180-181
61	Financial Performance of Indian Corporate Sectors During Pre and Post Mergers and Acquisitions	Dr. Shailesh N. Ransariya, Dr. Butalal C. Ajmera	Management	182-184
62	A Study on Influence of Pedagogical Effectiveness on Academic Achievement of Students of B Schools	Dr. Viral Shilu	Management	185-186
63	Stimulation of Entrepreneurship through Venture Capital in India	Vijayakumar, Subrahmanya K C	Management	187-189
64	Performance Analysis of Indian Banks	Ajay K. Shah	Management	190-192
65	An Emprical Study on Effect of Combination of Sun with Different Zodiac Signs on Return of it Sector of Indian Stock Market	Dr. Jaydip Chaudhari, Pinkal Shah	Management	193-197
66	Internet Banking Customer Satisfaction and Online Banking Service Attributes	Md. Mahtab Alam, Dr. Umesh R. Dangarwala	Management	198-199
67	Changing Customer expectations & preferences in Indian Banking	Ms. Smita S. Shetty	Management	200-202
68	Current e-Governance Scenario in Healthcare sector in India	Samir Roy	Management	203-204

69	Liver function abnormality & Vestibular symptoms with Azithromycin	Dr. Parveen Kumar Sharma, Dr. Rekha Bansal	Medical Science	205-206
70	Unicornuate Uterus with Functional Noncommunicating Rudimentary Horn - A Rare Mullerian Anomaly	Anju Kumari Rani, Anand Prakash, Deepa Kapoor	Medical Science	207-208
71	Antenatal Diagnosis and Successful Delivery of a Fetus with Complete Heart Block	Anju Kumari Rani, Aditya Kapoor, Deepa Kapoor	Medical Science	209-210
72	Kangaroo mother care diminishes pain from heel lance in preterm neonates:	Dr.S.Valliammal, Dr. Ramachandra, Mr. Raja Sudhakar	Nursing	211-213
73	Experiential Domain and Extentionalistic Vocabulary : A Critical Consideration of Behaviourism	Dr. Jatinder Kumar Sharma	Philosophy	214-215
74	The Effect of a Mindfulness-Based Stress Reduction (MBSR) Program on Stress and Well-Being in Adolescents: A Pilot Study	Urvashi Anand, Dr. Mahendra P. Sharma	Psychology	216-218
75	Personality Profile of Patients with Somatic Complaints at a Rural Health Centre	Dr. Mahendra P. Sharma,B. Padmasri and,Dr. Ramchandra	Psychology	219-220
76	Psychological Well-being: A study of the institutionalized aged	Dr. Pankaj S. Suvera	Psychology	221-223
77	Crystal Growth, Thermal and Optical Studies on L-arginine Based Nonlinear Optical Material	J. Ramajothi	Science	224-226
78	Encapsulation of Lactic Acid Bacteria in Calcium Alginate Beads for Bacteriocin Production	Vijay S. Wadhai, Shweta G. Kayarkar, Archana N. Dixit	Science	227-229
79	Synthesis Of Nonatitnate Based Dielectric Ceramic Using Various Grain Size of Starting Materials	Parul, Anand K Tyagi	Science	230-232
80	Separate Telangana Movement and Related Literary Works: A Study In Sociology of Literature	Dr. M. Sreedevi Xavier	Sociology	233-234
81	Changing Interests In Fine Arts as a Profession: A Study In Sociology of Art	Dr. Poonam Gandhi-Moirangthem	Sociology	235-236
82	Modeling Fertility and Growth of Mising Community of Assam, India	Deba Kr. Baruah, S. C. Kakaty	Statistics	237-239
83	Fort Vasota an Adventure Tourism Destination in Satara District	Dr. Ananadrao S. Patil	Tourism	240-242

Research Paper Computer Science

Estimating The Intravenous Fluid Resuscitation In Patients In The Intensive Care Units (A Fuzzy Logic Based Expert Advisory System)

* Kamal Kumari Dadhirao ** M. Surendra Prasad Babu *** Suresh Kumar Maddila

*,**,*** Department of Computer Science & Systems Engineering, AU College of Engineering, Andhra University

ABSTRACT

The work in this paper addresses the medical diagnosis of how a fuzzy logic works by illustrating its application on a simplified model of fluid resuscitation of ICU patients. It introduces a formal view of diagnosis in clinical settings and shows the relevance and possible uses of fuzzy cognitive maps and fuzzy logic. It enhances the control strategies in the medical field to diagnose a disease. This system uses fuzzy logic design: fuzzifier, rule base, and defuzzification. The entries for diagnosis are two inputs: Mean Arterial Pressure (MAP) and Hourly Urine Output (HUO) and taking one output: Intravenous Fluid Resuscitation (IFR). The medical diagnosis fuzzy rules are formulated and applied for the system. The results are found in agreement with the design based calculated results. This research work proposes to develop a control system to enhance the efficiency to diagnose a disease in a patient in the Intensive Care Unit.

Keywords : Expert System, Medical diagnosis, Fuzzy logic medical system and medical diagnosis fuzzy rules

1. Introduction:

Fuzzy logic posesses the ability to mimic the human mind to effectively employ modes of reasoning that are approximate rather than exact. In traditional hard computing, decisions or actions are based on precision, certainty, and vigor. In soft computing, tolerance and impression are explored in decision making. The exploration of the tolerance for imprecision and uncertainty underlies the remarkable human ability to understand distorted speech, decipher sloppy handwriting, comprehend nuances of natural language, summarize text, and recognize and classify images. Computing with the words explores imprecision and tolerance. Soft computing includes fuzzy logic, neural networks, probabilistic reasoning, and genetic algorithms. Today, techniques or a combination of techniques from all these areas are used to design an intelligence system. Fuzzy logic deals with issues such as forming impressions and reasoning on a semantic or linguistic level. In this paper, we will describe how fuzzy logic works by illustrating its application in a simplified model of fluid resuscitation of ICU patients. After clinicians appreciate the kinship of fuzzy logic with expert clinical thinking, we anticipate that fuzzy logic may become widely embraced for use in some aspects of clinical decision making.

1.1. Fuzzy Inference System:

A fuzzy inference system (FIS) essentially defines a nonlinear mapping of the input data vector into a scalar output, using fuzzy rules. The mapping process involves input/output membership functions, FL operators, fuzzy if–then rules, aggregation of output sets, and defuzzification. A general model of a fuzzy inference system (FIS) is shown in Figure 1. The Fuzzy Logic System maps crisp inputs into crisp outputs.

into a crisp number. Given a fuzzy set that encompasses a range of output valu

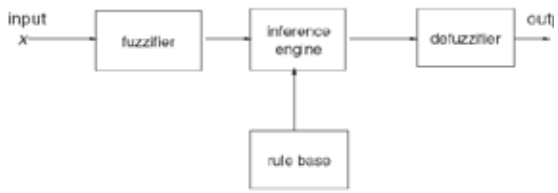

Figure. 1
Block diagram of a Fuzzy Inference System

It can be seen from the figure that the FIS contains four components: the fuzzifier, inference engine, rule base, and defuzzifier. The rule base contains linguistic rules that are provided by experts. It is also possible to extract rules from numeric data. Once the rules have been established, the FIS can be viewed as a system that maps an input vector to an output vector. The fuzzifier maps input numbers into corresponding fuzzy memberships. This is required in order to activate rules that are in terms of linguistic variables. The fuzzifier takes input values and determines the degree to which they belong to each of the fuzzy sets via membership functions. The inference engine defines mapping from input fuzzy sets into output fuzzy sets. It determines the degree to which the antecedent is satisfied for each rule. If the antecedent of a given rule has more than one clause, fuzzy operators are applied to obtain one number that represents the result of the antecedent for that rule. It is possible that one or more rules may fire at the same time. Outputs for all rules are then aggregated. During aggregation, fuzzy sets that represent the output of each rule are combined into a single fuzzy set. Fuzzy rules are fired in parallel, which is one of the important aspects of an FIS. In an FIS, the order in which rules are fired does not affect the output. The defuzzifier maps output fuzzy sets into a crisp number. Given a fuzzy set that encompasses a range of output values, the defuzzifier returns one number, hereby moving from a fuzzy set to a crisp number. Several methods for defuzzification are used in practice, including the centroid, maximum, mean of maxima, height, and modified height defuzzifier. The most popular defuzzification method is the centroid, which calculates and returns the center of gravity of the aggregated fuzzy set. FISs employ rules. Also, in an FIS, multiple regions are combined in the output space to produce a composite region. A general schematic of a Fuzzy Inference System is shown in Figure 2.

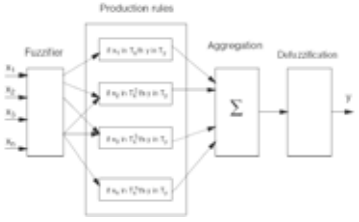

Figure. 2
Schematic Diagram of a Fuzzy Inference System

1.2. Determining Fuzzy Sets and Membership Functions:

The first step in implementing a fuzzy logic control algorithm is to "fuzzify" the measured variables. This can be done for MAP and HUO as follows. Considering MAP first, we note that this quantity may be either too high, high, normal or low, so we will divide its range of possible values into four corresponding fuzzy sets. Starting with the set corresponding to acceptable values for MAP, we first ask what range of values for MAP would be designed unquestionably normal. Let this be 75 to 100 mm Hg (not everyone might agree with this, so this choice merely captures the experience of one particular "expert"). We thus create a fuzzy set labeled $NORMAL_{MAP}$ and assign values of MAP between 75 and 100 mm Hg to a membership level of 1.0 in this set.

A key aspect of the fuzzy sets is that they overlap. In this example, although there are some ranges of MAP for which the classification of very high, high, normal or low is unequivocal, there are also two regions where classification is uncertain. A value of MAP in one of these regions thus has membership in two sets simultaneously, with the respective levels of membership reflecting the likelihood of belonging to either set. For example, a MAP of 110 mm Hg has a membership in $NORMAL_{MAP}$ of 0.5 and a membership in $HIGH_{MAP}$ of 0.5, with the two membership levels always adding to 1.0. The definitions of these sets are thus related to the probability of a certain value of MAP receiving a certain classification. If these probabilities are known then the sets can be defined accordingly. The fuzzification process of defining sets for MAP described previously can also be applied to the other variable of interest, namely HUO. Here again, we define four overlapping fuzzy sets labeled LOW_{HUO}, $NORMAL_{HUO}$, $HIGH_{HUO}$ and $VERYHIGH_{HUO}$, each characterized by their respective regions of certainty (membership level 1.0) and uncertainty (membership level between 0 and 1.0). The ranges of HUO over which the LOW_{HUO}, $NORMAL_{HUO}$, $HIGH_{HUO}$ nd $VERYHIGH_{HUO}$ sets have membership of unity are, respectively, 0 to30, 35 to70, 75 to120and 125 to 200 ml/hour.

1.3. Rule firing and fuzzy reasoning

All premises with membership exceeding the alpha values (membershipant) triggered the fuzzy system to fire their corresponding rules in the inference engine. Following the example used in the fuzzification sessions, the rules:

IF the respiratory rate is medium, THEN Fluid resuscitation is moderate

IF the respiratory rate is moderate, THEN Fluid resuscitation is high

When several rules with the same conclusion were fired, the conclusions and their memberships were stored in the inference engine.

1.4. Defuzzification

'Defuzzification' refers to the reduction of a range of conclusions being reached with different memberships to a single point output. The conclusions stored in the inference engine were defuzzified based on the output fuzzy sets. Defuzzification was based on the centroid weighted-average method, i.e., the output Fluid resuscitation factor was calculated from the average of the supremums of each output fuzzy membership function, weighted by the membership associated with each conclusion. In a triangular fuzzy membership function, the supremum is equivalent to the Fluid resuscitation factor with the highest membership. For trapezoid membership functions, the supremum was assumed to be the mid-point between the two ends of the plateau. Confidence limits were estimated by using the smallest and largest Fluid resuscitation factors that fall within the particularly fuzzy membership function at the specified membership level, instead of using the supremums. Therefore,

$$\text{Find Resuscitation} = \frac{1}{\sum_{i=1}^{4} Membership_i} x \left(\sum_{i=1}^{4} Membershi_i x Sup_i \right)$$

$$\text{Conf. Limits} = \frac{1}{\sum_{i=1}^{4} Membership_i} x \left(\sum_{i=1}^{4} Membership_i x f_i(\phi) \right)$$

where Supi is the supremums of conclusion fuzzy membership functions i, and f(φ) is the estimated upper or lower limit of the conclusion fuzzy membership functions at the specified membership (φ).

2. Proposed Fuzzy Control Algorithm:

The Fuzzy logic algorithm may be stated as a metaheuristic algorithm for numerical optimization. Metaheuristics are high-level strategies for exploring search spaces. The Control algorithm is an algorithm good at solving unimodal and multimodal numerical optimization problems. It is very simple and flexible when compared to other algorithms. It does not require external parameters like mutation and crossover rates, which are hard to determine in prior. The algorithm combines local search methods with global search methods and tries to attain a balance between exploration and exploitation.

2.1. Rule Tables

With the sets suitably fuzzified, we are now in a position to define the clinical status of a patient each time a pair of new measurements of MAP and HUO arrives. Each pair of measurements leads to one or more pairs of set memberships. For example, with MAP 110 mm Hg and HUO 120 ml/hour there is finite membership in the set combinations NORMALMAP and NORMALHUO, NORMALMAP and HIGHHUO, HIGHMAP and NORMALHUO, and HIGHMAP

The next step is to decide what action should be taken for each combination of set memberships. This question is again addressed in general terms using intuitive notions.

The various membership combinations for MAP and HUO are assigned to these categories as shown in the following table.

Table 1
Rule table for deciding what action should be taken

	Body Temperature	Pulse Rate	Blood Pressure	Oxygen Saturation	Central Venous Pressure
Low	1	1	1	1	1
Normal	0	0	0	0	0
High	1	1	1	1	1
Very High	1	1	1	1	1

2.2. Calculating the Action to Be Taken

The rules specified in Table 1 might make intuitive sense, but for them to be implemented in any given patient it is necessary to have some way of transforming terms like HIGH and LOW into precise changes in IFR in terms of ml/hour. This is achieved with the use of fuzzy sets but now applied to IFR.

The final action is clearly going to be some weighted sum of these four actions.

We thus have an algorithm for translating precise measurements of MAP and HUO into a precise change in IFR that could, in principle, be implemented completely automatically without human intervention.

3. Structure of the Fuzzy Expert System:

A fuzzy expert system is developed to evaluate the patients' initial state on a series of entered values. Four linguistic cat-

egories are determined, referring to the levels of the patient's state: (1) very high , (2) high, (3) normal and (4) low. The domain for these fuzzy sets is an arbitrary scale that ranges from 70mmHg to 120mmHg.

Without prior knowledge on the best type of function to be used, the simplest form of fuzzy membership functions is assumed. Thus, 'Very high' and 'Very low' categories, and symmetric triangles for the other two categories are formed. Thus, a value with MAP of 20 is 'low' with full membership, while a value with 70 would be both 'high' and 'very high,' with partial membership to each set.

Hence known relationships are collated. The published relationships were transformed into expert system (heuristic) rules. The rules are all in the IF-THEN format. The rules used for the rule based system are as follows:

Rule 1: If the mean arterial pressure is very high

Then Fluid Resuscitation is very critical

Rule 2: If the mean arterial pressure is high

Then Fluid Resuscitation is critical

Rule 3: If the mean arterial pressure is very low

Then Fluid Resuscitation is normal

Rule 4: If the mean arterial pressure is low

Then Fluid Resuscitation is moderate

Rule 5: If Hourly Urine Output is 0.5 ml/hr

Then Fluid Resuscitation is very critical

Rule 6: If Hourly Urine Output is 0.9 ml/hr

Then Fluid Resuscitation is critical

Rule 7: If Hourly Urine Output is 1.5 ml/hr

Then Fluid Resuscitation is normal

Rule 8: If Hourly Urine Output is 3.0 ml/hr

Then Fluid Resuscitation is moderate

Rule 9: If the mean arterial pressure is very high and the body temperature is very high

Then Fluid Resuscitation is very critical

Rule 10: If Oxygen saturation is very low

Then Fluid Resuscitation is critical

Rule 11: If the Electro cardiac monitoring result is too high

Then Fluid Resuscitation is critical

Rule 12: If Central Vines pressure is high

Then Fluid Resuscitation is very critical

Rule 13: if Arterial Blood Gas analysis is high

Then Fluid Resuscitation is critical

Rule 14: if Weight of the patient is high

Then Fluid Resuscitation is critical

Rule15: if the respiratory rate is high

Then Fluid Resuscitation is critical

Fuzzy logic thus has the ability to capture the experience-based expertise of a particular individual and code it as an algorithm. A computer program implementing the previous example of fuzzy logic is available for downloading from the online supplement. Of course, the aforementioned algorithm is too simplistic for clinical use.

4. Results
Test Results:

Figure 3: Expert Advisory System

Description: In this screenshot, user enters data

Figure 4: Result from the Algorithm with Optimization Values
Description: In this screenshot, the user can see the result.

5. Performance Evaluation:
In this section, the performance of the rule based algorithm in conjunction with fuzzy logic control algorithm is presented. A graph, Figure 5 is drawn for the values tabulated in Table:2

	Accuracy Rate	
No of iterations	Fuzzy Logic Control Algorithm	Rule Based Algorithm
2	75%	78.59%
3	76%	77%
4	79%	83%
5	80%	87%
6	81.94%	84.46%

Table 2: Accuracy Values

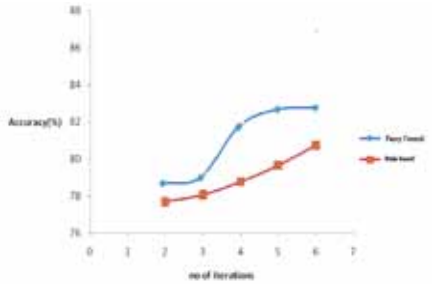

Figure 5. Comparison of performance

The graph determines that the accuracy level obtained with the fuzzy logic control algorithm is high when compared with the results generated merely with rule based algorithm.

6. Conclusions:

By the thorough interaction with the users and beneficiaries the functionality of the system can be extended further to many more areas in the field and around the world. More research is needed before we can even begin to understand the potential applications of fuzzy logic in medicine. This research will have to be undertaken in a series of steps, beginning with development of a fuzzy logic algorithm for a given application, followed by testing of the algorithm on hypothetical test cases, and eventually leading to validation in patients. This can be complicated and time consuming but may eventually result in procedures for formalizing medical decision making that will reduce unwanted variation in clinical practice. In addition, fuzzy logic may support the automation of some types of devices used in the delivery of health care services.

REFERENCES

1. Jason H. T. Bates and Michael P. Young, Applying Fuzzy Logic to Medical Decision Making in the Intensive Care Unit. Pulmonary & Critical Care Division, Department of Medicine, University of Vermont & Fletcher Allen Health Care, Burlington, Vermont. | 2. Bezdek, J. C., 1992. Computing with uncertainty. IEEE Communications Magazine, vol. 30, pp. 24–36. | 3. Dojat M, Harf A, Tochard D, Laforest M, Lemaire F, Brochard L. Evaluation of a knowledge-based system providing ventilatory management and decision for extubation. | 4. Eddy DM. Clinical decision making from theory to practice: a collection of essays from the Journal of the American Medical Association. Sudbury, MA.. | 5. Hanson CW, Marshall BE. Artificial intelligence applications in intensive care. | 6. J. Durinck, E. Coiera, R. Baud, et al., "The Role of Knowledge Based Systems in Clinical Practice," in: eds Barahona and Christenen, Knowledge and Decisions in Health Telematics -IOS Press, Amsterdam, 1994 | 7. Mamdani, E. H., 1977. Applications of fuzzy logic to approximate reasoning using linguistic synthesis. IEEE Transactions on Computers, vol. 26, no. 12, pp. 1182–1191. | 8. William W. L. Cheung, Tony J. Pitcher and Daniel Pauly. A Fuzzy Logic Expert System for Estimating the Intrinsic Extinction Vulnerabilities of Seamount Fishes to Fishing. | 9. Zadeh, L. A., 1965. Fuzzy sets. Information and Control, vol, 8, pp, 338–353.

Sara Publishing Academy
Indian Journal Of Applied Research
Journal for All Subjects

Editor,
Indian Journal Of Applied Research
8-A, Banans, Opp. SLU Girls College,
New Congres Bhavan, Paldi, Ahmedabad-380006.
Contact.: +91-9824097643 E-mail : editor@ijar.in

Printed at Unique Offset, Novatsing Rupam Estate, Opp. Abhay Estate, Tavdipura, Shahibaug, Ahmedabad