AI & IoT for Future of Digital Agriculture: Technologies and Opportunities

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Abstract

The Internet of things and Artificial intelligence have already started capitalizing across all the industries including agriculture. Advancement in these digital technologies has made revolutionary changes in agriculture by providing smart systems that can monitor, control, and visualize various farm operations in real-time and with comparable intelligence of human experts. Sensors collect the real atmospheric data and with the help of Artificial intelligence (AI) algorithms analysis of data takes place so that devices behave more smartly. The present article discusses how IoT revolutionized the agricultural community. The potential applications of IoT and AI in the development of smart farm machinery, irrigation systems, weed and pest control, fertilizer application, greenhouse cultivation, storage structures, drones for plant protection, crop health monitoring. The introduction of modern agriculture techniques using IoT & AI is revolutionizing the traditional agriculture methodologies and are making farming a profitable venture also. Precision agriculture is revolutionizing the concept of smart farming in the entire world. Smart and precise agriculture is the key to producing the best yield of crops. The major portion of the agrarian community is illiterate worldwide, which is unaware of smart farming and intelligence.

KEYWORDS: Agriculture, IOT assisted farming, Smart farming, sensors-based farming

1. Introduction

An AI-driven technology solution must be able to offer insights that will help farmers produce significantly higher yields. Building smart solutions involves staging multiple data points in large agricultural farms, collecting precise and pertinent information from those data points and various edge devices like drones, sensors, and smart cameras, and combining these with intelligent monitoring and analytics systems to provide relevant information to the farmer. Digital technologies, such as artificial intelligence (AI) and machine learning (ML), remote sensing, big data, block chain and IoT, are transforming agricultural value chains and modernizing operations. While several countries, such as the Netherlands, the US, Australia and Israel, have successfully adopted and exploited digital solutions to revolutionize agriculture, their adoption in India is still in its infancy. The future adoption of digital agriculture in India is anticipated to nurture under the Public-Private Partnership (PPP) mode. The demand for digitisation in Indian agriculture is well understood and acknowledged, likewise efforts have also been made towards digitising the prevailing value chain. World's population is growing at a rapid pace and is estimated to reach 10 billion by 2050. This puts an immense responsibility on the
agriculture sector to enhance crop production and increase yield per hectare. Several pain points for farmers such as small land holdings, labor shortage, climate change, extreme weather conditions, reduction in soil fertility, etc. are making agriculture less profitable. For the last few years, agriculture is continuously challenged by climate change and other environmental problems and they create a huge hurdle in achieving enhanced productivity. By incorporating the use of digital technologies like artificial intelligence and internet of things, better insights can be formed effectively from data gathered from the field and allowing farming practices to be planned systematically with minimal manual labor. Over the decades, the agriculture sector has realised the importance of precision farming. Despite the challenges due to climate change and other

DATA MINING & MACHINE LEARNING

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1. ABSTRACT:

Smartphones are changing humans' lifestyles. On smartphones, applications (apps) provide users with access to a broad range of services they need in their daily lives. The apps on a smartphone are loaded with a lot of information about its user, including demographics, interests, and needs. It is also possible to interpret from personality data. We can use this information to understand smartphone users and what can be made from the data for a better understanding of future users. The goal of this report is to understand the users based on their personality details and other factors to approach future users. We have used basic descriptive statistics and data visualization to understand the trends and underlying structure of data. We also used knn-clustering and random forest classification to see the important factors and groups that the users fall into.

Keywords: Smartphones, Visualization, Correlation , Clustering, Decision tree.

2. INTRODUCTION:

In this article, a user representation framework is proposed, where we model the underlying relations between various factors. *Smartphone Tech* has hired us data scientists to analyze and interpret the data to understand more about their future customers. The dataset consists of 13 variables. By implementing necessary statistics and machine learning techniques, we have come to certain conclusions about predicting what kind of people fall under certain categories of the given factors which can give the company an idea about how to better understand their future customers.

3. DESCRIPTIVE ANALYSIS AND DATA VISUALIZATION:

We use Descriptive Statistics and Data visualization to uncover the underlying structure of a data set. The visualization of data gives us a clearer understanding of its meaning by giving it visual context through graphs. By skimming the data, we see that the data set has 529 rows and 13 columns, where there are 2 categorical values and 11 numerical values. There are no missing values. We can see that the minimum age of a person is 16 and the maximum is 74. It is observed that Conscientiousness, Agreeableness and Openness are left skewed i.e a greater number of values are on the higher end than the lower side. Age is right skewed i.e there are more younger people in the dataset than older people.

Cloud Computing

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Abstract—Suppose you want restructure your business application and reduce the cost of the software and its application. The special applications which are being used in current market are too costly and need highly skilled labour to maintain them. This business application requires huge data, they require big office space; maintain cost, electric power, bandwidth, network, servers and storage. Also, they require complicated software and huge expert to solve configure and maintain them. Assume each servers remain stable they require upgrades or updates of software to ensure that business does not break. The chances of breaking the software application when there are any upgrades to the software. Assume to maintain a big application and it might require more software or business apps and to maintain it requires huge costs to acquire and maintain them.

The solution for the above problem, power computing is one of the better option to setup your own application which can run on their shared data centers which can be used as utility and can cost less. Example, Gmail which does not require servers and storage it uses cloud computing. When you use any application that can run on Cloud, you can login and customize the application

I. Introduction

A cloud computer provides a simple interface that allows end users to allocate large amounts of computing power and storage space at the touch of a button. However, many potential users of cloud computers have needs much more complex than simply the ability to allocate resources. In scientific domains, it is easy to find examples of workloads that consist of hundreds or thousands of interacting processes. A user that wishes to run such a workload on a cloud computer faces the daunting task of deciding how many resources to allocate, where to dispatch each process, when and where to move data, and how to deal with the inevitable failures. For this reason, many users with large workloads are reluctant to move away from the predicable environment of a single workstation or multicore server.

Abstractions are an effective way of harnessing large cloud computers while insulating the user from technical complexities. An abstraction is a structure that allows one to specify a workload in a way that is natural to the end user. It is then up to the system to determine how best to realize the workload given the available resources. This also allows the user to move a workload from one machine to another without rewriting it from scratch. The concept of abstraction is fundamental to computer science, and examples can be found in other software systems such as compilers, databases, and file systems.

Map-Reduce [9] is a well-known abstraction for cloud computing. The Map-Reduce abstraction allows the user to specify two functions that transform and summarize data, respectively. If the desired computation can be expressed in this form, then the computation can be scaled up to thousands of nodes. The Map-Reduce abstraction is well suited for analysing and summarizing large amounts of data, and has a number of implementations of which the open source **Hadoop** [6] is the most widely deployed.

But are there other useful abstractions? In our work with several scientific application communities at the University of Notre Dame, we have encountered a number of large workloads that are regularly structured, but do not fit the Map-Reduce paradigm. In each case, we found workloads that were easy to write on the chalkboard, possible to run on one machine, but very challenging to scale up to hundreds or thousands of nodes. In each case, our research group worked to design an abstraction that could represent a large class of applications, and was able to execute reliably on a cloud computer.

II. Overview

Cloud Computing provides us means of accessing the applications as utilities over the Internet. It allows us to create, configure, and customize the applications online.

2.1 What is Cloud?

The term **Cloud** refers to a **Network** or **Internet**. In other words, we can say that Cloud is something, which is present at remote location. Cloud can provide services over public and private networks, i.e., WAN, LAN or VPN.

Applications such as e-mail, web conferencing, customer relationship management (CRM) execute on cloud.

2.2. What is Cloud Computing?

Cloud Computing refers to **manipulating, configuring,** and **accessing** the hardware and software resources remotely. It offers online data storage, infrastructure, and application.

Big Data Analysis

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Abstract---Big data is very large, distributed aggregations of loosely structured data that often incomplete and inaccessible. On a broad scale, data analytics technologies and techniques provide a means to analyze data sets and draw conclusions about them to help organizations make informed business decisions. BI queries answer basic questions about business operations and performance. Big data analytics applications enable big data analysts, data scientists, predictive modelers, statisticians and other analytics professionals to analyze growing volumes of structured transaction data, plus other forms of data that are often left untapped by conventional business intelligence (BI) and analytics programs.

Keywords---Data Scientists, Modelets, Statisticians, Business Intelligence.

I. WHAT IS BIG DATA?

BIG data analytics is the often complex process of examining large and varied data sets -- or big data -- to uncover information including hidden patterns, unknown correlations, market trends and customer preferences that can help organizations make informed business decisions. On a broad scale, data analytics technologies and techniques provide a means to analyze data sets and draw conclusions about them to help organizations make informed business decisions. BI queries answer basic questions about business operations and performance.

Big data analytics is a form of advanced analytics, which involves complex applications with elements such as predictive models, statistical algorithms and what-if analysis powered by high-performance analytics systems.

II. EVOLUTION OF BIG DATA ANALYTICS

The concept of big data has been around for years; most organizations now understand that if they capture all the data that streams into their businesses, they can apply analytics and get significant value from it. But even in the 1950s, decades before anyone uttered the term “big data,” businesses were using basic analytics (essentially numbers in a spreadsheet that were manually examined) to uncover insights and trends.

The new benefits that big data analytics brings to the table, however, are speed and efficiency. Whereas a few years ago a business would have gathered information, run analytics and unearthed information that could be used for future decisions, today that business can identify insights for immediate decisions. The ability to work faster – and stay agile – gives organizations a competitive edge they didn’t have before.

III. WHY IS BIG DATA ANALYTICS IMPORTANT?

Driven by specialized analytics systems and software, as well as high-powered computing systems, big data analytics offers various business benefits, including new revenue opportunities, more effective marketing, better customer service, improved operational efficiency and competitive advantages over rivals.

Big data analytics applications enable big data analysts, data scientists, predictive modelers, statisticians and other analytics professionals to analyze growing volumes of structured transaction data, plus other forms of data that are often left untapped by conventional business intelligence (BI) and analytics programs. That encompasses a mix of semi-structured and unstructured data -- for example, internet clickstream data, web server logs, social media content, text from customer emails and survey responses, mobile phone records, and machine data captured by sensors connected to the internet of things.

IV. EMERGENCE AND GROWTH OF BIG DATA ANALYTICS

The term big data was first used to refer to increasing data volumes in the mid-1990s. In 2001, Doug Laney, then an analyst at consultancy Meta Group Inc., expanded the notion of big data to also include increases in the variety of data being generated by organizations and the velocity at which that data was being created and updated. Those three factors -- volume, velocity and variety -- became known as the 3Vs of big data, a concept Gartner popularized after acquiring Meta Group and hiring Laney in 2005.

Separately, the Hadoop distributed processing framework was launched as an Apache open source project in 2006, planting the seeds for a clustered platform built on top of commodity hardware and geared to run big data applications. By 2011, big data analytics began to take a firm hold in organizations and the public eye, along with Hadoop and various related big data technologies that had sprung up around it.

Initially, as the Hadoop ecosystem took shape and started to mature, big data applications were primarily the province of large internet and e-commerce companies such as Yahoo, Google and Facebook, as well as analytics and marketing services providers. In the ensuing years, though, big data analytics has increasingly been embraced by retailers, financial services firms, insurers, healthcare organizations, manufacturers, energy companies and other enterprises.

Internet of Things

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***Abstract*—**IoT has become one of the most important technologies of the 21st century. Now that we can connect everyday objects—kitchen appliances, cars, thermostats, baby monitors—to the internet via embedded devices, seamless communication is possible between people, processes, and things.

By means of low-cost computing, the cloud, big data, analytics, and mobile technologies, physical things can share and collect data with minimal human intervention. In this hyperconnected world, digital systems can record, monitor, and adjust each interaction between connected things. The physical world meets the digital world—and they cooperate.

Industrial IoT (IIoT) refers to the application of IoT technology in industrial settings, especially with respect to instrumentation and control of sensors and devices that engage cloud technologies. Refer to thisTitan use case PDF for a good example of IIoT. Recently, industries have used machine-to-machine communication (M2M) to achieve wireless automation and control. But with the emergence of cloud and allied technologies (such as analytics and machine learning), industries can achieve a new automation layer and with it create new revenue and business models. IIoT is sometimes called the fourth wave of the industrial revolution, or Industry .

***Keywords*—**Wearable, Thermostats, ZigBee, AMQP, CoAP, LoRaWAN, Amazon Web Services (AWS),

The following are some common uses for IOT: Smart manufacturing, connected assets and preventive and predictive maintenance Smart power grids, Smart cities, Connected logistics, Smart digital supply chains, Connected logistics Smart digital supply chains

I. Introduction

THE IoT is considered as a pillar of future Internet and expected to enable intelligent operations and advanced communications of devices, smart objects, systems, and services. Indeed, it is a new revolution in communication technology which means that everything, from tires to hairbrush, will be assigned a unique identifier so can be addressed, connected to other things and exchange information. There is no exact or standard definition of the IoT yet. defined as "based on the traditional information carriers including the Internet, telecommunication network and so on, Internet of Things (IoT) is a network that interconnects ordinary physical objects with the identifiable addresses so that provides intelligent services". In [4], the author suggested a definition of IoT as "a world wide network of interconnected objects uniquely addressable, based on standard communication protocols", semantically as its origin expression is composed of two words: "Internet" and "Things" .However, the true value of IoT is in its ability to connect a variety of heterogeneous devices including everyday existing objects, embedded intelligent sensors, context-aware computations, traditional computing networks and smart objects that differ in their design, systems, protocols, intelligence ,applications, vendors, and sizes. These entities a reable to communicate and integrate with each others to collect, generate, process, and exchange data through applications and management systems residing on data centers or network clouds. This helps to carryout complex operations and intelligent tasks cooperatively and to make decisions independently

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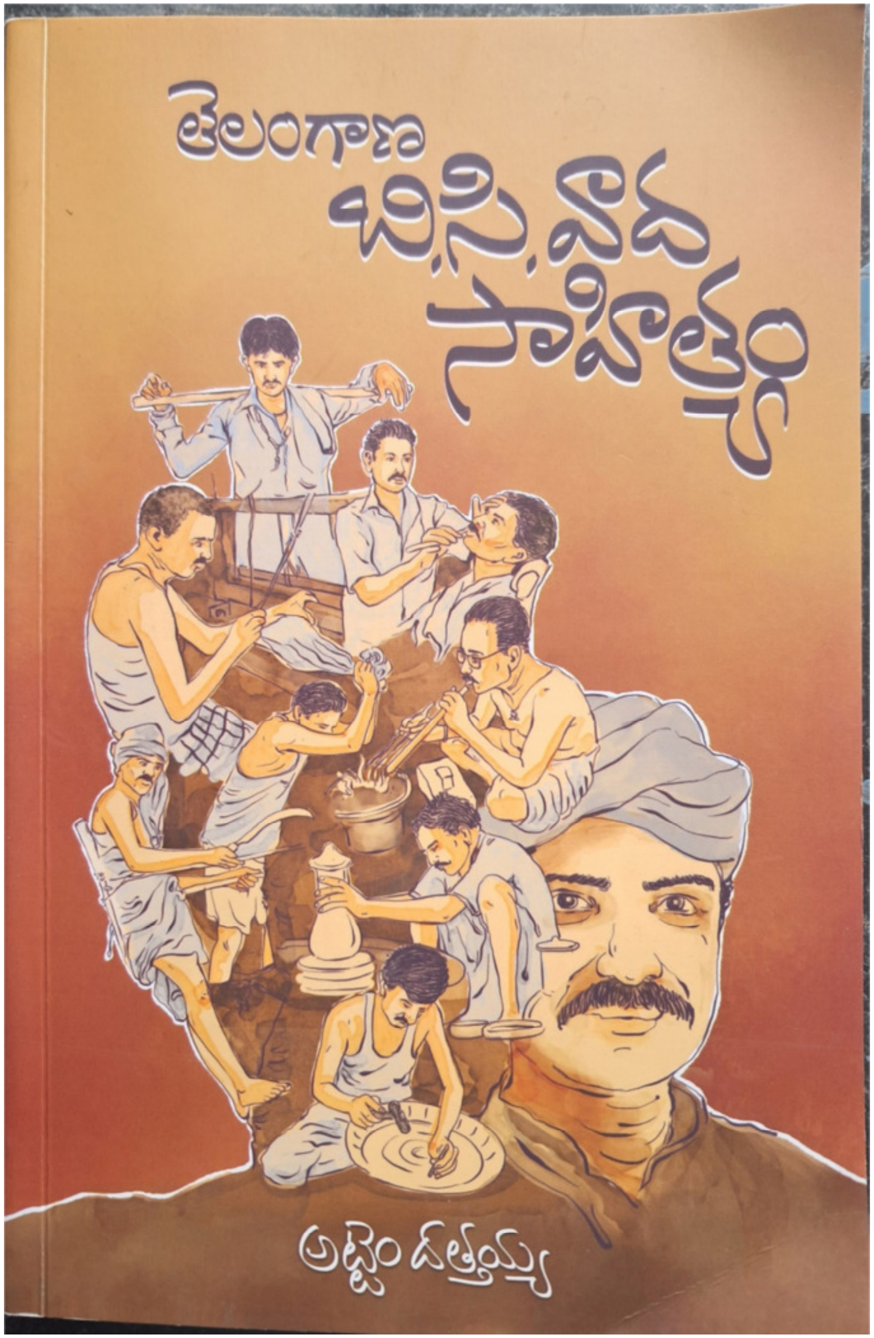

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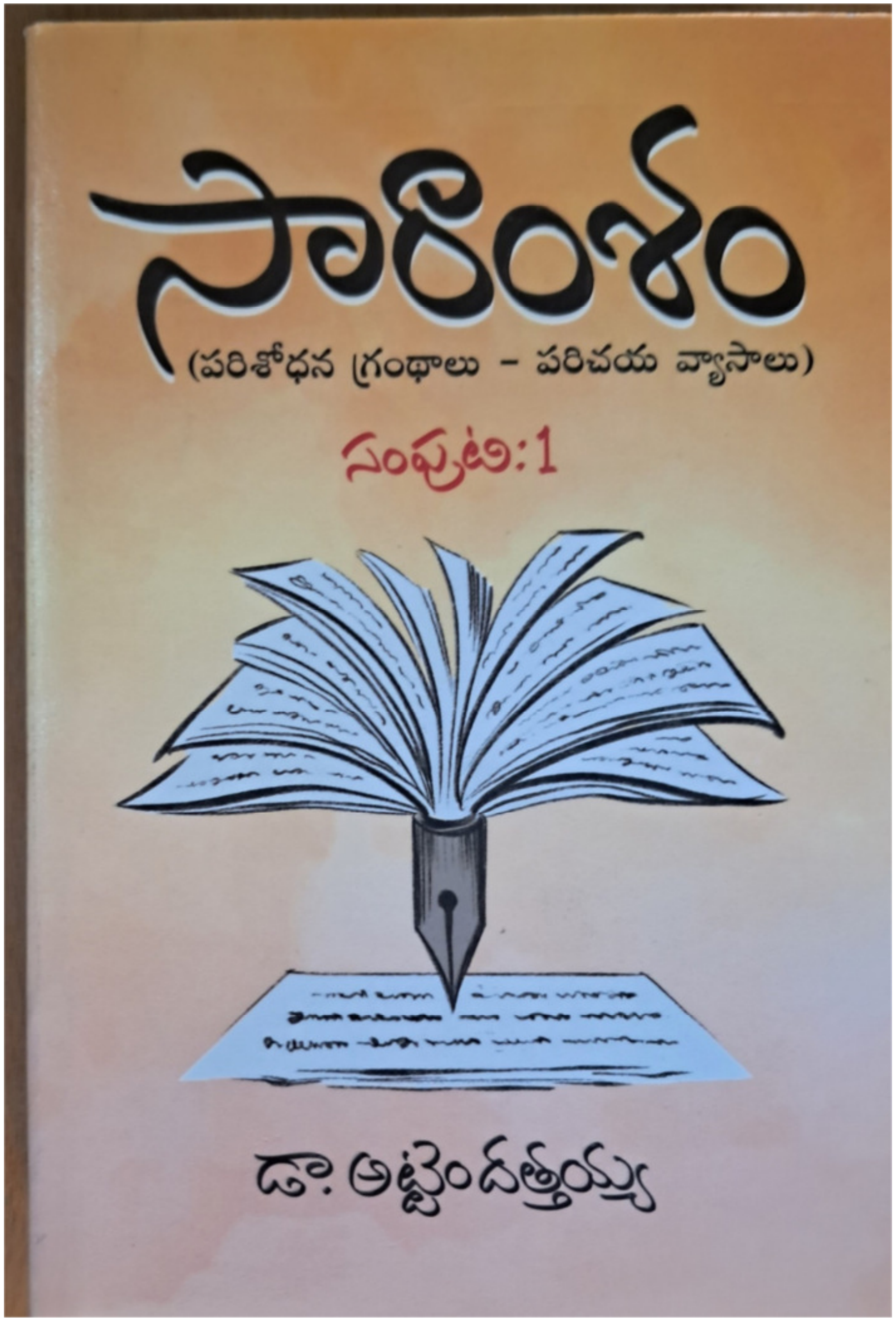

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A Study of Chamatkara Chandrika Radha and Krishna in Puranas

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Abstract

Radha and Krishna are worshipped across the globe in general and in India in specific. Radha and Krishna are seen as the epitome of love and affection. Devotees can find the references of Krishna in many Puranas apart from Mahabharata, the great epic, but they have a little knowledge of her presence in different Puranas.

The Puranas played an important role in shaping the Indian culture. They explained the teaching of Vedas in simplified manner for common people. The Puranic literature, once considered as a wild mass of myths and legends, deal with diverse topics which form a valuable source for understanding the richness of the Indian culture.

One among the fascinating themes in the Puranas, is the legend of Krishna and his *leelas*with*Gopis* in *Vrindavana*.Radha was the most beloved for Krishna in these *leelas*. The pair of Radha and Krishna, in later times, became so popular that Krishna was even called. The devotees from started celebrating and enjoying the marriage of Radha and Krishna.

Since Radha is related to Krishna, many think that she was mentioned in all the Puranas that depicted Krishna, more specifically the Vishnu Purana, Bhagavata Purana. To their shock Vishnu Purana does not mention Radha and even the Bhagavata Purana that mentions the names of the *Gopis*at 10.30, 38-39 is silent about Radha.Thusabsence of references to Radha in the early *Mahapuranas*, Mahabharata and Harivamsa indicates that the character Radha is developed later.

If all the 18 *Mahapuranas* are searched referred*Agni*, *Garuda*, *Kurma*, *Linga*, *Vamana*, *Vishnu*, *Brahma*, *Bhavishya*, *Varaha* and *Markandeya* Purana does not contain even a single reference to Radha. *BhagavataPurana*gives a veiled reference to Radha. *Matsya*, *Skanda* and *Brahmanda Puranas* provide stray references about Radha.*Brahmavaivarta*,*Narada* and *Padma Purana*gives a detailed description of the origin of Radha and her divine form.