An Experimental Analysis of Information Fusion in Social Network

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Abstract-In every field viz. medical science, engineering, etc.there is a strong need of intelligent system.Systems which thinkand work like humans are essential for reliable processing. Anew aspect in field of AI which is based on human cognition isCognitive Artificial Intelligence (CAI). Development of a Cognitivesystem is proposed using Information Fusion and KnowledgeGrowing which are the key features of human cognition. Thissystem makes use of techniques and method for knowledgegeneration and knowledge growing which is used for developinga knowledge database, which is helpful for processing. The ideais to forge information fusion along with Artificial Intelligence tocultivate an cognitive system. The system will mimic the humansbrain ability of knowledge generation and knowledge growing.

Index Terms-Cognitive Artificial Intelligence (CAI), Knowledge Growing System (KGS), Information Fusion

1. INTRODUCTION

Since ancient times, scientists have conducted innumerable research on how machines can work as human brain does. This uncountable research led to development of new field in computer science namely "Artificial Intelligence (AI)". Artificial Intelligence is termed as the science of producing intelligent machines. AI aims in design of machines far better than human thinking capability. With the technological advancement in field of AI machines can act intelligently in terms of decision making, visual perception, speech recognition etc.

A system which mimic humans must have excellency in terms of knowledge, planning, learning, reasoning, perception. AI systems though are similar to humans but they are immeasurably rear from becoming as smart as human being. The human brain initially have no knowledge or information about any phenomenon, as time passes brain acquire different information and meld it to form new information or any perception. The knowledge within the brain grows from zero to a certain level [11][6]. Knowledge generated helps in decision making for example, probability of having cancer is much lower than cold or heartburn. Coughing is most likely to be caused by cold and not by heartburn. Human brain makes such inference based on the knowledge generated [14].

The intelligent systems developed do not exactly replicate humans, there is no improvement in experience and no original creativity. Countless experiments have been carried out to better understand human mind which lead to development of psychology. Cognitive science emerged as extension of psychology. The essential consciousness of cognitive technology is how information is stored and transferred inside the human mind. Modern cognitive technology research emphasis on how people and machines keep records related to belief, language, reasoning and emotion [7].

Aim of cognitive technology is to use the strength of computer systems to understand human thinking, this lead to the development of cognitive system [6]. The cognitive system is composed of knowledge growing system (KGS). Human derive a conclusion after perceiving information from certain phenomenon, based on the conclusion he gains knowledge this process is termed as knowledge growing, this impact us to perform studies to assemble and understand knowledge growing system (KGS). Simply KGS is a system capable of growing its knowledge with the help of perceived information [10]. KGS emulates mechanism of knowledge growing in human brain.

There are many approaches for emulating human intelligence into computer system. As example, [6] Artificial Neural Network (ANN), Evolutionary Computation (EC), Swarm Intelligence (SI), Artificial Immune System (AIS), Fuzzy System (FS) all this approaches are classified into a group called Computational Intelligence (CI). All this approaches share a common foundation for emulating i.e. probabilistic technique [10]. Emulating human intelligence is not an easy task because of its complexity. Inferencing is the highest human ability [2].

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1.1. *Related Theories*

- **Information:** Information is not only a term it is something which can be processed to become a data or knowledge [1]. The emphasis is how to process the information to get inferences and how to fuse inferencing to obtain comprehensive inferencing.

- **Inferencing:** It is described as the practice of inferring the meaning of unfamiliar expression or word from the meaning of acquainted words having same context, collectively with one's knowledge or ideals about the word [6]. Inferencing is nothing but conclusion reached through reasoning which finds indications, put them together, and use it to solve the problem at hand [8].

- **Fusion:** The term fusion is defined as integrating two or more entities to form a single entity. This term is then adopted by information fusion groups to depict a method in combining data records from different assets to achieve single comprehensive information.

- **Intelligent Agent:** Agent is a thing that causes significant effect on situation in real life. To achieve the desired effect agent must perceive capabilities viz. ability to manage where, when and how the task must be carried out, it must have an idea about the success rate and consequences of the tasks carried out. Intelligent Agent have the ability of self-governing i.e. it instructs itself to accomplish the task and carry out self-evaluation to calculate success rate. It has to have a mechanism to obtain comprehensive information-inferencing regarding the situation it observes..

2. RELATED WORK

According to a study in 2006 by Yi X. Zhong Structuralism, functionalism as well as behaviorism have been the three major approaches to Artificial Intelligence. The cognitive approach in AI investigate the mechanism for constructing intelligence in the intelligent systems [1].

Human observes any situation with his/her sensory organs and gains information by communicating with other people, before making any decision. Inferencing is carried out by fusing information collected from different sources. Comprehensive inferencing is achieved by fusing new information with previous information. The approach on how to emulate human's comprehensive inferencing capability in machines is proposed [2].

A.D.W. Sumari proposed a System in 2009 which mimic how human brain obtain new knowledge is termed as Knowledge Growing System (KGS) it is a novel perspective in Artificial Intelligence (AI). The new knowledge collected by the system is the used as the basis for making estimation. An application to estimate genes behaviour is explained using yeast genes-interaction values [3].

The novel perspective of AI viz. KGS is validated for its feasibility to solve real time problems. The KGS for inferring behaviour of genes [3], is validated to obtain comprehensive information regarding genes' behaviour. The MCC framework is used to boost the computation due to which comprehensive information can be obtained faster [4].

Knowledge Growing System grows its knowledge when it interacts with the environment and its knowledge will grow to some extent until the ultimate knowledge it gains is satisfactory. It determines its own knowledge through Degree of Certainty which is obtained after carrying out numerical computation of probability values of information from the observed phenomenon perceived by its sensors. The result is considered through different perspective viz. Psychological perspective, Electrical engineering and informatics perspective, Mathematical perspective [6].

An outline regarding interdisciplinary study of cognitive science is carried out, contemporary studies in cognitive science AI is carried out by Samantha Luber presented his view in 2011. The final cognitive science studies shows how improved intelligent agents will simulate human level intelligence and future studies regarding identical is discussed [7].

Decision is the conclusion reached after analysing different considerations, it is nothing but the choice you make about something. Strategic decision making is one of the major aspects in many applications specially real time applications like military which require accurate and quick decisions. An example based on the A3S algorithm proposed by Arwin and Adang[5]is proposed, related to military aircraft selection using some hypothesis to depict the use of algorithm [8].

In 2012 A.D.W. Sumari analysed Human activity automation phenomenon, human capabilities can be modelled and integrated in automation application. Studies describe working of algorithm that enable to create analogous mechanism in AI system. Solution can be used in real time AI systems [9].

The most important characteristic possessed by human brain is knowledge growing, where brain gains knowledge by observing a phenomenon as a new born child. Review of some fundamental theories is carried

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out which are appropriate for carrying out human like intelligence in machines. A system is assembled based on hypothesis of review result that compose of Human Inference System (HIS), Sense-Inference-Decide and Act (SIDA) cycle and Observation Multi-time Arwin-Adang-Aciek-Sembiring (OMA3S) information-inferencing fusion method [10].

In 2016 Arwin \& Adang proposed a perspective in Artificial Intelligence (AI) named Cognitive Artificial Intelligence (CAI), which works based on cognition. This sub-field of AI viz. CAI not only emulate how human think but also explore how knowledge growing take place in human brain. Some important terms like Knowledge Growing, Information Fusion, Knowledge Generation, Human Inference System(HIS) are discussed [11]. Knowledge Growing System (KGS) is new aspect in Artificial Intelligence which mimic how human brain develop new knowledge from information obtained by its sensory organs. VHDL program is designed to execute KGS's Information Fusion Algorithm [12].

The novel perspective of AI viz. KGS is validated for its feasibility to solve real time problems. The KGS for inferring behaviour of genes [3], is validated to obtain comprehensive information regarding genes' behaviour. The MCC framework is used to boost the computation due to which comprehensive information can be obtained faster [4]. Computational model of social working memory might be helpful to psychological and cognitive science studies for better understanding of human social memory function. It can be used in extensive range of intelligent applications [13].

In 2016 Bayesian model of cognitive hypothesis is designed and Bayes' rule is used to find the best explanation of available data. Understanding of neural mechanism based probabilistic models is carried out. Neural implementation based probabilistic model represent probabilities without any representation from external world it mimics how humans make decision [14].

3. SYSTEM ANALYSIS

3.1. *System Overview*

Action in a human occurs in such a way that a structure from the upper level is replaced
with functionally equivalent structure from the biological level. Information fusion is the most important feature carried out by human brain, proposed system demonstrate an example based on

social media which highlights the importance of information fusion.

US Supreme Court Justice Stewart Potter say that "I can't define what information fusion is, but I know it when I see it", according to this term information fusion can only be understood when it is done, it is a basic process of fusion multi-information to get some new information or new conclusion. Proposed system include "Human Activity Creation", "User level activity recommendation", "Comments on activity", "Nearest user on the same activity" all this operations on activities are fused which give conclusion like Activity ranking, Activity willingness based on recommendation, user connectivity etc.

Problem Statement: Implementation of human brain inspired system viz. Knowledge Growing System (KGS). The proposed system uses information fusion for growing knowledge and mimics human cognitive behaviour.
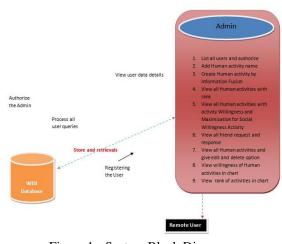
3.2. *System Block Diagram*

Figure 1. System Block Diagram

Admin: the Admin has to login by using valid user name and password. After login successful he can perform some operations such as:

- view and authorize users
- Adding Activity Names
- Creating Activities
- Viewing All Activities with rank
- Viewing all Activities with activity Willingness and Maximization for Social Willingness of Activity
- Viewing All Friend Request and Responses
- Deleting or Editing Activities
- Viewing Willingness Activities in Chart
- Viewing Rank of Activities in Chart.

User: Valid user can perform some operations such as:

- Register and Login
- View your Details and search friends,req / res friends
- View all your friends and their details
- Select and join in Human activity, recommend your activity to your friend
- View all other friends' Human activity and its discussion and recommendations
- View all activity join recommendations from your friends.
- View your nearest neighbor in terms of activity and show their location in GMap

3.3. *Mathematical Model*

Let 'K' be the set of knowledge in the system
Initially, K = { θ }
Let 'NK' be the set of new knowledge perceived
NK = { NK_1, NK_2, . . . , NK_n}
Let 'H' be the set of Hypothesis
H = { H_1, H_2, . . . , H_n}
Let 'I' be set of Indication
I = { I_1, I_2, . . . , I_n}
Now,
|K| = |NK| + |K|
If,
|K| ≤ |NK| and |K| ≥ |NK|
then,
|K| = |NK| ...**[According to cardinality of Injective and Bijective function]**

4. PERFORMANCE ANALYSIS

4.1. *Implementation*

The proposed system demonstrate operation carried out on social media using information fusion. Basic operations such as user register and login, sending \& receiving friend request is carried out. The main focus is on human activity creation, where admin creates various activities and each activity is followed by number of users. Activities are also recommended by one user to another. Each activity is ranked on the basis of user recommendation, willingness and comments. This fusion allows us to analyze each activity.

4.2. *Result*

The runtime result analysis graphs for Activity Rank and Activity Willingness are shown below.
In the graphs 'X' axis contains Human generated activities and 'Y' axis contains Rank and Willingness of each activity.
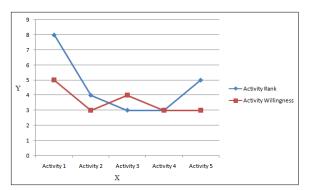

Figure 2. Activities Ranking and Willingness Graph

5. CONCLUSION

Information fusion is one of greatest human capability, this can be used to solve real-life problems if emulated to a computer system. The proposed system depicts example based on information fusion, this fused information generates new knowledge which is helpful for decision making.

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