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A Review on Cloud Framework for Healthcare Analytics

D. L. Joshi[1*], M. A. Joshi[2], A. A. Dande [3] P. Wararkar[4]

[1*]Dept. of Computer Engineering, MPSTMEMukesh Patel School of Technology Management and Engineering Shirpur, SVKM's NMIMS (Deemed-to-be-University), Mumbai, India
[2] Dept. of Applied Mathematics, Mukesh Patel School of Technology Management and Engineering Shirpur, SVKM's NMIMS (Deemed-to-be-University), Mumbai, India
[3] Dept. of CSE, Anuradha Engineering College, Chikhli, SGBAU, Amravati, India
[4] Dept. Electronics and Telecommunication Engineering, Mukesh Patel School of Technology Management and Engineering Shirpur, SVKM's NMIMS (Deemed-to-be-University), Mumbai, India

**Corresponding Author: dj4query@gmail.com*

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Abstract— With the wide spread use of the internet in almost all of the fields in our day to day life, has created many new opportunities and challenges in the Data Analytics. Data Analytics deals with the methods to processes, analyze and to draw the knowledge based conclusion from the data sets obtained from various sources applied to take proper decisions for any Artificial Intelligence based systems. Big Data Analytics deals with the larger sized data analytics in terabytes or peta bytes. Presently cloud computing along with Big Data Analytics has wide spread applications in many expert systems design. In this paper we are focused on the basic conceptual model used more specifically in Health Care Analytics using cloud framework based Big Data Analytics. Based on proper data sets available, this framework will be able to make proper healthcare analysis for preventive and remedial decisions.

Keywords— Big Data Analytics, Artificial Intelligence, Expert System, Cloud Framework

I. INTRODUCTION

There exists no machine, science or a technology that can predict 100 percentage accurate future medical diagnosis of any person after next five minutes. To carry out the remedial measures using an experience, skill set and prediction before an incidence happening also has some human limitations. Doctor cannot be always right. Hence people should neither consider a doctor as a God nor as a Criminal. [1]

In the above[1] statements Swami Vivekananda has focused on the core of the medical profession that Doctor cannot make always the accurate decision for the diagnosis of any particular disease for a patient since it is also based on accumulated knowledge base though experience and the knowledge base can never be practically complete and correct. Every knowledge based system always has scope for more and more perfection to make most accurate decisions. In case of the Health Care Analytics if the proper and wide database can be made available, this becomes the easier task to arrive at proper inference and conclusions based on these. In combinations if the Big Data Analytics concepts of Data Mining and Data ware Housing can also be applied to give the expected output of the Health Care Analytics expert system.

Rest of the paper is organized as follows, Section I contains the introduction of Healthcare Analytics, Section II contain the related work of Big Data and Cloud Computing, Section III contain core concept of cloud framework for healthcare analytics, Section IV concludes research work with future directions.

II. RELATED WORK

The Authors in [2], presented a proposed application of big data analytics in healthcare at Maharaja Yashwantrao Hospital and discussed about electronic health record (EHR), how to generate useful information using analytic techniques at M. Y. Hospital. This proposed model maintains EHR and big data analytics will help to reduce healthcare cost and time. Future scope of this work is make use of cloud computing.

In [3], author discussed about electronic medical records and healthcare mobile cloud computing. Author identified problems, one is data retrieval is challenging as healthcare information is isolated among healthcare providers. Second problem is size of healthcare data. Such big data is difficult

to process and analysed using traditional database system tools. Framework introduced by author, provides a high level of integration, interoperability and sharing of Electronic HealthCare Record (EHR) among HPs, patients and practitioners. It integrates distinct EMRs of patient as EHR from different HPs to cloud storage.

The proposed framework [3] uses big data analytics and finds useful insights which will helps practitioners to take critical decisions in right time. Author concludes that cloud computing provides fast Internet access, allows sharing and provision of EHRs by authenticated users. Big data analytics helps to analyse patient data, provide right intervention to the right patient at the right time. Proposed framework also provides high quality and low cost health service. Future scope of this work is to design and implement health information system based on proposed framework.

Nina S Godbole et al. [4], discussed about how to make healthcare green using data science and big data analytics. Author states that healthcare industry needs to use emerging technologies such as data science, big data analytics, mobile computing and cloud computing, and health information technology (HIT) to solve the ever growing operating cost problem. Green IT, allows hospital to reduce equipment and system management cost using virtual server and virtual data storage technology. Author concludes, Green IT is about energy efficiency and improves service in healthcare industry.

Rajesh Jangade et al.[5] in their paper Big data with integrated cloud computing for health care analytics, focused on, healthcare data is increasing at tremendous rate, hence it is difficult to manage and store such big data, and problem can be resolved by storing such big data into cloud. Real time healthcare analytics or batch healthcare data analytics can be used for healthcare big data. Author concludes, merging of healthcare and cloud computing increases the effectiveness and efficiency for patient outcomes of disease.

The Authors in [6] presented mobile cloud computing model and big data analysis for healthcare applications and discussed not only about network healthcare systems and but also about role that mobile cloud computing and big data analytics play in its enablement.

Author discussed about E-healthcare system using cloud computing & web services [7]. Using IoT condition of patient can be monitored and controlled remotely. It provides automatic updates of measured parameters and sends alert mail by using SMTP. Paper concludes better solution and critical conditions can be avoided frequently checking of sensor data at webpage.

P K Mishra et al [8] presented, wearable sensors equipped with IoT intelligence, and it enables observations and recording of data at home and work environments, over much longer duration than are currently done at office and laboratory visits. Author concludes that this Treasure trove of data, when analysed and presented to physicians in easy-to-assimilate visualizations has the potential for radically improving healthcare and reducing costs. Challenges in sensing, analytics and visualization is highlighted by author and that need to be addressed before systems can be designed.

III. METHODOLOGY

Cloud computing is a service through internet such as software as a service (SaaS), platform as a service (PaaS), infrastructure as a service (IaaS).

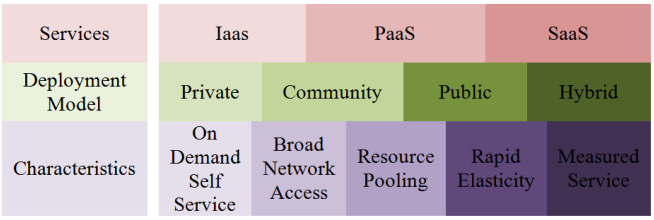

Fig 3.1: Basic Architecture of a Cloud Computing [9]

The clouds can be technically implemented and deployed as a private, community, public or as a hybrid cloud. In private deployment the computing infrastructure is dedicated to and is owned by particular organization. The goal of the private cloud is to gain the benefit of the cloud architecture and not to sell as a service. Private clouds in many cases prone to be expensive with burden of full maintenance and service both at the owner side. In community cloud there is a sharing of the computing infrastructure between organizations with common dedicated goal. In public cloud the infrastructure is owned and maintained by the vendor company. The customer has no control and authority of the visibility of the computing infrastructure. Public clouds prove many times economical for the organization to get cloud advantage of the cloud architecture. Hybrid cloud is the combination of private and public cloud concept. In the peak period requirement the workload can be given to the public cloud and in normal workload conditions the internal private cloud service becomes functional.

Very large sized data in petabytes is called as big data, alternatively the data size beyond the processing capacity of any particular program can also be called as big data. E.g. for an e-mail application program data of size 50MB will also be large hence can be called as big data for this application.
If we gather the appropriate data sets for any particular disease based on various parameters such as symptoms of the patient, internal and external body reflections, diagnosis through medical engineering tools such as ECG, MRI,

Radiology we can get good enough data sets to predict the diseases more accurately and thereby implementing machine learning techniques, cloud based big data analytics more precise preventive and remedial action can be taken for the patients for proper health care analysis.

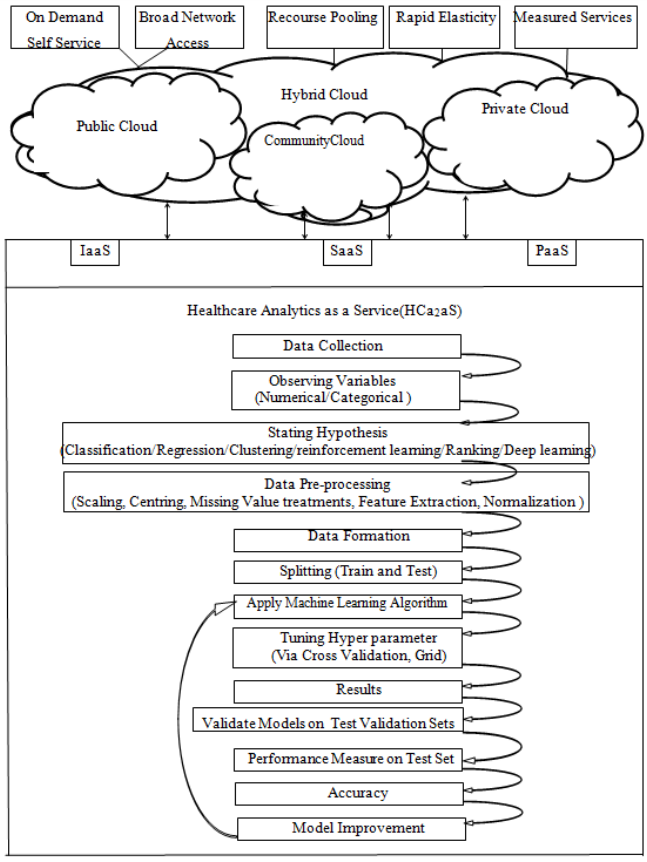

Fig 3.2: Cloud Framework for Health Analytics Expert System

Following are some Big Data Analytics Tools that can be integrated in cloud framework to obtain the desired result for health care analytics

Analytics tools are explained in this section [10][11].
Hadoop is a freely available apache's framework for map reduces, written in Java.

MapReduceis written in java and used to process large distributed datasets. MongoDB, CouchDBuses MapReduce.
Hadoop Distributed File System (HDFS) - it file system for Hadoop, but it can be used as a standalone distributed file system.
Mahout is Apache's project used for to generate machine learning algorithm for Hadoop.

Hiveisan Apache project**,** used for data warehousing. Hive allows querying and data analysis.

HBase- is distributed and non-relational database that provides read and write access to big data.

Pig is scripting language and performs all data manipulation.
Storm is used to perform real-time stream processing of big data.

Cassandrais open source, NoSQL database system. It also has integration with Hadoop.

MongoDB- it NoSQL database.
Zookeeper is simple, ordered and fast and open source service for distributed application.

Spark- Spark is batch data processing engine, faster than Hadoop and MapReduce. It can be used alongside Hadoop or its own.

Scikit- learn- is simple, efficient and open source library for machine learning.

R(H2O) is package. The open source math engine for big data that computes distributed machine learning algorithm with various cluster environments.

As based Fig 3.2 cloud based big data analytics diagram framework , the above mentioned steps are need to be carried out to get the correct diagnosis of the patient in health care analytics expert system.

IV. CONCLUSION and Future Scope

The paper here is mainly focused on the basic concepts and terminologies of the big data analytics integrated with the cloud computing as an application for Health Care expert system. We tried to explain the basic architecture of cloud computing. We also supplementary elaborated the concept with the preliminary description of few Big Data Analytics Tools that can be integrated with various cloud computing platform. We also made attempts to demonstrate the integrated Big Data Analytics tools and the cloud with its application for the Healthcare Analytics. The detailed diagrammatic representation of the various sequential processing steps as Healthcare as a Service is also illustrated in the paper discussed here.

If good and varied data sets are available this Health Care Expert system will yield most accurate result thereby facilitating the more correct diagnosis of the patient with proper preventive and remedial action. It is also efficient and faster way of diagnosis with wide knowledge base obtained from larger different resources and hence is always be at a higher level than the knowledge of a single specific expert person. Hence this Health Care Expert System functions as a equivalent tool for collective opinion of the number of experts in the medical field.

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Authors Profile

Mr. D L Joshi pursed Master of Engineering from SRTM University, Nanded, India. He is currently working as Assistant Professor in Department of Computer Engineering, SVKM's NMIMS University Mumbai India, since 2015. He is a life time member of ISTE. His main research interest focuses on Healthcare Analytics and Cloud Comuting. He has 7 years of teaching experience. He can be reached at dj4query@gmail.com

Dr M A Joshi pursed Bachelor of Science and Master of Science from Mumbai University India and PhD from Sant Gadge Baba Amravati University, India. He is currently working as Assistant Professor SVKM's NMIMS University Mumbai India, since 2012. He is a member of Indian Mathematical society. He has published more than 20 research papers in in various National and International Journals and conferences. His main research work focuses on Abstract Harmonic Analysis Machine learning Data Science, healthcare analytics, topological data Analysis. He has certifications in Statistical machine Learning, Applied Regression Analysis**,** data Scientist**,** MySQL and Teradata**,** R Programmer and Base SAS Programmer. He has 11 years of teaching experience. He can be reached at mlnjshl@gmail.com

Mr. Abhay A.Dande pursed Master of Enginering from Sant Gadge Baba Amravati University, India.. He is currently working as Asst. Prof in Computer Department of Anuradha Engineering College Chikhli since 2008. He is a life member of CSI and ISTE. He has published more than 10 papers in various National and International Journals. His areas of interest are Machine Learning, Artificial Intelligence, Object Oriented Programming languages and Network Security. He can be reached at dandeabhay@gmail.com

Mr P P Wararkar pursed Master of Technology from Nagpur University and pursuing Doctoral Degree from Nagpur University, India.He also completed Various PG Diploma in Management domain from Nagpur University He is currently working as Assistant Professor SVKM's NMIMS University Mumbai India, since 2015.He is a member of Various professional Societies like ISTE, IEI, IETE, IAENG, SCIEI, MEASCE, NSPE, UACEE-IRED and E4C. He has authored Several Books in Engineering & Management domain. He has also authored over 50 papers in the journals & conferences of international repute and approx. 54 citations, h-index: 5, i10-index: 1 (Google Scholar).He acts as a regular reviewer for reputed journals like "Elsevier, Springer, Taylor & Francis" and IEEE Conferences. He is a Session Chair for Various Technical Events, Seminar & Workshops. His areas of interest are Wireless Communication,Vehicular Adhoc Networks(VANET's), Embedded System Design, Digital System Design & Human Resource Mangement. He has 8 years of teaching experience.He can be reached at pwararkar@gmail.com

