A Survey on Recent Research Areas in Computer Science

Dr. B. Vani

Assistant Prof., Dept. of Computer Science, Srimad Andavan Arts and Science College, Tamil Nadu, India

Abstract— *Computer science and application is a wide spread area with numerous branches that are evolving day to day. There are lot of research works carried down by the educationalists and scientists on each and every domain of Computer Science. There exists lot of important research areas yet to start research in our country that supports various social, medical and scientific issues. This paper summarizes the current research areas of computer science that are being focused by the researches and the future issues to be taken into account.*

Keywords— Big data, Cloud Computing, Software Engineering, Natural Language Processing, Network Security, Speech Processing.

I. INTRODUCTION

Computers made a huge impact on the scientific, medical, business, mobile communication fields with a fast reformation. Research in the 20th century focuses on the areas such as algorithms and theory, data management, data mining and modeling, distributed systems and parallel processing, economics and electronic commerce, education innovation, hardware and architecture, human computer interaction and visualization, information retrieval and the web, machine intelligence and translation, mobile systems, natural language processing, networking, security, privacy and abuse prevention, software engineering, software systems and speech processing etc. As the usage of internet and computers increase, the need for maintenance of data, processing and security also gets importance. Human brain is filled with their computers' hard disks, cell phones and memory cards information. There is a situation that completely relies on the electronic gadgets even for the children. The huge amount of unprocessed data can be processed by the automated systems and may be utilized for medical, scientific and business people.

Human brain can never be substituted to the computer as we all understand; there exists a lot of research work that should be induced by the human brain in order to attend the social, human relations and global issues. Researchers have to analyse the issues that become challenge to the nature and suggest solutions to them with the help of the computers. In this paper, the recent research areas as per the literature are listed down under various areas of computer science and the future research focus also emphasized as per the survey.

II. LITERATURE REVIEW

As per the survey of Forbes, there exists a need for processing the abundant data such as data mining, machine learning and hardware architecture in order to handle them more effectively. Google is also focusing on data management, data mining and modeling in order to process the data that supports various business, scientific and medical problems that are arising day to day. Next to the data analysis, distributed systems and parallel processing gets enormous research avenues to proceed. Artificial intelligence and robotics is another important area of computer science to make research in an advanced manner that helps to develop algorithms. Bio informatics is the next field which has lot of areas to proceed research that supports biomedical engineering. Computer assisted education, human computer interaction, multimedia and programming languages get attention next to the medical field.

III. MAJOR AREAS OF RESEARCH IN COMPUTER SCIENCE

Computer science and applications is a vast field which is growing fast and consequently developing number of problems to resolve. Research is carried down in many of the areas such as algorithms and theory of computing sciences, data management, data mining and modelling, distributing systems and parallel computing, economics and ecommerce, education innovation, general science, hardware and architecture, human computer interaction and visualization, information retrieval and the web, machine intelligence, machine perception and translation, mobile systems, natural language processing, networking, security, privacy and abuse prevention, software engineering, software systems and speech processing etc. In this section, some of the important areas of research are discussed.

3.1 Algorithms and Theory

There are many algorithmic and optimization challenges to be resolved based on searching the information, optimizing the internal systems, finding best paths in

transportation networks. In the paper 'Ant colony optimization' [1], finding answers to how and why the methods work will support the applicability of the concepts. Ant colony optimization is one of the techniques used to solve hard combinational optimization problems.

3.2 Data Management

The data management research issues include information extraction and integration which is carried out by different techniques such as information retrieval, data mining and machine learning. Management of structured data within an organization supports to discover and access high quality datasets. This type of data sets carries different richer, semantics than structured data which in turn opens new research opportunities and technical challenges in their management.

Data mining supports to develop metrics, designing experimental methodologies and models through efficient algorithms to work with large data sets, secured methods for classification and clustering. Different issues in data mining such as security and social issues, user interface issues, mining methodology, performance and data source are discussed by the author [2] in the data mining survey paper. For example, finding shortest paths is one interesting challenge for the researchers by improving the existing methods. Figure 1[3] illustrates the frame work followed to shed light on the procedure followed after the collection of the data from Dataverse in XML format, its then preprocessed to form the graph data network based on interactions and weight is represented as edges between nodes as described by the authors.

3.3 Distributed systems and Parallel Computing

Collection of data from widely dispersed locations need lot of computations that could be dealt with distributed systems and parallel computing become the next avenue for researchers to serve the web users to have accurate and fast service [4].

3.4 E-Commerce

The major research work in ecommerce is concentrated in the areas of auction design, effectiveness in advertising, statistical, forecasting and prediction and policy analysis etc. This research involves interdisciplinary collaboration among the computer scientists, economists, statisticians and analytic marketing researchers. Social commerce involves social media technologies to support online transactions. A framework is proposed by the authors [5] to define and identify the potential research issues in social ecommerce are depicted in Figure 2. The hazards involved with the frequent use of social networks among adolescents and children are discussed in the recent papers since it is associated with poor psychological functioning [6].

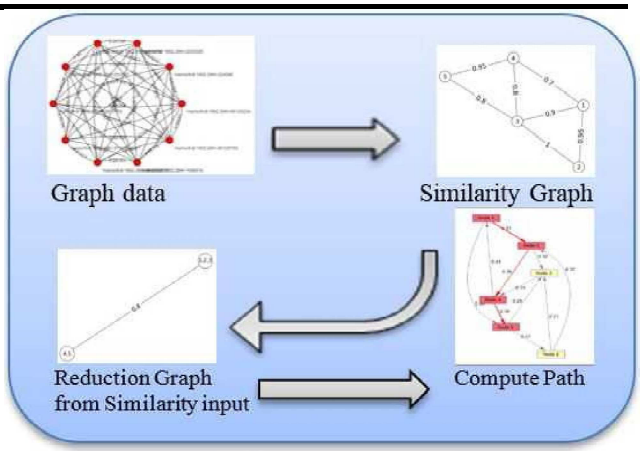

Fig.1: Framework of reduction and path calculation [3]

3.5 Education Innovation

Education is one of the important areas which need widespread research to promote online learning through educational technology, curriculum and programming tools for computer science education etc. Innovative behavior is a process of introducing new ideas which explores the future quality of education [7]. A detailed study which discusses the factors affecting the innovative behavior of the teachers is discussed based on an elaborative data analysis. Messmann and Mulder [8] described innovative teacher behavior encompasses observing, listening, adapting new ideas that access the innovation methodologies.

3.6 Hardware and Architecture

Most of our interactions with the internet are made possible with the recent technologies used to search the web, smart way of using social networks, email, online videos, shopping and gaming are done with smallest and the most massive computer. A comparative study of 3G and 4G mobile technologies are discussed in the recent papers [9]. Smart phones are ten times faster than the IconicCray-1 supercomputers which are called Warehouse-Scale Computers (WSCs). Programmers and cloud developers largely involved in promoting an environment which is efficient in terms of speed, cost and energy [10].

3.7 Human Computer Interaction and Visualization

HCI research is mainly contributed towards large scale interactive systems in the real world. The recent research works in this area is engaged with predictive user interfaces, mobile and ubiquitous computing, user engagement analytics, user interface development tools and interactive visualization of complex data. The research focus in the use of hand gestures as a natural interface explores the major three phases namely detection, tracking and recognition and the further advances needed in this field is discussed by Siddharth et al.[11]. Caban et al [12] explores the visual analytics in

the health care challenges. Huge amount of data in the medical field can be utilized to meet the challenges.

3.8 Machine Intelligence and translation

Exploring theory and applications involve machine learning in terms of languages, speech, translation, visual processing, ranking and prediction. When learning systems are collaborated with the interactive services, deep learning and statistical models are needed to be devised. Improving energy efficiency is one of the major research areas for high performance data centers [13].

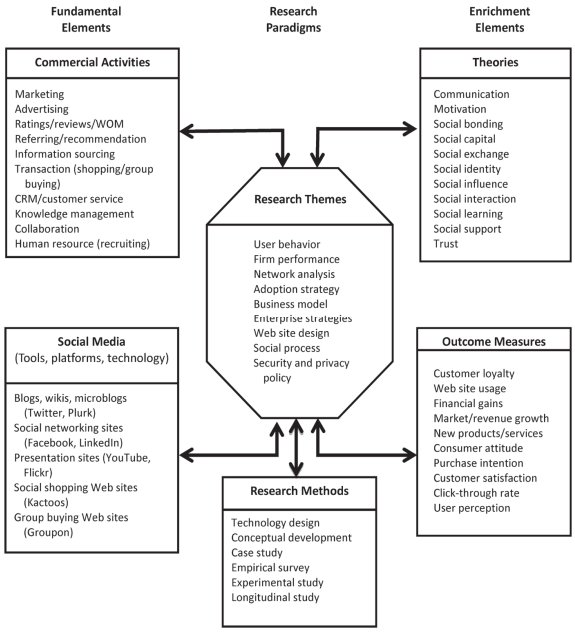

Fig.2: Research framework for E Commerce [5]

3.9 Mobile systems

Mobile systems are getting popular and they may outpace desktop usage worldwide. Lot of research works are carried down in the areas of mobile computing, networking, operating systems and programming platforms [14]. Research works are concentrated on improving the network performance and reducing network data usage and energy consumption. Wireless communication protocols are also under focus in the avenues of security and privacy [15].

3.10 Natural Language Processing (NLP)

NLP research focuses on algorithms that can run efficiently in a highly distributed environment. Hirschberg et al. [16] discusses the advances in NLP research and the future research in this field. New algorithms that support NLP are proposed by the researchers in this field recently.

3.11 Networking and Security

Networking is one of the important areas which need research to build a network infrastructure with high performance, availability, security and privacy. There are more avenues to promote research in the fields of wireless networks, mobile networks that are interconnected with the cloud environment. There are many challenges involved with the information security, privacy, availability of networking systems and the protection of information against unauthorized access [17]. Recent security threats and their proposed solutions are discussed by the authors especially in the field of prepaid mobiles [18].

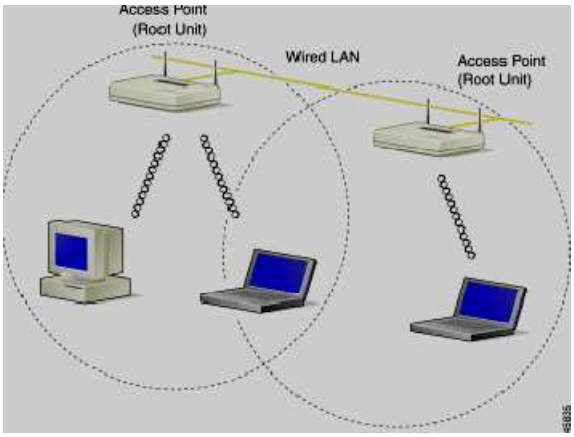

Fig.3: WLAN Infrastructure environments [20]

Cryptography supports for the secure sharing of information with the advanced algorithms. Denial of Service (DoS), spam detection and prevention, anonymity, disclosure controls that covers a broad range of systems including mobile, cloud, distributed, sensors and embedded systems gets :re attention from the researchers [15][19].

Resources access denial attacks are called Denial of Service (DoS). Figure 3 depicts a WLAN environment which is prone to DoS attacks often [20]. It involves saturating the target machine with external communications requests, such that it cannot respond to legitimate traffic, or responds so slowly as to be rendered essentially unavailable. Such attacks usually lead to a server overload. In general terms, DoS attacks are implemented by either forcing the target computer(s) to reset, or consuming its resources. So that it can no longer provide its intended service or obstructing the communication media between the intended users and the victim. DoS attack takes place on the Physical, Medium Access Control, Network, Transport and Application layers of the Open System Interconnection (OSI) model.

3.12 Software Engineering and Software systems

There are some technical challenges along with development of new products arise every day in software engineering which included various languages and tools to build new products [21]. Forty years of research on personality in software engineering [22] are studied in detail. New algorithms are developed in pace with the fast developing technological challenges to promote the distributed systems [23].

IV. RESULTS AND DISCUSSION

Computer science and applications explores various important research avenues that supports the promotion of fast and secured, optimized use of computer related resources. As the usage of computers increase in every domain, there arises the consequences related to the various aspects starting from theoretical concepts to applicability of the proposals. This paper discussed the important research fields and the major problems addressed by the researchers in the recent era that may help the researchers to promote their work. Real time problems get the priority since they need immediate solution to the breeding problems associated with them. New improved algorithms, frameworks are proposed by the researchers that supports the usage of computers and their related resources with more secure and robust environment.

V. CONCLUSION

This paper summarizes the research problems involved with most of the important areas in computer science related with the recent literature. Some research problems are discussed with reference to the recent research works. There is lot of other related fields with every research that is to be promoted by the researchers in this great field. More usage of social networking generates its own security issues that are to be immediately addressed by the researchers.

REFERENCES

[1] Marco Dorigo, Christian Blum, "Ant colony optimization theory: A survey", Theoretical Computer Science 344 (2005), pp- 243 – 278, Elsevier.

[2] Meenakshi Sharma, " Data Mining: A Literature Survey", International Journal of Emerging Research in Management &Technology ISSN: 2278-9359 (Volume-3, Issue-2), 2014.

[3] Haysam Selim and Justin Zhan, " Towards shortest path identification on large networks ", Journal of Big Data, Springer Open Access, 2016, pp. 1-18.

[4] TorstenWilde, Axel Auweter, Hayk Shoukourian, "The 4 Pillar Framework for energy efficient HPC data centers", Published online: 25 July 2013, Comput Sci Res Dev (2014) 29:, pp-241–251.

[5] Ting-Peng Liang and Efraim Turban, "Introduction to the Special Issue Social Commerce: A Research Framework for Social Commerce", International Journal of Electronic Commerce / Winter 2011–12, Vol. 16, No. 2, pp. 5–13.

[6] Sampasa-Kanyinga, Hugues, and Rosamund F. Lewis. "Frequent use of social networking sites is associated with poor psychological functioning among children and adolescents." *Cyberpsychology, Behavior, and Social Networking* 18.7 (2015): 380-385.

[7] Marieke Thurlings Arnoud T. Evers, Marjan Vermeulen, "Toward a Model of Explaining Teachers Innovative Behavior: A Literature Review", *REVIEW OF EDUCATIONAL RESEARCH* published online 12 November 2014.

[8] Messmann, G., & Mulder, R. H, "Development of a measurement instrument for innovative work behaviour as a dynamic and context-bound construct". Human Resource Development International, 15, pp 43–59, 2011.

[9] Zheng, Kan, et al. "Research & standards: advanced cloud & virtualization techniques for 5G networks [guest editorial]." *IEEE Communications Magazine* (2015): pp. 16-17.

[10] K. Kumaravel, "Comparative Study of 3G and 4G in Mobile Technology", IJCSI International Journal of Computer Science Issues, Vol. 8, Issue 5, No 3, September 2011 ISSN (Online): 1694-0814.

[11] Rautaray, Siddharth S., and Anupam Agrawal. "Vision based hand gesture recognition for human computer interaction: a survey." *Artificial Intelligence Review* 43.1 (2015): 1-54.

[12] Caban, Jesus J., and David Gotz, "Visual analytics in healthcare–opportunities and research challenges", *Journal of the American Medical Informatics Association* (2015): pp. 260-262.

[13] TorstenWilde, Axel Auweter, Hayk Shoukourian, "The 4 Pillar Framework for energy efficient HPC data centers", open access at Springerlink.com, Comput Sci Res Dev (2014) 29: pp. 241–251.

[14] Hu, Xiping, et al. "A survey on mobile social networks: Applications, platforms, system architectures, and future research directions." *IEEE Communications Surveys & Tutorials* (2015): pp. 1557-1581.

[15] L. Arockiam, B.Vani, "A Survey of Denial of Service Attacks and it's Countermeasures on Wireless Networks", International Journal on Computer Science and Engineering, Vol. 02, No. 05, August 2010, ISSN 0975-3397, pp. 1563-1571.

[16] Hirschberg, Julia, and Christopher D. Manning, "Advances in natural language processing.", *Science* 349.6245 (2015): pp. 261-266.

[17] Bienkowski, Marcin, "Migrating and replicating data in networks." *Computer Science-Research and Development* (2012): pp. 169-179.

[18] Arshiya Begum, Mohammed Tanveer Ali, "Security Threats in Prepaid Mobile", International Journal of

Computer Science and Network, Vol 2, Issue 2, April 2013 67 ISSN (Online) : 2277-5420.

[19] S.Anu H Nair, P.Aruna, K.Sakthivel, "Sparse Representation Fusion of Fingerprint, Iris and Palmprint Biometric Features", *International Journal of Advanced Computer Research (ISSN (print): 2249-727, Volume-4 Number-1 Issue-14 March-2014.*

[20] L. Arockiam, B. Vani, "Framework to Detect and Prevent Medium Access Control Layer Denial of Service Attacks in WLAN", International Journal of Computer Networks and Wireless Communication, IRACST, Vol. 3, No. 2, April 2013, ISSN: 2250-3501 (Online), 2277-5307 (Print), pp. 152-159.

[21] Fetscherin, Marc, and Daniel Heinrich, "Consumer brand relationships research: A bibliometric citation meta-analysis." *Journal of Business Research* 68.2 (2015): pp. 380-390.

[22] Cruz, Shirley, Fabio QB da Silva, and Luiz Fernando Capretz. "Forty years of research on personality in software engineering: A mapping study.", *Computers in Human Behavior* 46 (2015): pp. 94-113.

[23] Shaikh, Aijaz A and Heikki Karjaluoto. "Making the most of information technology & systems usage: A literature review, framework and future research agenda." *Computers in Human Behavior* 49 (2015): pp. 541-566.