Human- Centered Cognitive Computing and Application in Emotion Communication System

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Abstract— **Human-centred cognitive computing (HCCC) is a technology to develop systems which provides service like emotion communication, health care, decision making, social interaction and intrinsic information transmission in a way that helps human to survive in a healthy way when going through challenging situations. HCCC is basically assisted by cognitive computing which is closely related to cognitive science; a research area deals with cognitive processes like attention, perception, decision making, memory, language and related disorders. HCCC has multiple applications in real life, this paper basically focuses on in the area of emotion communication system; technology designed to deal with emotion aspect of human machine interaction.**

Keywords— **human cognitive computing, information transmission, cognitive science, cognitive processes, emotion cognitive computing.**

I. Introduction

In the field of academics where computer software, hardware and AI is developing very rapidly, cognitive computing defined as an interdisciplinary and research field which encompasses methods from psychology, signal processing, biology, statistics, physics, mathematics and information theory and try to construct , machines equivalent to human brain in terms of reasoning abilities.

Most of the application in the industry is AI based. One of the demerits of AI based application is lack of human intrinsic information like emotion, motivation, perception and other mental state of human being. Though we can observe in the modern era dealing with emotion is one of the challenges. Most of the people suffering from psychological disorders depression, anxiety, autism, schizophrenia, borderline personality disorder they all have trouble dealing with emotional aspect of their personality.

Later on in this area some other machines have been developed that controls behaviour on the basis of intrinsic information. MEXI (robot) is the example of such machine that has been modelled such a way that uses emotion and drives to glam and control it's behaviour in the environment (paper 5).

Human centred cognitive computing overcomes the above mentioned draw backs of AI based application. Machine, cyberspace and human come under the area of human centred cognitive computing. Machine includes the hardware and cyberspace is the space contains information stored in virtual network.

Cyberspace plays trivial role in the paradigm of human centred cognitive computing. In this paradigm human and machine can interact by using data in cyber space at deep algorithm level. Thus cognitive computing provides effective ways to search and find out human internal information, so that it can work according to the need of the users on the basis of the understanding of human cognition. That is how it works towards the direction of removing AI drawbacks by providing more facilities to users.

One of the major challenges about human centred cognitive computing is regarding the sensors that are easy to carry. In the present era ratio frequency has also been used for machines to extract information from human but it has difficulty of mobility. Another challenge is regarding the line-of-sight and non-line-of-sight propagation environment. There are numerable intrinsic cognitive information like emotion, motivation, attention of human being that can be used for providing homeostatic to the user. Emotion disturbance produces more imbalance in human behaviour comparatively other mental state of the mind.

The cognitive computing has multiple applications in the area of robot technology, emotion communication system and medical cognitive system. While talking about human centred cognitive computing, application in emotion communication is major to deal with, which is underexplored area. This paper focuses on application of human centred cognitive computing in emotion communication.

II. History of Cognitive Computing

During the 20th century the field of behaviourism was gradually reduced. Due to the tremendous development of linguistics, information theory and data science in computer technology bring back the cognitive science field and developed lot. Cognitive science is a one of the interdisciplinary field it mainly deals with the information processing and treatment of the human brain. The research is mainly focus on human brain by observing the language, perception, memory, attention reasoning and emotion. The cognitive process of human brain activity can be explored by two stages. First the physical environment like weather etc human being sense the environment through skin, eye, ear etc, it acts as the external input information to the brain. Second stage the input information pass to the brain through the nerves and process the information by storing, analysing and learning. After processing the result will send back to the whole body through nerves. Each part of the body response according the process information received that is behaviour response. This is the closed loop that includes decision making and action response. So whenever the new cognitive activity emerge it communication is required to the world to obtain the information. Brain develop the own cognitive system by using the information obtain from the world environment. Cognitive system is

very complex system it required tools method to function in multidimensional way. So the cognitive science needs a huge contribution from different field like psychology, AI, Philosophy, Neuroscience and anthropology. Because of involvement of different filed in cognitive science it is often referred to as interdisciplinary field

The above figure shows the evolution of cognitive computing. Big data analysis and cognitive are two different technology derived from data science. In big data analysis the processed data should be 5v feature of big data. In cognitive computing mainly focus on processing the data and it not necessary to be big data. In human brain some memory position does not affect the cognition information. The information process by human brain is more efficient. Cognitive computing focuses on developing algorithm by studying theories in cognitive science. The algorithm make the system have some certain cognitive intelligence. Cognitive computing aim is to enable the computer to cognize the object of the world in the view of human thinking to understand the human beings needs. The cognitive system need to improve the decision making and intelligence. In some typical problems the cognitive system exceeds the traditional machine learning technology. IoT is used in cognitive system may help to human begins for decision making and provide suggestion to the problems. In cognitive computing if we use radio cognitive network of information communication it will very easy to use both big data analysis and cognitive computing at the same time.

III. Architecture of cognitive computing

The technologies like 5G network, robotics deep learning with cloud IoT infrastructures gives more human computer interaction. The cognitive application can be used for health monitoring, cognitive disorder treatment smart city, transportation different scientific experiments. Each layer of architecture corresponding to different technologies challenges and system requirements. Each layer of cognitive computing and technology be studied and explain in detailed in this paper.

Cognitive computing and internet of things:
Cognitive computing is mainly based on information communication is important in transformation of information. In cognitive computing application the information is represented by data both structured and unstructured data. The IoT collect the real time information from the object and forms the huge network through the internet and make interconnection with the sensing device in order to make bond between data and the real object. Presently some distributed information bonding technologies can be used to improve the accuracy of sensing large scale network information. The IoT obtain information related to the monitoring object using perception technology such as RFID, wireless sensor , satellite positioning, through the Wi-Fi and finger print . Later it spread the information in the networks by different mode of communication and then it will do analysis and processing of information using machine learning cloud

computing and data mining technologies. Data mining is mainly used for decision making. The increase in use of IoT will generate the large amount of data for cognitive computing.

Cognitive computing and big data analysis:
The increase of information and improvement of computer technology takes it to big data. The information has both structured and unstructured data it increases exponentially. Both the data compose of bigdata it represent in %V its nothing but large volume of data, velocity of rapid changing of data, value and veracity. These features may cause problem during analysis and processing information. Here we going to brief about the difference between big data analysis and cognitive computing

Cognitive computing focuses on human senses. Connection between cognitive computing and big data analysis is big data thinking. Once the information quality various experience become very large then human begin posse big data thinking, this is the hierarchical of deep learning. The deep learning level is compared in cognitive computing. The first level is improvement of humans' life and environment. The second level is pursuing spiritual culture and the third level is meaning of life. Currently its focus on thinking it is simulated in machine intelligence and next level is living standard and emotion state of human sense. There are many applications like health monitoring, smart healthcare, smart city, emotional communication these are help in improving the second level. The third level is finding the meaning of life and predicting suggestion ideas to make life happy and easier. At present machine can't be done. It is one of the biggest challenges on artificial intelligence.

There is a difference between big data analysis and cognitive computing is data size. The big data analysis data is indirect pointing to something in cognitive computing the not necessary to be indirect. Without large volume of data the accuracy and reliability of prediction cannot be achieved. The collection of data in cognitive computing does not depend on the size of data. Cognitive computing tries to solve the problem of fuzziness and uncertainty created by human brain. Like learning, thinking and problem solving. The size of date collected in cognitive computing is not large but still it can be processed. The cognitive system can mine the data and expose the hidden meaning in the data.

Furthermore still there is combination of cognitive computing and big data analysis. The cognitive computing is learning if the process of human beings in short time and cognize the image observed by human. For e.g. by using dig data and cognitive computing we can differentiate the human capture image between dog and cat but we can't differentiate the different variety of dogs or varieties of cat. And there is a big data redundancy for huge volume of data it occupies large amount of storage space. Cognitive computing is mining large amount of data from everywhere and acquiring more cognitive intelligence. Due to storage, processing data, mining requires lot resources here cloud computing plays important role to make everything easy.

Cognitive computing and cloud computing:

cloud computing helps to provide the resources in virtualization to perform the operation of cognitive computing . It mainly reduce the cost and physical resource utilization, the strong computing and storage capacity of cloud computing provide dynamical, flexible, virtual, shared and efficient computing resources to the cognitive computing. There are large amount of data and information processing in big data analysis using cloud computing technology. The machine learning uses cloud computing for mining the data produce the results. Cloud computing and bigdata provide hardware software's things to the cognitive computing

IV. EMOTIONAL COMMUNICATION.

In the world where being human, people share good relation to form society. At the same time they do share emotion with each other to develop relation as well as to get help when suffering from some emotional troubles to get rid of it. Gradually with the time technology is on peak to compete human ability. Still there are many method and technologies are developing which basically deals or focus on human communication systems. Research in the area of human machine interaction is not new but with the development of technologies improvement in the human machine interaction system can be seen.

Dealing with human emotion according to the information available is a subjective quality which varies among individual. So developing such machines which can calibrate the nature of action according to the human emotion and can communicate accordingly is a challenge. Multiple researches have been done on human machine interaction whose main target function is to identify human emotion. Characteristics of human emotion communication system contains two aspects, one is emotion; it focuses on emotion of human being living in this world, and try to deals with the emotional troubles of children and adults suffering in this modern era where the work pressure and other social and interpersonal relations cause the emotional troubles. Another one is communication; communication part of emotion communication system is exchanging information between two sides. For every system particular protocol use to be follow for authentication, validation and integration of system. There are machine which take in to consideration particular information from human to understand and communicate emotional information. There are four types of human emotion communication system (paper8).

1. Audio-visual information based
2. Multimodal form based
3. Tactile perception based
4. Physiological signal based

One of the inconvenient of the human machine interaction system or emotion communication system between human and machine is regarding line-of-sight (LOS) interaction which is not possible in all circumstances. Most of real life communication many time based on non-line-of-sight (NLOS). So the current human machine emotion communication system researches try to remove all these drawbacks like convenience of use, cost, accuracy of

recognition method, computational complexity of and enhance the accuracy of human emotion recognition method.

Emotion communication between human and robot has been developed gradually in terms of many prospective like accuracy, adjustment in behaviour of machine according to human behaviour. Emotion communication between human and robot which has the emotion model was designed in a way which refers as internal secretion system of human and it has four kinds of hormone parameters to adjust conditions such as motor output, sensor gain, and cooling fan output. Psychological impression of robot was evaluated, as a result robot friendliness with human was confirmed and also human robot emotion communication was found (paper-7). Later in research robot with face for emotional communication between human and robot was developed (paper 6). As we know from our daily life experience that for emotion communication face expression plays crucial role. Only from we can understand the emotion on basis of expression whether the individual is happy, sad, or anger. The robot was expressive in all basic emotion i.e. happy, sad, anger, disgust, fear, surprised. They also developed the head motion in robot like human friendly where human and robot co-exist data.

V. CONCLUSION AND FURTHER WORK

In this paper human-cognitive computing and it's implication in emotion communication has been presented. This paper also gives the comprehensive view of practical implication of emotion communication and how it has been designed and used in robots which were designed to help human dealing in emotion communication. Further research work based on existing drawback in data extraction and transformation and other issues of human cognitive computing in the area of emotion communication.

VI. REFERENCES

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