Enhanced Decision Support Processing of Autonomous Agents Based on Cortical Learning Algorithm

P.O. Asagba, Uchechukwu-Njoku Uchenna, C. Ugwu

Abstract— Making good decisions and solving problems effectively is the basis for the work we do. Individual, organizational, national, and global success and survival depend upon making good decisions over the long term. The goal of this dissertation is to design a new generation of decision-support processing of autonomous agents that are capable of handling the increasing complexity of the problems in their domains of application based on cortical learning algorithm using anticipatory adaptation and cognitive reasoning in an unsupervised manner using xml dataset as an in memory of the information for the algorithm to run on. Agile Methodology was used in this study which refers to a group of software development methodologies based on iterative development, where requirements and solutions evolve through collaboration between self-organizing cross-functional teams. The results shows that series 1 which represents data gotten from execution of the adopted probabilistic solution shows a maximum accuracy of 65%, while series 2 represents data gotten from the proposed model and gives a maximum accuracy of 89%, showing a heavy rise in percentage accuracy as the systems accepts more node of information, that is at the later end of the system as the system gets more information from users input, which it uses to improve its training. Showing that the cortical based algorithm will be a better system for evaluation as the system grows. The system was implemented using java programming agents and java jade classes, in combination with xml data files for easy data manipulation and at the end of the analysis it was discovered that while probabilistic algorithms seems to have an average percentage accuracy, cortical based algorithms percentage accuracy seems to increase exponentially with the increase in training data in an unsupervised environment.

Index Terms— Decision Support system, Agent Based model, Autonomous, Cortical, Learning, Algorithm, Neocortex

1 Introduction

The backing of decision makers in foundation by PCs is a noteworthy field of enthusiasm of the Information Systems discipline. Progress made in man-made reasoning (AI),suggest expand the effect of the management support by fusing AI instruments that can be connected to feebly organized, information rich, non-quantitative decision areas [1]

According to [2], decision support processing would consist of the following components: data management component; model management component; user interface management component; choice backing organizational architecture. Nowadays, the components of decision support systems are very much become like the ones identified by Sprague: user interface; knowledge based subsystems; data management module; model management module. The user interface is a component that provides the communication between the user and the decision support processing. The proper design of this component is really important, as it is the only one the user actually deals with. The data management technique is a subsystem of the computer-based decision support processing, the integrated decision support system database, which includes data extracted from internal and external sources, data which can be maintained in the database or can be accessed only when is useful, the database management system; the database can be relational or multidimensional. In Figure 1.1 denotes the basic components of a decision support system.

1.1 Aim and Objectives

The aim of this dissertation is to structure another age of choice help preparing independent operators that are equipped for taking care of the expanding unpredictability of the issues in their domains of use dependent application, based on cortical learning algorithm using anticipatory adaptation and cognitive reasoning.

The objectives include:

I. To design a decision support system with enhanced reasoning capabilities, anticipation adaptation and cognitive reasoning using CLA/HTM.
II. To develop a software that will improvement in the information processing speed of already existing systems using the cortical learning algorithm
III. To compare the existing and proposed system.

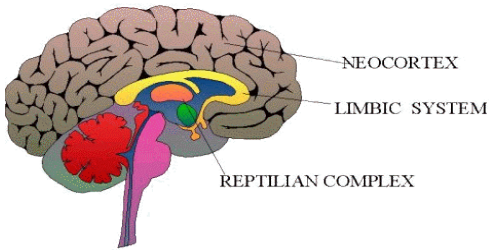

Fig. 1.1 Human Brain

2 LITERATURE REVIEW

2.1 Related Works

A comprehensive survey of the DSS field when all is said in done is Eom's arrangement utilizing a bibliometric approach for exploring the scholarly structure of DSS research and DSS applications. As one of the outcomes, Eom perceived the position orders of DSS finding and the commitments of psychological science and Artificial Intelligence to DSS [3]. Additional evaluation series uses content analysis in overall reviews of the DSS field of research. The result reveal that nearly

Half of the investigated articles do not refer to judgment and decision making literature at all [1] many other recent surveys don't ponder the overall DSS research area, but focus on diverse research streams.

The application of KBDSS in financial management confirms the importance of using domain knowledge to DSS and ends with the suggestion to combine KBDSS with techniques of the field of Artificial Intelligence to increase the efficiency of decision support [4]. A review of DSS application published in 2005 concludes that the engagement of machine learning in decision support system appears to be increasing in significance, but there are still too few applications [5].

Modern decision support systems combine human judgment with computer processing to produce a diversity of meaningful information for decision making. Rather than replacing the need for human verdict makers, these systems, like their predecessors and their domain specific contemporaries, become additions of decision makers' reasoning processes and capabilities [6]. They support managers make decisions in circumstances where human judgment is an important contributor to the problem-solving process, but where human information-processing limitations impede decision making.

These sayings are hinged on the basic insight – arguably the foundation of the 1956Artificial Intelligence uprising that computers are not only numeric calculators but rather all-purpose symbol manipulators. [3] state clearly in their physical depiction system hypothesis, intelligent behavior appears to require the ability to interpret and manipulate symbolic structures.

As I have described somewhere else [7], in the late 1980s a number of factors converged to change this situation, including the influx of pattern-recognition techniques, the call for estimation using metrics like classification precision, and the UCI reposis

- *Uchechukwu-Njoku Uchenna, masters degree program in Computer Science in University of Port Harcourt, Nigeria,, +2347038409127. E-mail: uchechukwunjoku.uchenna@mail.com*
- *P.O. Asagba, Professor Department of Computer Science in University of Port Harcourt, Nigeria,. E-mail: asagba.prince@uniport.edu.ng*
- *C. Ugwu, Senior lecturer, Department of Computer Science, University of Port Harcourt, Nigeria, E-mail: chidiebere.ugwu@uniport.edu.ng*

Story's emphasis on attribute-value notations, which was well suited to statistical approaches. Early applications of machine learning [2]also focused on supervised learning with attribute-value notations, and the arrival of the data-mining movement and the

[8]) read about the significance of social connections and derivative behavior for grounding and use of communication in autonomous robotic agents. For an up-to-date introduction to work on imitation in both animals and artifacts see the cross-disciplinary collection [5].

2.2 Structure of the Neocortex

In the 70s Mountecastle had discovered that this structure remains constant everywhere throughout the Neocortex, whether it is the area dealing with perceptual, auditory, or somatosensory inputs (Bengio, 2009). Figure 2.2 denotes a figure of cortical learning.

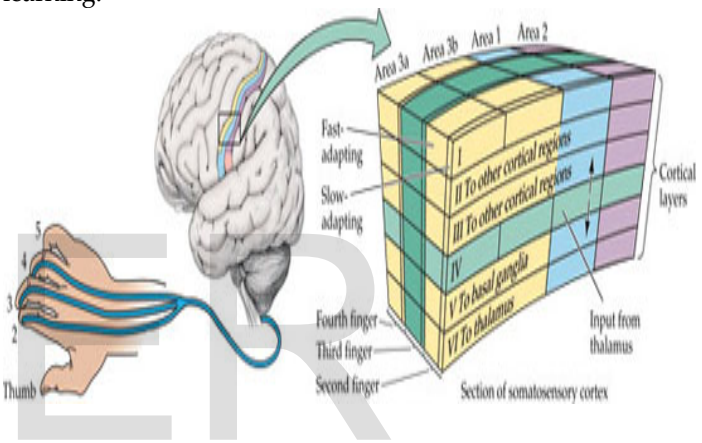

Fig 2.2: Coartical Learning Description (Bengio, 2009).

This means that there's one, powerful algorithmic rule that's universally enforced by the cortex. What this implies is that after we have a tendency to program this plant tissue algorithmic rule, we will feed it any inputs we wish. It is not restricted to the 5 human senses. Regardless of that section of the cortex you're handling, it is aware of is patterns of transitory spikes or "action potentials". And it learns these patterns via the plant tissue Learning algorithmic rule. These patterns form the model of the outside world that you interact with your entire life, you never actually perceive the real world. You live your entire life in a virtual reality, this is how you are able to have free will, because you are not interacting with the deterministic universe, but because you are interacting with a model of the deterministic universe that you are able to make constant predictions about in real time.

2.3 Limitations of Human Decision Makers

i) Intellectual points of confinement, caution the value of choice issue, information accessible and choice methodology and systems, strategies and procedures gotten a handle on by the decision maker;

ii) Expenses of outer specialists that are conceivably called

to help crafted by the leader. Also the expanded need of the arrangements picked on the nature of administrations given by collaborators might be viewed as a constrain.

iii) Sequential constraints must be detected when serious choices should be taken in hazardous circumstances or a few choice issues are to be comprehended in the meantime by a similar individual or gathering of people;

iv) Communication and alliance limits show up when a few people who have different foundations, information bodies and plans are engaged with settling on a choice and actualizing a favored arrangement;

v) Poor conviction of human decision takers in the game plans prescribed by electronic decision procedures and the cost of the related information advancement (programming and hardware) things.

2.4 Cortical Learning Algorithm

The innovative age of HTM learning calculations depends on fixed-sparsity coursed portrayals. It reproductions cortical segments that block neighboring segments in the neocortex therefore generating a meager incitement of sections. An area creates a meager portrayal from its contribution, to encourage a fixed level of segments which are dynamic whenever [6].

Each HTM region comprises of number of highly unified cortical columns. This region is parallel to the neocortex third layer of. A cortical segment is accepted as a gathering of cells with the equivalent receptive field. Each segment has various cells that can recall some past states. A cell can be in one of three conditions: dynamic, dormant and prognostic state.

3 MATERIALS AND METHODS

Agile Methodology was employed in this study which discusses on a group of program creation methodologies built on iterative development, where requirements and solutions advance through association between self-organizing cross-functional teams. Agile method promotes a controlled project management process that encourages regular inspection and adaptation, a leadership philosophy that encourages teamwork, self-organization and accountability, engineering best observation are planned to permit the rapid distribution of superior software, and a commerce approach which supports development with customer requirements and company goals.

3.1 Existing System model

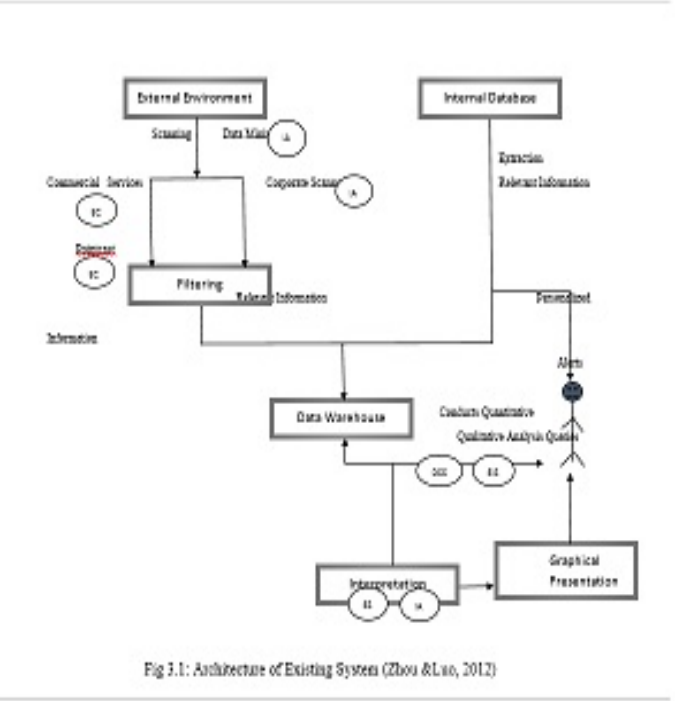

Fig 3.1: Architecture of Existing System (Zhou &Luo, 2012)

At the end we adopted the work of [9] on decision support system, to use its model to improve already existing decision support processing of autonomous agents based on cortical learning algorithm using anticipatory adaptation and cognitive learning and eliminating the cost over head of the probabilistic techniques implemented thereby producing a more enhanced solution.

3.2 Proposed System model

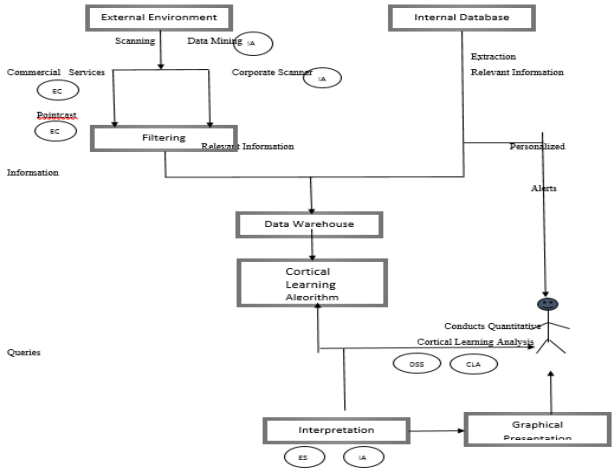

Fig 3.2: Architecture of Proposed System

Advantages of Proposed Systems

The system presents an unlimited capability in reaching solution due to the use of CLA/HTM.

The systems algorithm have a simpler interface therefore are fairly manageable algorithm.

3.3 Sequence Diagram of the Proposed System

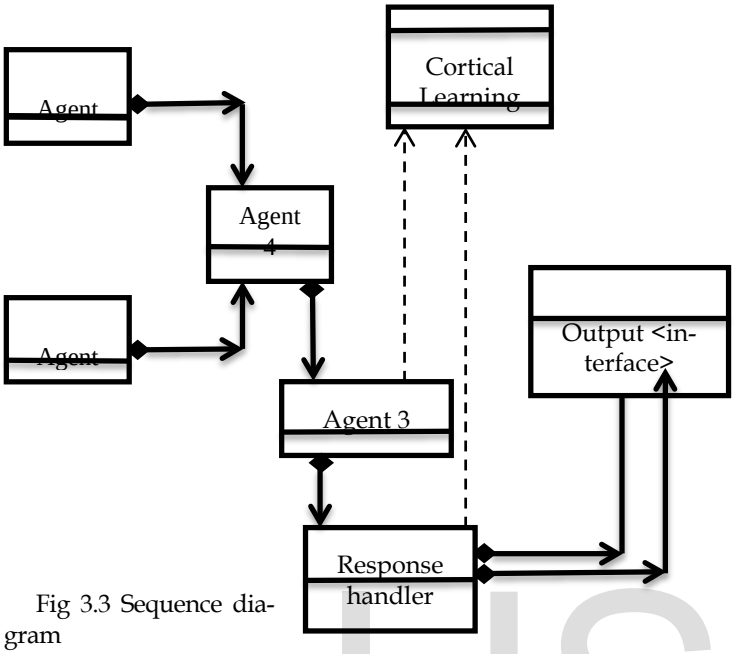

Fig 3.3 Sequence diagram

The sequence diagram describes the interaction among the different agent and components in the system. The agent 1 and agent 2 process always deals with analysis of information, where agent 3 is the supervisor agent for all the system to perform optimally and agent 4 is used for reporting into the various parts of the system for the other processes to occur. Figure 3.8 shows the sequence diagram of the system.

4 RESULT AND DISCUSSION

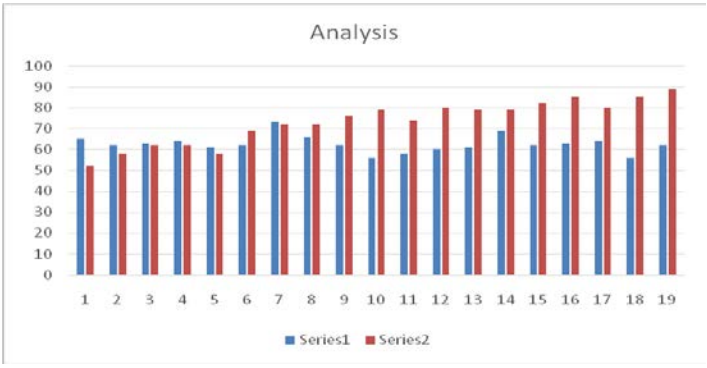

Fig. 4. 1 Result Analysis presentation

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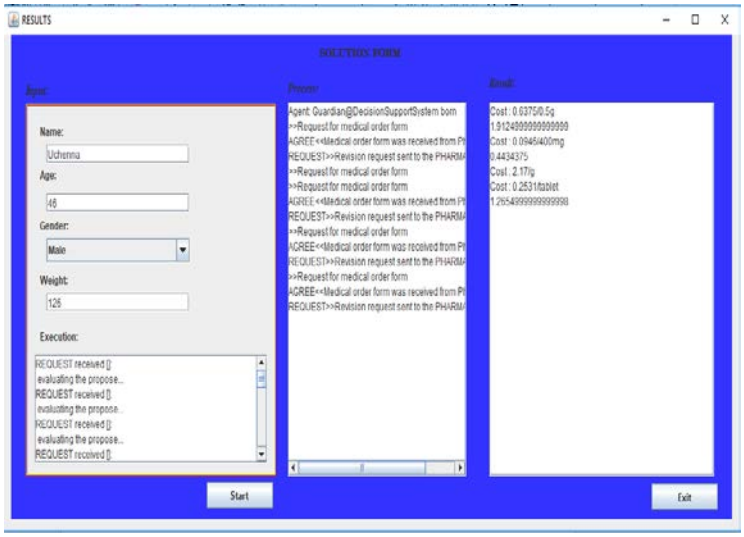

Fig. 4.2 Result Page

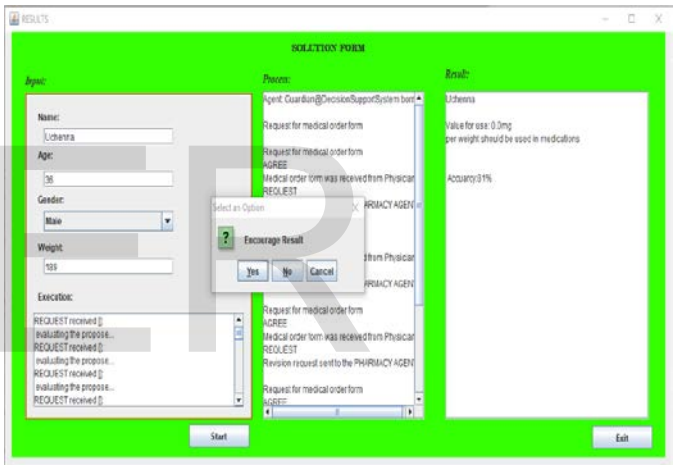

Fig. 4.3 Analysis of result page

Table 4.1 Result Analysis

Number Of Nodes	Number of Runs Of Existing System	%Accuracy for Existing System	Number Of Runs for Proposed System	% Accuracy Of Proposed System
4	1	65	1	52
8	1	62	1	58
10	1	63	1	62
15	1	64	1	62
20	1	61	1	58
25	1	62	1	69
30	1	73	1	72
35	1	66	1	72
40	1	62	1	76
45	1	56	1	79

50	1	58	1	74
55	1	60	1	80
60	1	61	1	79
65	1	69	1	79
70	1	62	1	82
75	1	63	1	85
80	1	64	1	80
85	1	56	1	85
90	1	62	1	89

4.2 Discussion of Results

Where series 1 represents data gotten from execution of the adopted probabilistic solution shows a maximum accuracy of 65%, while series 2 represents data gotten from the proposed model and gives a maximum accuracy of 89%, showing a heavy rise in percentage accuracy as the systems accepts more node of information, that is at the later end of the system as the system gets more information from users input, which it uses to improve its training. Showing that the cortical based algorithm will be a better system for evaluation as the system grows.

Figure 4.1 represents a bar chart description of the data analysis which shows that the system efficiency tends to increase tremendously as it keep receiving input from the user to train itself for better result, thereby producing more refined solutions at the later stages.

Figure 4.2 displays the results of the analysis based on the input of the user i.e weight and height e.t.c, using cortical learning algorithm to generate management data for pharmacies and hospitals and the agents being initiated, their various initiation and output results.

Table 4.1 denotes Analysis of the information of the results of the data gotten from the system, and its accuracy in percentage, this analysis is based on the xml based data retrieved from numeta.org. The software was tested with varied data input up to 90 nodes and the results were recorded to derive this analysis.

Figure 4.3 displays the results of the analysis based on the input of the user, using cortical learning algorithm to recommendation and percentage accuracy based on precious inputs.

5 CONCLUSION AND RECOMMENDATIONS

5.1 Summary

This dissertation treated the topic "enhanced decision support processing of autonomous agents based on cortical learning. It involves the efficient manipulation of values to produce results that could be used for decision making in a medical environment and can be adapted to any other environment, and has come to bring relief to problems discussed in the statement of account in chapter one of this research work. The first of this text, discusses the preliminary stage of the dissertation, it contains the Title page, approval page, certification page, Dedication, Acknowledgement, Table of content, List of tables and Abstract.

Secondly the first stage, treated the chapter one: It contains the background of study, statement, purpose and significance of the study. The scope and limitations are also in this chapter.

Chapter two unveils the literature review, the comparison of the decision support systems and intelligent based algorithms were equally discussed in the terms of strength and weakness of their operations.

The third chapter discussed the research methodology which comprises of how data used in this research were collected and also analyzed the state of the existing system, the problem discovered in the existing system analysis of the existing system, the stated objective of the new system and the analysis and design of the new system.

In chapter four, treated implementation of the new system with it's specifications and measurement. It also deals with the programming language used,

Finally the fifth chapter (chapter five) talks generally in the content of this dissertation work. It deals with the summary, conclusion, recommendation and suggestion of further studies.

5.2 Conclusion

Intelligence based decision systems keeps evolving as artificial intelligence keeps improving and hardware keeps getting better. Intelligence based systems must evolve to meet the needs of the economic society and management practices, as well as the social, and cultural context of which they are a part. These changes are generally incremental, rather than wholesale overhauls of decision support processing. Many recent and proposed changes to existing decision support systems tend to implement and improve them by introducing an intelligence factor in such systems, by the improvement of current system architecture's such intelligence can be improved using the cortical learning algorithm to minimize the amount of calculations being performed by such algorithms to derive a solution. The goals of recent reforms vary widely, from increasing computation speed and better memory management to reducing the influence of human error to better meeting the needs of the economic environment.

5.3 Recommendations

Gaining a greater understanding of the intelligent decision models currently in use and exploring the issues and challenges outlined in this dissertation in more depth would help organisations determine the practices and procedures best suited to meet their needs, as well as ensure precision, accuracy, and performance and realize the full potentials of their organizations.

This dissertation has sought to contribute to improving the procedures adopted by intelligence based decision support system in conducting daily management procedures.

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