

On the expanded information contents for the YUBITSUKIYI system and the Dementia situation taking account of Fuzzy concept of Markov's information source

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ABSTRACT

In authors' previous papers the essential meaning of the ubiquitous system has been presented as it is in the idea that the functions that the today's ordinary and healthy society lives have lost should be recovered as before or supported up to their ordinary average levels. On the other hand the authors have discussed the design technique and direction of the expanded EMR (Electric or Electronic Medical Record), and at same time, in parallel, have developed the communication system in which the "YUBITSUKIYI (which is the name of communication tool for blind deaf persons. See Fig.3)" system is included. Therefore the authors have proposed that the Life Support System to be

developed from the expanded EMR system should be restructured and synthesized and used on the basis of the essential meaning of the ubiquitous concept. And by using this Life Support System the lost functions are able to be recovered as before and supported up to the ordinary average levels. Now when the authors treat the dementia situation, by considering an ontology of the situation it is treated as a kind of handicapped situation from the point of view that the dementia situation is the situation in which the function to be gained before has been lost. As a result it is able to be estimated that the Life Support System can be used to find and support the dementia situation, especially to find and support the early dementia situation not only of the blind deaf persons, but also of the ordinary

persons. And also it is able to be estimated that the dementia situation can be treated quantitatively by this Life Support System through the communication process and the consideration of information processing. From the point of views of communication process and information processing the authors have already presented the new information contents able to be applied to the dementia situation, at present it is becoming more clear that the new concepts are able to be applied to a kind of human error situation of the ordinary people. On such new information contents at same time the authors have studied these concepts in parallel for three directions as main directions. The first of them is the direction that such information concepts themselves must be newly considered from the entirely different view point, and the second of them is the direction that such concepts should be studied on the philosophical view point (for example, Peirce's semiotics and its interpretant etc.), and the third of them is the direction that these concepts are treated on the basis of Fuzzy concepts and expanded from the ordinary Shannon's information theory by the use of Fuzzy system's idea. In this paper the discussion of the third one is developed over the discussion which was already described in the authors' previous papers. From the third one of discussing direction authors have already studied the new information contents on the basis of Fuzzy concepts and have gained some important ideas and relations among the information structures and the meaning and concepts of such factors. At this time, expanding such results it is described that the Fuzzy model expanded from the model of ordinary Markov's information source is introduced into the object of Fuzzy set model and some relations of the Fuzzy information system derived from the Markov's information source are described.

Keywords: the dementia situation, the information content, the Fuzzy Set, Markov's information source

1. INTRODUCTION

The authors' previous papers have reported that although the recent concept of ubiquitous system has been popular and has been put mainly on the stress of its merit side its essential meaning is not in such concept, but in the recovery or support concept of the handicapped situation or the lost function in the ordinary life style. And it has been reported that along such essential ubiquitous concepts the design of the expanded EMR system has been developed for the YUBITSUKIYI system to be embedded and the designed system has been made to become the Life Support System (of course, this Life Support System itself has been developed now). And the most fundamental and important element on dynamical situation of such system is the analysis of information contents on such system working. From this stand point the three directions of consideration of such information contents have been performed at same time in parallel and some results of them have been presented in author's previous papers and oral presentations. The first is such discussion as these kind of information concepts themselves should be newly reconsidered from the entirely different point of idea, and the second is such consideration that into these concepts the philosophical view point (such as Peirce's semiotics and its interpretant etc.) should be introduced, and the third is the idea that these discussions should be on the basis of Fuzzy concepts and expanded from the ordinary Shannon's information theory by the use of Fuzzy system's idea. Especially in the third direction in such studies some important results which are estimated to be able to be applied for the handicapped and dementia situations have been derived. In this paper this third method is more developed than it is shown in the authors' previous paper descriptions. There, the concepts of information contents are more developed by introducing the Fuzzy Set expanded from

the basis of ordinary Markov's information source. Therefore, here, firstly the expanded EMR system, the YUBITSUKIYI system and the process until synthesizing the Life Support System along the ubiquitous concept is described briefly. Secondly the consideration of communication structure by the YUBITSUKIYI system and the Life Support System is described and some information relations are considered. And it is performed to discuss the information process and the communication state among the blind deaf persons and others. Especially from the side of the quantitative consideration the information process and communication state are treated, and the information and communication state models not only in the handicapped and dementia situations but also in the states among the ordinary people and such handicapped people are discussed and described. There, the communicating and working situations of the YUBITSUKIYI system are shown by the example of signs of Japanese characters. As a result, therefore, from some view points the information contents of such cases are discussed there, and the consideration of information contents taking account of the Fuzzy Set and the Fuzzy concept is performed on the basis of model consideration of communication process in these handicapped and dementia states. There, although some examples of the Fuzzy concepts applied to these handicapped and dementia situations are described as the first step of quantitative analysis, such examples are some kinds of information content models taking account of the Fuzzy concepts, and of course the such model values applied to the real handicapped and dementia situations are needed to be revised in the concrete examples. [1],[2]

Thirdly the Fuzzy concept is introduced for analyzing the information content, and its possibility to be applied to dementia situation is discussed and the characters of its information content are derived. And the relations and elements which are estimated to be

useful to analyze the handicapped and dementia situations are derived. And furthermore, there, on the Fuzzy concepts and relations which have been derived until now from the Fuzzy Set expanded from the ordinary Shannon's information theory the concepts of the Markov's information source are expanded to its Fuzzy concepts. Especially the consideration of Fuzzy relations with regard to the Markov's information source is progressed from the situation based on the most simple condition. And an example of the Fuzzy concepts taking account of the Markov's information source is proposed for analysis of such handicapped and dementia situations. Finally it is presented that some conclusions have been derived and as the further works the analysis of the information content to be able to be applied to the handicapped and dementia situations is needed for considering the concrete values of such information content model.

2. THE PROCESS TO THE LIFE SUPPORT SYSTEM

Today's easy ubiquitous concepts have the dangerous problems because the one who use the ubiquitous system is humankind and not God. Therefore authors have made the essential meaning of the ubiquitous concept clear in authors' previous papers. There, it is described that the essential and fundamental meaning of ubiquitous concept exists in compensations or supports of the functions which had been gained before and have been lost at present in ordinary life style. And such situation as lost function of life style causes the difficulty in ordinary life style. On the other hand it is estimated that in today's Japan there are about 20,000 blind deaf persons, from this estimation it is able to be understood that there are more much blind deaf persons in whole world at present. Therefore along the essential meaning of ubiquitous concept the synthesis of the Life Support

System into which the "YUBITSUKYI" system which is the blind deaf persons' communication system is embedded as a module has been proposed in authors' previous papers. There, it is estimated that the Life Support System is not only useful to communicate among the blind deaf persons and others, but also is able to make the diagnosis of dementia, especially the diagnosis of the blind deaf persons. And there it is treated that the dementia situation is a kind of handicapped situation because its situation means the lost state of function of persons. As the "YUBITSUKYI" system is embedded into the Life Support System the information contents on the Fuzzy concepts is firstly discussed considering the information structure of the "YUBITSUKYI" system, therefore the outline of the "YUBITSUKYI" system is briefly described at the following. As the "YUBITSUKYI" system has been described in author's previous papers, it is the system for the blind deaf person to communicate among themselves and others. The word "YUBITSUKYI"(see Fig.3) is the name of this communication terminal tool of this system. As the blind deaf persons have both obstacles in sight and hearing senses their both senses do not work sufficiently. Therefore some communication techniques for them have been developed. For instance, there have been developed the Touch finger language, the Finger Braille (see Fig. 2) etc. At present such techniques can satisfy user's needs to some extent. The "YUBITSUKYI" system is too for such communication process, and it is embedded into the Life Support System synthesized from the expanded EMR system on the Linux operating system as a module. The finger Braille technique is made on the method of the Braille system in which two sorts of point patterns (that is; Convex and Concave sides) have been considered. In this paper the Japanese point patterns which have been used corresponding to Japanese characters are used and analyzed to derive the

information contents for the handicapped and dementia situations. The Fig.1 shows a Braille pattern of Japanese character "ka", and its symmetrical expression patterns of the Braille and the finger Braille corresponding number of the character. In the "YUBITUKYI" system such finger Braille patterns are used, and by the touch sense of the six vibrating points of "YUBITUKYIs" such Japanese character patterns are transferred among the users of this system, and the mutual communications of users are accomplished.

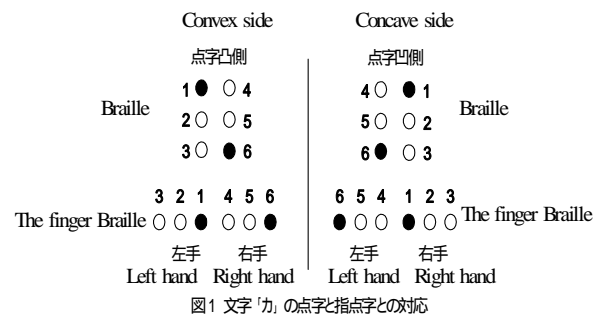


Fig.1 The correspondence of Braille and the Finger Braille



Fig.2 The Finger Braille



Fig.3 The "YUBITUKYI" (Left: Ver.1, Right: Ver.2)

As the "YUBITUKYI" is the electrical devices (at present having been improved), its signals are treated

by electrical techniques and its data are able to be used directly as the information processing data. [1],[2]

3. THE FUZZY CONCEPTS TAKING ACCOUNT OF MARKOV'S INFORMATION SOURCE

From the above facts, on consideration of information contents applied to the handicapped and dementia situations, firstly the 6 vibrating points situation is analyzed because it is most simple situation and although the joysticks of the "YUBITUKYI" terminals have total 8 vibrating points the 2 points are for the function of transmission of signals and main patterns of Japanese characters are shown by the 6 points. Here, firstly the character patterns made from such 6 points are considered as the fundamental information elements. On this case the "YUBITUKYI" terminals have 6 bits and the active state of vibrating points means to be the events of ON or OFF from the Shannon's theorem. As a result the set of total $2^6 = 64$ patterns of Japanese character can be the fundamental pattern set. But in this paper as the handicapped and dementia situations are considered the discussion of information content over the Shannon's theorem is needed for the analysis of information process of such situations. Here the Fuzzy concepts taking account of the Markov's information source are proposed as an analyzing technique of such situations developing the Fuzzy set described in author's previous papers. Now here the sign of Fundamental Set is made SF, and the sign of the Fuzzy Set is made FA. Then x_i ($i=1,2,\sim 64$) are the elements of SF and each element is x_i ($i=1,2,\sim 64$) and its membership function is $m_{FA}(x_i)$ ($i=1,2,\sim 64$). Therefore each different handicapped and dementia situation is presented by each different membership function. And here each Fuzzy Set (FB,FC,...) is derived by the definition of each membership function ($m_{FB}(x_i)$, $m_{FC}(x_i)$, ...). As a result it is estimated that such factors can make

the handicapped and dementia situations clear as described in author's previous papers. That is; When the membership function $m_{FA}(x_i)$ ($i=1,2,\sim 64$), and the Probability of the element x_i ($i=1,2,\sim 64$) is $p_i=P(x_i)$ ($i=1,2,\sim 64$), here p is a set of $p=\{p_i\}$, then the probability of the Fuzzy event $P(FA)$ becomes $P(FA)=\sum_{i=1\sim 64} m_{FA}(x_i)P(x_i)$.

As a result, the information content, $I(FA | p)$ with regard to Fuzzy set FA becomes

$$I(FA | p) = (1/P(FA)) \sum_{i=1\sim 64} P(x_i) m_{FA}(x_i) \log m_{FA}(x_i) + \log(1/P(FA)), (i=1,2,\sim 64),$$

here, the calculating progress is omitted. And the Fuzzy content is $F(FA | p) = I(FA) - I(FA | p)$ and becomes an index of such situation. Here $I(FA)$ is the information content in such case as the set FA is a ordinary set, and at this time the values of the membership function are 0 or 1. On these result here the Markov's information sources are considered as developed models of such situations. Ordinarily the Markov's information sources are defined by the conditional probability for the fundamental events set, and there the appearance probability of the next events is influenced by the appearance probability of the past events. Therefore, in this paper, a Fuzzy concept expanded from ordinary Markov's information source is proposed for more analysis of the handicapped and dementia situations considering that all elements of the ordinary Markov's information source are expanded to the corresponding Fuzzy concepts. Here, a Fuzzy concept of the conditional probability is introduced as the membership functions are distributed to the unit events of the ordinary Markov's information source. Namely this Fuzzy concept at this time is structured by two step definitions, and firstly considering the Ergodic character for the space of ordinary Markov's information source and probabilities of its unit events are defined, and secondly considering this fundamental elements the membership functions corresponding to those unit events are defined. As a result, the Fuzzy

concept to the unit events set of the ordinary Markov's information source is introduced and a Fuzzy Set to the unit events set is defined. That is; Considering the conditional probabilities of the Markov's information source, the space of $\{(s_{j1}, s_{j2}, \dots, s_{jm}, s_i)\}$ which defines $P(s_{j1}, s_{j2}, \dots, s_{jm}, s_i) = P(s_i/s_{j1}, s_{j2}, \dots, s_{jm}) \times P(s_{j1}, s_{j2}, \dots, s_{jm})$ is expanded to the Fuzzy Set, here s_{jk} is ordinary alphabets notation of information source in Shannon's information theory and $(s_{j1}, s_{j2}, \dots, s_{jm}, s_i)$ is ordinary notation of unit event of the Markov's information source and P is ordinary probability notations.

And although the detail is omitted here and some of them will be presented in other author's papers, from the Fuzzy Set the similar relations and formulas above described can be derived. And as these Fuzzy concepts have some meaning of the models of the handicapped and dementia situations and are useful for the analysis of such situations, it is proposed that the introduce of the Fuzzy concepts expanded from the concept of ordinary Markov's information source is needed.

[2], [3]

4. THE CONCLUSION AND FURTHER WORKS

In this paper it was made clear that the Life Support System is useful for the handicapped and dementia situations to be analyzed from the view point of some new information contents applied to such situations. Therefore, considering the new information contents the concept on the basis of the Fuzzy Set derived from the Fundamental Set is introduced and on some characters derived from the concepts the Fuzzy concepts expanded from the ordinary Markov's information source are introduced and proposed as a method of analysis of the handicapped and dementia situations. As a result a part of the information structure of dementia situation has been made clear. After this on the more concrete and real models of such handicapped and dementia situations the Fuzzy Sets

and the relations and the membership functions are needed to be identified with concrete values. Furthermore, the Fuzzy concepts on the Markov's information source which will be introduced from different points of view from this time view are needed to be derived.

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