LEARNING METHODOLOGY FOR EFFECTIVE TEACHING IN FUZZY COGNITIVE MAPS (FCM)

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Abstract Nowadays FUZZY COGNITIVE MAP (FCM) is getting significant in the domain of Data Mining due to the frequent applications obtained for the society. However the research community finds the difficulty in tackling Data Mining. The main aim (objective, goal, result of this paper is to achieve a simple layout for the knowledge structure for an effective class room (learning platform) in order to meet the learning outcome of FCM. The construction is carefully made after surveys & reviews throughout the branches of AMET University and obtained the knowledge structural model .This model is finally evaluated for its performance and result are presented.

Keywords- Fuzzy sets, Cognitive maps, FCM, ontology, knowledge structure.

1. Introduction

The main goal of Mathematics education in schools is the Mathematization of the Child's thinking, clarity o thought. Mathematics education can be classified into three broad categories.

- Survival Mathematics
- Mathematics for use
- Mathematicians Mathematics

Survival Mathematics is the one which we need in order to go about our daily business and make good use of our leisure time. We almost always have to use it in a situation that requires an immediate response paying a bus fare, deciding the date for the completion of a contract, choosing the right camera exposure.

The second one is Mathematics for use. This extends from simple skills .Such as decimal arithmetic up to advanced topics, such us the use of differential calculus. It describes all the Mathematics that some people need in order to do their work successfully. Mathematics is also an essential tool for the scientist and this has been used to justify the inclusion of particular Mathematics topics in curriculum.

The third category contains definitions, proof and abstract structures. Most curricula contain something of this kind of Mathematics. There are other aspects of Mathematician's Mathematics. Thinking of the pleasure which many people get from solving Mathematical puzzles and playing games with Mathematical structures.

1.1 Techniques:

Techniques of Teaching Mathematics:

- Analysis
- Synthesis
- Induction
- Deduction

Analysis method of teaching contains breaking the given mathematical statement into micro statements and arrives at the desired result. Next, if we observe the given statements and arriving at a result by combining all the statement then it is synthesis method. When we teach from examples to generalization, it is sorted under Induction where as deduction method is getting result from formula, definition, etc.

1.2 Fuzzy Cognitive Map (FCM):

Occasionally, you can lose interest in studies, if it seems like there is too much to do, if you don't like a subject, or if you just find school boring. As an alternative of thinking of education as a task, and something you just have to do, why not make the primary (and most important) years of your life more enjoyable. If you focus on creating the right manner and developing some good habits, you can stay fascinated in school and achieve something. Identify what interests you naturally. Even as you may not be the major fan of every subject, you most likely are interested in at least a few. If you can identify the things that you like learning about, then this can help you become more interested in school in general. When you are naturally drawn to do something (like study a favorite subject), it is called intrinsic motivation, and finding this can increase your success at school consider which classes you pay the most concentration in, which ones you seem to do the best in, which ones you don't mind studying for, etc. This can point out which subjects you are naturally interested in.

Fuzzy Cognitive Maps (FCMs) are digraphs that capture the cause effect relationship in a system. Nodes of the graph stand for the concepts representing the key factors and attributes of the modeling system, such as inputs, variable states, components factors, events, actions of any system. Signed weighted arcs describe the casual relationships, which exists among concepts and interconnect them, with a degree of causality. The constructed graph clearly shows how concepts influence each other and how much the degree of influence is. Cognitive Maps (CMs) were proposed for decision making by Axelrod [16] for the first time. Using two basic types of elements; concepts and casual relationship, the cognitive map can be viewed as a simplified mathematical model of a belief system. FCMs were proposed with the extension after fuzzified casual relationships. Kosko [4], introduced FCMs as fuzzy graph structures for representing casual reasoning. When the nodes of the FCM are fuzzy sets then they are called fuzzy nodes. FCMs with edge weights or causalities from the set {-1, 0, 1} are called simple FCMs. Consider the nodes/concepts P_1, P_2, P_3, …,P_n of the FCM. Suppose the directed graph is drawn using edge weight eij from {-1,0,1}.

1.3 Roadmap

In section II, we discuss about the related works around Fuzzy Cognitive Maps in order to link the relevance of our work section III describes the terms and methods in order to enhance the readability of the research work Section IV presents Methodology for Application of Image classification using deep learning**,** Section V presents the main experiments applied for main approach and the results are presented, In the section VI with concluding remarks.

2 Related works

In this paper (11) develops a knowledge based system to autonomous navigation using Fuzzy Cognitive Maps (FCM). A new variant of FCM, named Dynamic-Fuzzy Cognitive Maps (D-FCM), is used to model decision tasks and or make inference in the robot or mobile navigation. Fuzzy Cognitive Maps is a tool that model qualitative structured knowledge through concepts and causal relationships. The proposed model allows representing the dynamic behavior of the mobile robot in presence of environment changes. The human knowledge is represented by a rule based system that is triggered when critical situation occurs. As a result, the inference engine adds temporally concepts and relationships into the FCM

In this paper (7) was discussed one of the first applications of Fuzzy Cognitive Mapping in marine governance. A generic model was constructed augmenting 29 FCMs for the Black Sea resilience & 26 concepts with 145 connections were obtained & Central concept is Municipal Solid Waste, most mentioned is Coastal Development & Scenarios simulating policy measures help environmental decision policy making.

In this paper (9) a knowledge representation approach of an adaptive and or personalized tutoring system is presented. The domain knowledge should be represented in a more realistic way in order to allow the adaptive and or personalized tutoring system to deliver the learning material to each individual learner dynamically taking into account her/his learning needs and her/his different learning pace. To succeed this, the domain knowledge representation has to depict the possible increase or decrease of the learner's knowledge. Considering that the domain concepts that constitute the learning material are not independent from each other, the knowledge representation approach has to allow the system to recognize either the domain concepts that are already partly or completely known for a learner, or the domain concepts that she has forgotten, taking into account the learner's knowledge level of the related concepts

3 Terms and Methods

In this section the terms and methods for FCM are described in simple form as follows. The terms are introduced from the conceptual level and methods are selected to emphasis the proof of existence of terminology for FCM.

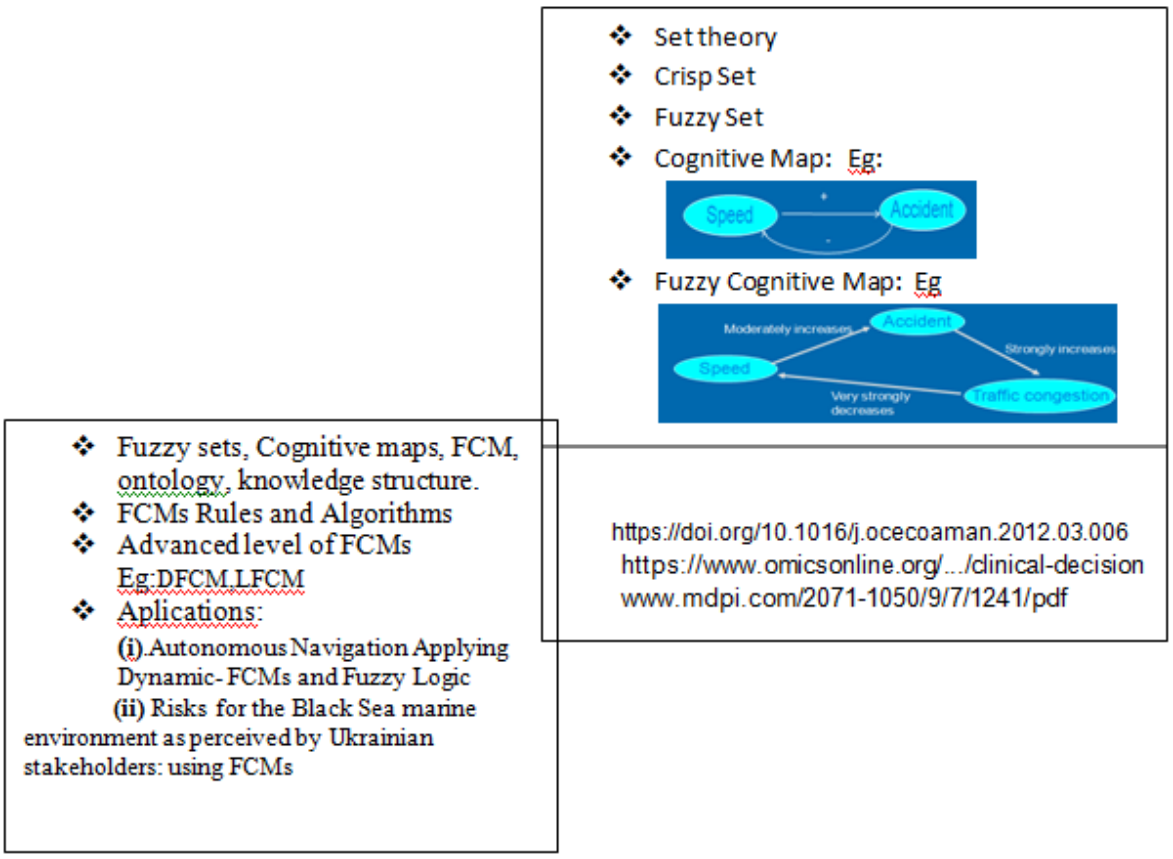
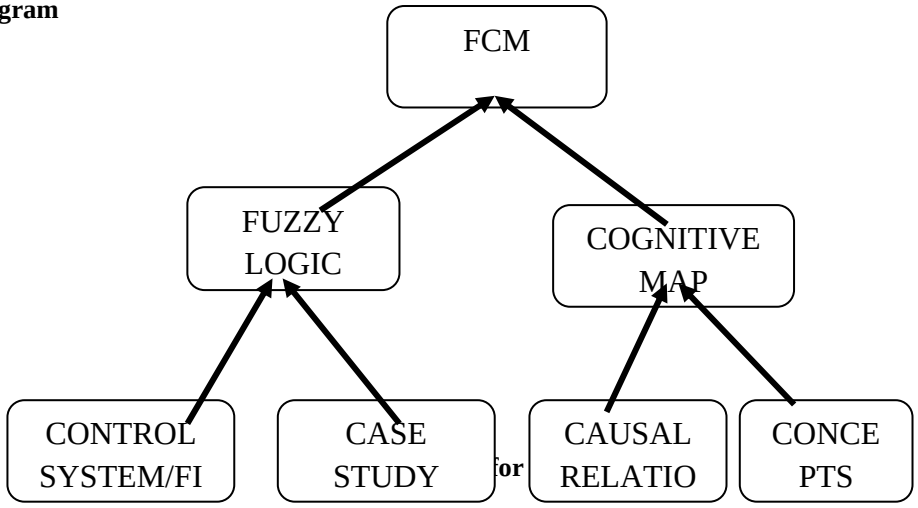


Fig 1. Architecture Diagram

Ontology Diagram



4 Methodology for Application of FCM:

The recent development in instruction Technology for Education has shown various methods for effective learning. Preparation of knowledge structure of FCM for using inside a class room must be evaluated for its design and contents. The framework shown in the fig1. architecture diagram contains three components. The focus concept is treated with three levels namely with three levels familiarity scale, (which can be dealt as reading assignment or self study through the internet search engines), threshold concepts (which are mandatory learning task inside the class room or library or in the form of project based or mini projects) and list of pointers in the web space namely the uniform resource location.

5 Experimental Setup

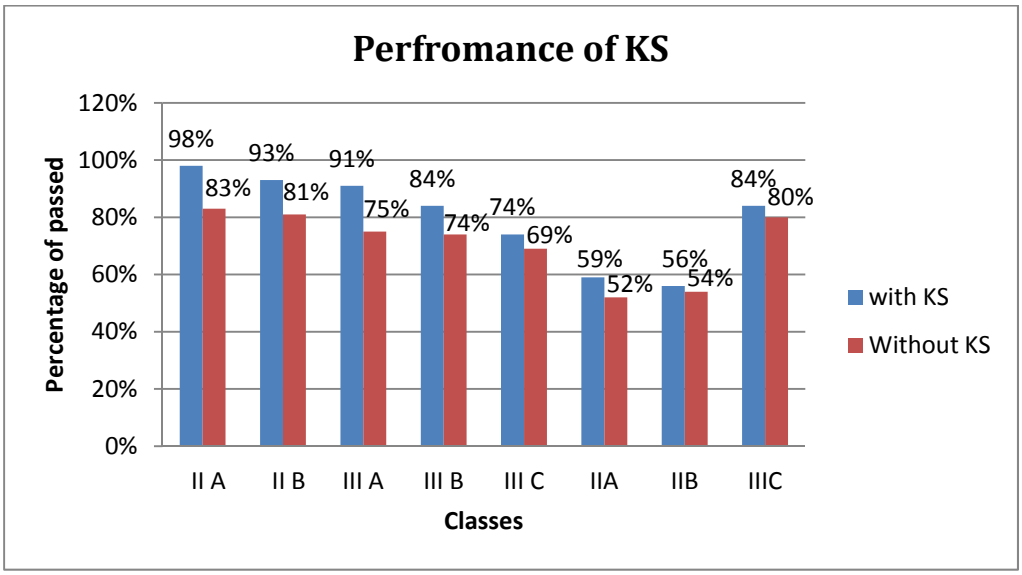
The experiments based on our selection of topic in the domain of interest were carried out. This had been implemented with appropriate approvals from authorities in the university. Since the knowledge structure are part of activities of the teacher's pedagogy style, getting permissions happened to be cleared quickly as well automatically. Few classes were selected for internal assessment and these tools were applied to check the feasibility and the correctness of the approaches .The following table shows the difference in the performance.

Table 1.Comparison of KS –(N) with Non KS approaches

S.No	Class	Branch	with KS	Without KS
1	II A	Nautical Science	98%	83%
2	II B	Nautical Science	93%	81%
3	III A	Marine	91%	75%
4	III B	Marine	84%	74%
5	III C	Marine	74%	69%
6	IIA	Marine	59%	52%
7	IIB	Marine	56%	54%
8	IIIC	Nautical Science	84%	80%

The above table clearly makes us to understand the following observations. The foremost observation is the Knowledge Structure approach demonstrates the other approaches. The last row values are inferior due to the learning style of the students in the class as well as difficulty level inherently hidden in the some of the parts of FCM.

Class	with KS	Without KS
II A	98%	83%
II B	93%	81%
III A	91%	75%
III B	84%	74%
III C	74%	69%
IIA	59%	52%
IIB	56%	54%
IIIC	84%	80%



Efficiency of knowledge structure

In fig.3 the efficiency of depicted by the difference in the approaches and it demonstrate the performance appreciably. The maximum efficiency is found for approach in the range of 93% to 98%.

6 Conclusion

The spectrum of methods followed traditionally yields much variation and not of any lifted advantages. However our novel approach based knowledge structure mapping into the syllabus contents yield better results as demonstrated by our experiments.

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