BIG DATA ANALYTICS FOR HUMAN-COMPUTER INTERACTIONS:

A NEW ERA OF COMPUTATION

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IoT and Big Data Analytics

(Volume 3)

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PREFACE

Human-Computer Interaction has dramatically altered computing. The goal is to create appropriate levels for display resolution, color utilization, and application accessibility. HCI research concentrates on developing methods and approaches to assist individuals with usability and user experience. The popular graphical user interfaces are used by desktop programs, internet browsers, mobile computers, and computer kiosks (GUI). Voice user interfaces (VUI) are utilized in voice recognition and synthesizing systems, and the development of multi-modal Gestalt User Interfaces (GUI) lets people interact with embodied character agents in ways that existing interface approaches allow. Instead of building traditional interfaces, many research fields have focused on principles such as multimodality rather than unimodality, autonomous computer interactions rather than instruction-based ones, and lastly active rather than passively integrations. Big data refers to massive amounts of data that cannot be handled by typical database management systems. Big data sources include data from numerous sensors, healthcare, and networking websites. This exponential expansion of data presents a number of issues in today's digital age, where data publication plays a significant part in all aspects of health and the economy. Big data might be unstructured text or well-organized data. This massive amount of information with varying dimensions poses two fundamental issues in the big data domain: raw large amounts of data. Big data integration may be used to create ecosystems that incorporate structured, semi-structured, and unstructured content from public data. However, the primary problem is with the confidentiality limits in data publication. Individuals' right to privacy may be described as their ability to control how and to what extent information about them is shared with others. As a result, there is a significant need to examine informational privacy and anonymity problems in Big Data. This book compiles high-quality academic papers and industrial practices on HCI Challenges for Big Data Safety and Confidentiality. In order to construct the human-computer interaction modeling, communications assumptions, graphic and manufacturing design disciplines, cognitive science, linguistics, and disciplines such as sociology, social psychology, and human elements are employed. Human-machine interaction (HMI), computer-human interaction (CHI), and man-machine interaction (MMI) models are other names for human-computer interaction approaches. Algorithms and approaches for building novel computer interfaces are among the features and functionalities of human-computer interaction frameworks.

• Creating programming skills and library procedures to enable the interface to be implemented.

• Evaluating the appropriateness and intended goals of created and managed human-computer interfaces.

• Investigating the consequences and significance of human-computer interactions.

• Identifying analytical frameworks and contexts for implementing human-computer interface modeling, such as determining the values of inspiring computational architecture and computing interaction.

It comprises outcomes from long-term study and innovation in the theories, architecture, deployment, and evaluation of human interaction. Furthermore, the book will investigate the influence of Privacy Preservation of Big Data on healthcare, industry, government, and public sectors. Finally, I hope that this book will play an essential part in this new era of science and technology.

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CHAPTER 1

Big Data Introduction

Abstract: Big Data is a new social and economic development engine worldwide. The accumulation of data globally is approaching a critical threshold due to recent innovations in health, education, and other sectors. Data complexity depends on data volumes, diversity, speed, and truthfulness. These also affect the capacity to find big data analytics and associated tools.

Big Data Analytics is a significant challenge in developing highly scalable data and data integration algorithms. New algorithms, methods, systems, and applications in Big Data Analytics are potential discoveries that will effectively identify valuable and hidden information in Big Data. This chapter discusses big data, and its history; Big Data drives the world's modern organizations. There is a need to convert Big Data into Business Intelligence that enterprises can readily deploy. Better data leads to better decision-making and improved strategies for organizations.

Keywords: Conventional source, Constraints, Digital storage, ETL, Logical analysis, Multi-structured information, Meta-data, Quantification, Relational database, RFID, Sustainability, Tabulating machine, Web interaction.

INTRODUCTION

Nothing will influence advanced analytics more than the continued proliferation of additional and substantial knowledge resources in the coming years. When analyzing consumers, the days of depending entirely on demography and pricing information are over. Virtually every sector has at least one new research instrument or new data source coming online if it is not already. Some sources of information are extensively available in several sectors; others only concern a relatively limited number of companies. Many of these sources are covered under a brand-new phrase, big data [1].

Big data is used all around and have various advantages. Ignoring big data in an enterprise is not possible. To remain competitive, companies must take active action to capture and analyze the knowledge resources knowledge associated with Big Data analytics.

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This chapter starts with a history of big data. It will then discuss a series of aspects of how a company may employ Big Data.

WHAT IS BIG DATA?

There is no universal agreement on describing large amounts of data in the competitive environment, but some consistent themes exist. Gartner's Merv Adrian's initial description is seen in an article in Teradata Magazine in Q1, 2011. He claimed that “Big data surpasses the capability of a widely used hardware environment and software applications for capturing, managing, and processing within a reasonable period for its target audience. “Big data is an information set that is larger than the capability to record, store, maintain, and evaluate standard database software applications”.

These descriptions suggest that, as technology improves, significant data will alter in time. The data which is Big nowadays would not be big enough to be known as Big Data tomorrow. Some people have found this component of the description of Big Data disturbing. The above criteria also indicate that Big Data may vary according to industry or organization if existing capabilities and technology differ widely.

A few noteworthy facts in the McKinsey study help to highlight the amount of data available today:

$600 may be enough today to buy a disk drive to hold all the music from the globe. Every month on Facebook, there are 30 billion bits of data shared. 15 out of 17 industries have more data than the U.S. Library of Congress.

MEANING OF BIG DATA

Big data requires a great deal of data, but big data solely does not mean the volume of information. Extensive data also have enhanced speed (*i.e.*, the rate of transmission and receipt of data), complexity, and variety in comparison with primary sources of data [2]. It means that when you work with extensive data, you're obtaining much data. Information is arriving at you quickly from several sources in various formats.

It is essential to build different analytical techniques and methods using updated technology and approaches to evaluate and react successfully to Big Data. Before this chapter is concluded, we will discuss the efforts being made to manage and process big data.

HISTORY OF BIG DATA

Big Data may have a brief history, but many of its foundations were laid down long ago [3]. Before computers became commonplace (as we now know them), the idea that we were creating an increasingly ready-to-analyze technology was prevalent in academia.

While it may be easy to forget, our improved capacity to store and interpret information has been gradually increasing – although the developments of digital storage and the internet certainly have intensified at the end of the last century.

Big data offers a brief overview of the history of thought and creativity that led to the dawn of the Internet era.

Ancient History of Data

C 18,000 BCE

Tally sticks were the first examples of human storage and study. Ishango Bone was found in Uganda in 1960 and is considered one of the earliest techniques of prehistoric data storage. The Palaeolithic tribes used to trace trade activity or supplies with sticks or bones. Sticks and notches weres measured to conduct simple calculations and to determine how long they will have a food supply.

C 2400 BCE

In Babylon, the abacus was the first tool built explicitly for calculations.

300 BC – 48 AD

The Alexandrian Library is probably the most important data set in the old world. Sadly, in 48 AD, the invading Romans are believed to have destroyed it, perhaps accidentally. Contrary to the common myth, not everything was lost – essential parts of the library's collections have been moved or stolen and scattered around the old world.

C 100 – 200 AD

Greek scientists, presumably, produced the Antikythera mechanism, known as the first mechanical computer. The "CPU" consists of 30 bronze fasteners and is believed to have been designed for astrological purposes and to track the Olympic

CHAPTER 2

Human-Computer Interface Introduction

Abstract: HCI is creating and developing interactive computer systems in which users can communicate with each other. It covers both laptops and embedded systems in various devices. The success of technology comes simply from the user's ease of interacting with it. The customer will automatically disregard the product or technology when the interface is wrong or difficult to use. A convenient and easy way of using a device does not mean that behind such a system is simple technology; a very sophisticated technology is required to construct it. Functionality and accessibility are the main principles of HCI. Systems services are customarily called functions. Functions are commonly referred to as services delivered by a device. Usefulness is where users simply, correctly, and explicitly use the device's features. Features and usability could differ between systems. This chapter, "Human-Computer Interface (HCI)", deals with man-machine studies or man-machine interaction design, execution and assessment of computer systems and related phenomena for human use.

Keywords: Closure design dialog, Display design, Human-Computer Interface (HCI), Graphical User Interface (GUI), Information access cost, NLS design, Proximity principle, Perception, Redundancy gain, SAGE, SD-ROM, Top-down processing, Ubiquitous computing, Voice interface data, WIMP configuration.

INTRODUCTION

The interface between people and machines is the key to facilitating this relationship. Human interaction with computers, in many aspects, is crucial. Today, the most prevalent visual user interfaces (GUI) are being used for desktop applications, internet browsers, mobile devices, ERPs, and computer kiosks. Voice User Interfaces (VUI) are used for automatic speech recognition and synthesizing technologies. The emerging multimodal and graphical user interfaces (GUI) allow people to interact unrealistically with embodied character agents. New techniques have been developed to improve the quality of human-computer interaction within the field. Instead of developing standard interfaces, the different research branches have focused on the idea of multimodality rather than unimodality, innovative adaptive interfaces, and eventually active instead of passive interfaces [14].

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As “a field dealing with architecture, assessment and execution of digital computers for the use of people and the study of significant phenomena around them”, the Association for Computing Machinery (ACM), one critical aspect of HCI is customer retention or user satisfaction. “Since contact between the human and computer studies a human and a communication system, it depends on the machine and the human side of related information. Side strategies are important for computer graphics, operating systems, language programming and development contexts. Communication theory, linguistics, psychological science, cognitive psychology, social psychology, and human factors such as computer user satisfaction on the human side are important. Moreover, engineering and design approaches are important. Due to its multidisciplinary existence, HCI contributes to its performance through persons of diverse backgrounds. HCI is also known as the interaction between human and machine interaction (HMI), the interaction between human and machine (IME), or computer-human interaction (CHI).

Poorly built interfaces between humans and computers can cause several unforeseen problems. The classic case is the explosion of Three Mile Island, a nuclear crash in which studies have suggested that the configuration of the human-machine interface caused at least part of the incident. Similarly, aviation crashes result from fabricators' decisions to use standard aircraft instruments or throttle quadrants. While in the simple relationship between humans and the plane, the latest designs have been suggested to be superior, pilots have already incorporated the 'standard'. In reality, the design and conceptually positive ideas had unwanted consequences.

The Interface for Human Computers (HCI) was historically referred to as the relationship between man and machine. It addresses not only operating machines' design, execution, and assessment but also associated human phenomena.

In all disciplines, HCI should be used where device installation is possible. Any fields of distinctive significance in which HCI can be applied are discussed below.

Informatics - for device design and engineering:

- Analytical and Theoretical application Psychology.
- Sociology − for techniques-organizational Engagement.
- Industrial design − for smartphones, microwaves, *etc.*, digital products.

ACM – SIGCHI stands for Computer Machinery Association − Computer-Human Special Interest Group, the world's largest organization of HCI. In SIGCHI, computer science is described as the HCI primary discipline. It emerged as an interaction proposal in India, primarily rooted in design.

Objective of HCI

This topic aims to study how user-friendly interfaces or experiences can be designed. Taking this into account, we understand the following [15]:

- How immersive environments are designed and evaluated.
- How to minimize time across cognitive and task models.
- Immersive interface construction procedures and cognitive biases.

HISTORY

Multiple milestones are listed below, from the original machines which process the ton to the user-centered architecture.

- The improvement of the H/W technology led to a massive rise in the power of computers (*e.g*., ENIAC 1946). People began to dream about new ideas.
- Motion sensing unit (the 1950s), a U.S. air protection system, utilizes the earliest VDU variant of the VDU, SAGE (semi-automatic ground environment).
- Scratchpad technology (1962) − Instead of using computers for anything other than data collection, Ivan invented Scratchpad.
- The concept of tool kit programming (1963) was brought by Douglas Engelbart − Small systems produced larger systems and components;
- Mouse (1968) - NLS Design
- Introduction of the Word Processor (online system).
- Personal Computer Introduction Dynabook (the 1970s) − Xerox PARC Small Speaker created.
- Concurrent desktop jobs, transitions between displays and jobs, sequential connectivity among windows, and WIMP configurations.
- The metaphor principle – Photocopier stars and alto were among the first to introduce the idea of a metaphor that helped make the GUI possible—becoming spontaneous.
- Ben Shneiderman's (1982) direct handling − First used in Apple Mac PCs (1984), decreasing syntax mistakes.
- Vannevar Bush presented hypertext (1945) to indicate non-linear text structure.
- Multimodality
- Different network (the late 1980s).
- Cooperative work assisted by computers (the 1990s) − correspondence mediated by computers.

CHAPTER 3

HCI Learning From Cognitive Web

Abstract: A cognitive framework is suggested in this article to monitor learning processes based on the combination of human-computer interaction. The observation is founded on the interaction of elements between humans and the computer. The adaptive architecture of cognitive learning is introduced for interaction between humans and machines. The authors have also chosen a topology tree as the hierarchical model of a low-dimensional educational space to perform online observations. In addition, the methodology for the BSM (coupling-manifold brain human cognitive scenario) is provided for the coupling morphism. It proposes that things be observed in a mental or learning diverse way. Finally, this chapter suggests developing new tools and implementing different functionalities integrating intelligent data analysis techniques. An area that still needs further work is the cognitive area, particularly towards helping build more accurate mental model.

Keywords: Computational, Computer simulation, Google brain, Indexing, Internet web, Knowledge base, Learning, Sense reality, Searching, Shannon, Smart Behavior, Sensor Technology, Search engine, Teletype Machine, Think deeper, Trigger, Web page.

INTRODUCTION

In this chapter, we will examine in detail the mechanism by which robots can automatically carry out such “logical inferences” and how knowledge may be gained from experiences. It emphasizes that Holmes has to look at the data from outside the globe and examine the 'facts' gained from his prior experience to draw his logical conclusions. In our regular lives, each of us carries a multitude of such 'look-ups' which enable us to recognize our friends, remember a name, or detect a horse vehicle. In addition, as some scholars have claimed, our capacity to talk and the foundations of all human languages are merely an extension of our ability to properly analyze and categorize last memory events. This memory of these events is undoubtedly necessary and a crucial part of our capacity to join the dots and understand our environment [25].

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The Basic Sense Reality

Some think that universal search is more than just a handy tool. Most of us search Google multiple times a day. We do not recall famous events, such as the battles of Lexington and Concord at Waterloo or the establishment of the East India Company in the Indian subcontinent. Even though we remember our history lessons, our minds frequently get deviated. Google comes to rescue us most of the time. The connectivity of various facts so that they can be put in a chronological sequence requires additional details, such as European *vs.* Indian history, which our brains do not instantaneously link in comparison; however, usually, in any such frame of reference, we can organize events more efficiently in a designated period. In such instances, Google's ubiquity gives immediate gratification and enhances our cognitive capabilities, even though it also decreases our need to record information.

Recent research has shown us that the Internet 'changes our mind'. In particular, we are decreasing our capability to read and absorb material profoundly, as Nicholas Carry's "The Shallows": What the internet does to our brains has been shown in it. The screening approach of connections on the web enables us 'to bounce from source to source and to return to any resource we have visited before. As a result, our drive and the capacity to concentrate and acquire an author's concepts are being steadily restricted.

There may be another complementary capacity, which will probably be strengthened and not reduced. Naturally, we discuss linking the points and making sense of our reality. Consider our remembrances: each looks detailed compared to the natural occurrence. Usually, only some parts of each encounter are remembered. Although we only need to "skim over" our memories without digging into each element when we need to make the connection, like remembering when or where we have encountered a stranger in the past, to correlate and utilize them to make more profound references.

Similarly, browsing the web is, again, rather a negative act to correlate different information pieces when trying to link points. Hanover Bush's MEMEX is now with each other through online searching. Maybe quite often, every moment we enjoy the same surfboard 'skimming activities' that Carry believes are damaging to us, we routinely uncover previously undiscovered relationships with people, ideas, and happenings [26].

Algorithm Indexing

Informatics is about quicker methods or algorithms. It is also about understanding why and how quickly an algorithm could be. For example, we observed a thousand checking if the index included 1 million items necessary for our basic computer system, which progressively contained each indexing entry starting from the start of the index. If the time taken by the computer quadruples the input size, the number of lines taken with this naïve approach corresponds precisely to the gradient magnitude. Data scientists call such behaviour a linear one, typically described as a linear algorithm.

Let us now analyze if our intelligent method is quicker than the naïve linear technique. Our better algorithms successfully remove half of the data from the initial check-in in the middle of the index and leave only the remaining half. The quantity of entries is reduced by half with each consecutive check until the operation finishes, either by discovering or failing the inquiry word. Imagine searching for a small book index with only a hundred entries using our better method. How often might the number 1,000 be halved? It turns out to be around 10, since 2 x 2 x 2 x 2 ... x 2, ten paragraphs, that is to say, 210, exactly 1,024 paras. Now that we think about our intelligent algorithm, namely, a million entries, working on a much bigger index, we can find that it can take 20 steps at the latest. Because one million or 1,000,000,000 is less than 1,024 to 1,024. When we write 1024 each, we notice that a million is beneath the value of 2, 20, or 220, each being a product of 10 2's. It is easy seeing that our intelligent algorithm would stop working slowly even if the web index were larger, say one million items, and now take 30 steps instead of 20. Technologists aim to develop algorithms with these kinds of behaviours. The number of steps required by an algorithm is considerably smaller than the input, so enormously big problems may easily be addressed. This is called the 'binary search' algorithm because the number of steps taken by the clever search algorithm, 10-20, or 30, is equivalent to a logarithm input size called 1.000,1.000,000,000 or 1,000.00. This is called the logarithmic time algorithm.

When we put in the Google index a search term, such as 'Obama, India', one of the Servers that handle our request will search the 'Obama' and 'India' web index entries, which provides the specific address in both of those websites. The sorted internet index with around 3 billion items does not require more than a very few hundred steps, at most 100 degrees. It is no issue for any one of Google's millions of servers to complete our research within a split-second period, as we show how quickly the exponential algorithm functions even on enormous inputs. Google, of course, has to process billions of searches a second, meaning millions of servers manage this demand. In addition, several copies of the website page are stored for execution on all these computers. Consequently, even before entering our inquiry, our results frequently begin to show.

CHAPTER 4

Thinking Tool Based HCI

Abstract: This chapter provides methods to systematically and efficiently examine massive complex systems to describe the conduct of a realistic CRT exercise in larger companies. Situations are explored to capture complicated probable futures, and suggestions for creating CRT exercises are provided. Complexity is organizations. As a result, a part discusses the intricacy of the interactions and interconnection between the four fields: physical, technological, cognitive, and social. This debate introduces two approaches to managing this degree of complexity. One of the offered approaches has been intended to separate this complexity into chunks in which huge organizations can generate impacts. This chapter presents the different operations that can be conducted on networks in which it is possible to capture a complex system such as a social system in a network form.

Keywords: Credibility, CRT, Controlling capability, Constraints, Cyber security, Cyber-physical system, Decision-making, Electromagnetic waves, Geno typical, Graphic vision, Hypothetical, Integrity, Morphological analysis, Neuroscience, Phenotypical, Preconceptions, Possibility, Plausibility, Socio-cognitive, Veracity.

SCENARIOS

A scenario is sometimes a hypothetical future in strategy formulation. In every future, a nation or an organization may confront a crisis in the future. In decision-making, a scenario typically captures several possible modifications for the model. The drop in the allotted budget is, for example, a hypothetical, and the analytics would like to comprehend what effect the reduction would have on performances. In architecture, a scenario is generally referred to as a 'test case'.

Strategic Planning

In all disciplines of science, the word scenarios are often used. In investigative designing, a setting in which the researcher exposes the experimental and control is constructed. In psychology, for example, the designers may be engineering conditions where a human subject feels worried if we wish to investigate human

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compartmental tension. These circumstances can be fictional and disappointing, but they are designed to communicate the phenomena.

These testing processes are the conceivable circumstances a machine will face in the future. They evaluate the abilities of the equipment to function in a wide variety of conditions. In economics, the scenario is often seen as fluctuations in a company's financial status or budgetary variances. In all of this, the basic notion of a scenario stays unaltered even though scenarios may take many shapes in numerous scientific disciplines.

One example shows how uncertainty may be combined to produce a realistic collection of forces (a background), which affect a network's efficiency [37].

We have avoided using the term “future” in the preceding description, especially as the notion of the situation is confused by suggesting that a situation may be solely about the coming years. We build scenarios to get to know the history in some analyses. In a circumstance that originated 20 years ago, when we identify the forces that created the context, we may explain this event. A straightforward argument is that we might not include sufficient information to describe the phenomena as in trying to comprehend a market choice made in the past.

In different sectors, the shape and structure of the situation will change. It can be a tale in strategy formulation, an excellent sheet containing the company's accounting budget, a sequence of psychologically exposed occurrences; a range of model parameters that a model optimization takes; or a flashing notion on a topic that can be asked in a work interview. Scenarios indicate uncertainty in the language employed. A scenario is a believable collection of forces the system may confront. Here we must stress that we employ the word 'credible' rather than 'possible', widely used, incorrect. A “potential” force set is not a scenario. It emphasizes what is feasible and what cannot make a script designer concentrate on the probability of anything happening. Veracity addresses how an internal situation may be brought together too rationally, consistently, and continuously create the whole circumstance. The difference between credibility and opportunity is essential because it moves the developer's emphasis from thinking about whether an event can focus on its inherent dynamism and make suggestions. What components must be brought together to make this scenario credible? This translates the attention from potential to argumentation, integrity, and intellectual consistency in general.

Authenticity, however, means a non-zero chance and an opportunity. Possibility focuses on the study of fundamental causes rather than just events. The distinction between the two analytical techniques resides in the angle used for the evaluation and the potential matching bias achieved. A 'bottom up' strategy is like credibility.

The essential elements are the fundamental forces that determine and form a situation's dynamics. We then analyze how these factors combine to make a crisis happen. Some of these contexts may not be reasonable enough (weakly reasonable) and are thus eliminated, while others are indeed possible and include. This technique gives us a highly plausible position that we earlier thoughtless possible. However, the only way a designer can concentrate on a local environment is without contemplating the entire scenario reasoning in the broader context. Syntax focuses on possibilities, but the semantics are the probability. There are numerous ways of constructing the situations in literary works: whether the script represents a simple arrangement, in a mathematical equation, of uncontrolled parameters or a space specified with a collection of elements that may affect the design of a context.

Instructional material can be accomplished in conventional mathematical modelling by sensitive analysis or quantitative analyses or by integrating probability into the model. A hypothetical definition is easy in this context, and the research focuses on assessing the consequences. Scenarios are viewed as tales in strategy formulation. In other cases, a more formal definition is that a scenario is seen as a group of elements that shape the probable space of opportunities. In this chapter, we will talk about CRT situations. Situations no longer reflect ordinary uncertainty. CRT offers the possibility of creating conditions: When blue constructs scenarios, purple tries to grab the spaces in the red simulation in its territory. Before we advance, an example would be helpful [38].

Let's look at John's example and his scenario work meetings. In the course of a CRT conversation, John may rely on the discussion with Martin and Amy. However, as we said earlier, CRT is not a basic obedience activity. The way of thinking is crucial in CRT. John had to do more than just execute a job during the CRT exercise (*i.e.* mock-up interview). John had to be more engaged and reflect on the practice. He wanted simulations on the probable queries he may receive in his thoughts. However, John had to consider seriously how he may cause Cindy and Michael doubts. It sounds too complex. Why would Peter instil in Cindy and Mitchell's thinking uncertainties?

Johnny already has seized possession of issues he will ask him if he controls Cindy and Mitchell's place of doubt. John can affect and re-form Cindy and Mitchell's inquiry space unintentionally. For example, suppose he has transferred over a brief duration among several professions and is concerned that his applications are unfavourable. He has the choice to wait; he's happy and sees whether he will be asked. Whether the inquiry is asked or not, the impact in both situations is likely to be wrong. It does not imply that this topic does not impact your choice regarding the fitness of John if it is on the table, but Cindy and

CHAPTER 5

Big Data Decision Computations To HCI

Abstract: This chapter deals with CRT calculations. The idea of experimenting, optimization, simulation, data mining, and large data is explained in plain language before introducing the intelligent architectures, which turn data into CRT system judgments. Most of the architecture may be employed in any circumstance outside the CRT. However, increasing this architecture to the ability of CRT provides unparalleled computing skills for both offline and real-time decision-making. In this chapter, augmenting these architectures with CRT capabilities offers unprecedented computational capabilities for offline and real-time decision-making situations equally.

Keywords: Analytic mind, Business intelligence, Big data, Conceptualization, Computer networking, Cause-effect connection, Data mining, Evolutionary algorithm, Global optimal solution, Human-in-loop simulation, HCI, Mapping points, Negotiation-based optimization, Resilience, Simulation CRT, Search optimization, Social intelligence, Secure communication, Think to model.

RED PARTNERING BASIC COMPUTING COMPONENTS

The Model-to-Think School (M2T) offers a more adaptable form for formal scientific investigation. The models, in this case, are like investigations, not only for solving the problem. The term "strategy" is used in M2T School rather than "solution" since it aims to find ways of transforming the means into goals. Models serve to specify the methods and objectives to define a problem.

From Traditional Problems to Computer Networking

Before technological debates on CRT, the distinctions between conventional problem-solving techniques and CRT should be explained. Fig. (**1**) shows the categorization of two ancient schools of thought which seek to differentiate in addressing problems.

The Think-to-Model School (T2M) combines conventional IA and numerical modelling into operations (OR). Within the military, the so-called Military Asses-

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sment Process (MAP) is used to teach process officials to address difficulties. The models, in this case, are like investigations, not only for solving the problem but also in order to determine, first of all, what the problem is. After determining the problem, the alternate course of action is expressed mathematically or subjectively. Still, *via* this description, the most appropriate course of action will be selected and implemented in an organised way. The term "strategy" is used in M2T school rather than "solution" since it aims at finding ways of transforming the means into goals. Models serve to specify the methods and objectives to define a problem. [49].

CRT is a method of M2T. In CRT, the activity is not subject to problem specification. As the participants experienced the scope, the connections and common occurrences might modify the context and identify new difficulties during the activity. This feature of CRT should be emphasized. CRT is usually addressed as an approach to issue definition. One team's problem is defining a new aim that must be achieved. A unique difficulty is found every time a new objective is identified. Organizations can rely on the T2M but depend upon the M2T method to generate further tests to tackle that new problem.

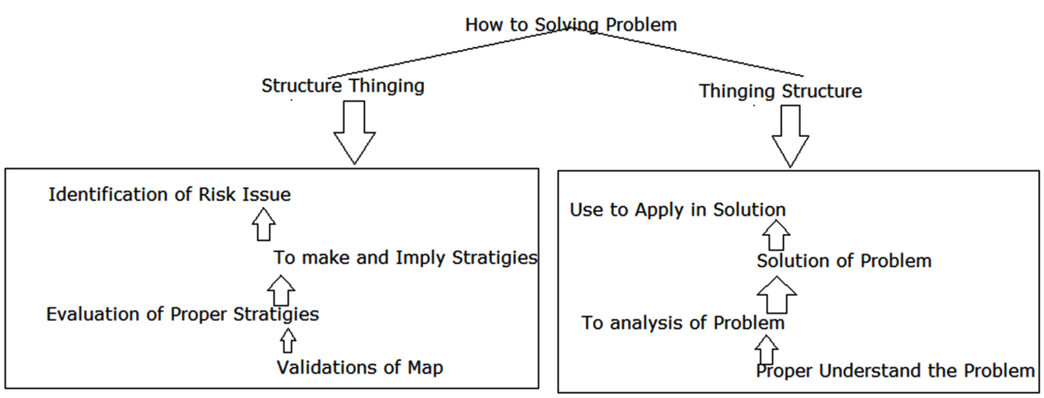

Fig. (1). Problem-solving schools of thinking.

CRT Example

Let us remember that challenges are associated with two core principles in the CRT. Decisions to criticize the institution under study are examined using a risk perspective. This part offers a synthetic scenario for a CRT exercise to show how various models are combined to produce a cohesive CRT environment.

There are two nations, Ram (red) and Bagaga (blue): Ramada is being developed, and Bagaga is being developed.

Ramada relies on Bagaga's external funding to offer its older people monetary assistance. Bagga provides this financial support to enhance the allegiance of the residents of Ramada to Bagga. To determine the impact of the various degrees of financial help that Ramada may give, Bagaga set up a CRT experiment. Bacaga's creation of this CRT exercise means Bagaga is represented by the blue team and Ramada's red squad [50].

Bagga's methodologies have been applied throughout the years to undertake CRT activities of the same kind. Bagga chose to use its capacity to carry out the CRT activity, given the intricacy of the issue.

Baggage created an extremely competent red team of five specialists: an anthropologist, a political psychologist and a psychotherapist (everyone with expertise in and dealing with Ramada); and a computer programmer (who knows how to machinate Ramada's regulations); (who specializes in running CRT models). To help the Red team, several professionals have also been engaged.

Baggage has established a blue team of specialists in international economic affairs and an informatics specialist in operational CRT models.

Both teams were told how the activity was to aim "for designing a plan for maximizing the value received by the Bagaga from Ramada's (benefit) financial help and for reducing financial support (cost)". The exercise is based on the following.

Every team has been allocated the following roles: "Blue teams must decide on the degree of financial support Bagaga could provide, while the red team must identify the weaknesses in the choice of the opposite team that could lead to a less than a projected return. On value".

The value for the money is described in this activity as:

$$\text{Value for money for the blue team} = \frac{Benefit}{Cost}$$

$$\text{Value for money for the blue team} = \frac{Positive\ Effects}{Negative\ Effects}$$

As a cycle, the activity continues. The blue team aims to decide Bagaga's financial assistance level. The conclusion of this choice will be shared with the defending side, who aim to assess Bagaga's decision's weaknesses. The red team delivers their results to the defending side using the amount of loyalty obtained in Exchange for financial assistance. The susceptibility cycle of financial support will remain until Bagaga can comfortably analyze the space well.

CHAPTER 6

Relationship Between Big Data, NLP, And Cognitive Computing

Abstract: The capacity to get insights and operations from data has not significantly altered with tremendous technological advances over the previous 30 years. Applications are generally built to fulfill default responsibilities or automate tasks; thus, the designer must prepare and write the logic for every situation. Computers are quicker and less expensive but not significantly more intelligent. Naturally, people are not more brilliant than they were 30 years before. For people and robots, this is going to change. A new generation of information technology emerges, starting with the automation technology from the previous computer model to offer a collaborative discovery platform. These technologies' initial wave has already increased human knowledge in several disciplines. These computers may draw meaning from volumes of natural language text as collaborators or collaborators for their human users and create and assess hypotheses in minutes based on analysing more significant facts than a person would absorb in a lifetime. That's the potentil of artificial intelligence. This chapter discusses a relationship between big data, NLP, and Cognitive Systems, voice in NLP component and performing the related tasks. This chapter contrasts unstructured data in written material, video, and images, designed for human consumption and interpretation and also explains big data's role in creating cognitive computing systems.

Keywords: Catalogs, Cognitive system, Classification, Context-free language, Data-oriented technologies, Dictionaries, Emotional variations, Hierarchical database, Intellectual system, Lexical analysis, Labels, MRI, NLP, Ontologies, Regression algorithms, Statistical techniques, Statistical techniques, Speech recognition, Tokenization, Videoconferencing.

INTRODUCTION

One element that distinguishes cognitive processes from other data-oriented technologies is the capacity in the context of the questions to handle, comprehend, and evaluate structuring data. In many companies, up to 80% of the recorded and maintained data is available. These papers, reports, e-mails, speech and pictures, and videos should be comprehended and evaluated for excellent decision-making to make sound judgments. For example, millions of papers in professional publi-

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cations can give novel therapy possibilities in a single year. There are thousands of media platforms discussions in the retail industry that indicate future trends. There's vital information that can influence a range of fi ages inside videoconferencing recordings.

In contrast to an original organized database that depends on schemas to provide meaning and context to data, unorganized data should be processed and annotated to significant components. The classification, thesauri, ontologies, labels, catalogues, dictionaries, and regression algorithms are tools to identify the significance of each word. The developer must construct and evaluate the hypothesis in a cognition team and provide alternative responses or insights at the related confidence levels. The information employed in the visual process is often text-based.

The NLP interprets connections between vast quantities of human language parts in this circumstance. The NLP approaches interpret the relationship.

An advanced analytic environment provides appropriate data to detect patterns or abnormalities. Extensive data collection is necessary for many scenarios. It is vital to have sufficient data within a memory structure, so the outcomes of analyses are confident and repeatable. An intelligent system needs data to be ingested and mapped so that the system may begin to find out where links between data sources start to generate insights. A cognitive system incorporates both structured and unstructured data to achieve the objective of providing insight into data. For information processing, structured data, for example, are generated in a database system. On the other hand, Unbuilt information is for human consumption and interpretation in the form of textual material, video, and pictures [61]. The importance of big data in building intelligent computer systems is explained in this chapter.

THE MAJOR ROLE PLAY NLP IN A COGNITIVE SYSTEM

NLP is a series of approaches to extracting text significance. These approaches identify the definition of a sentence, paragraph, phrase or document by detecting the principles of grammar—predictable characteristics in a speech. Individuals rely on the dictionary, repeating patterns of co-occurring phrases, and other contextual indicators to assess the significance. To infer importance in the text, NLP utilizes the same established practices. Furthermore, these approaches may detect and extract meaning components such as correct names, places, acts, or events, even across texts, to uncover the links between them. These approaches may also be used to detect duplicated names or locations in a database or examine comments or explanation fields in big datasets, for instance, over a period.

The Importance of Cognition System

The NLP task is to translate uncontrolled information into a meaningful knowledge base from an informational corpus. The book is divided into language analyses to give meaning. The content must be changed such that the user may ask queries from the knowledge base and receive relevant responses. Every system requires strategies and tools to allow the user to comprehend the data, either a hierarchical database, a query engine, or a depth of knowledge. The quality of information is the key to moving from data to comprehension. With NLP, data and the connections between words may be interpreted. It is vital to choose which knowledge to preserve and how to seek patterns for distilling meaning and contexts in the structure of that information.

NLP allows brain functions to retrieve text meanings. The whole context of phrases, languages, or complicated papers will enable you to comprehend the definition of a word or word. The real purpose of text-based data is crucial to evaluate in this situation. Patterns and connections between words/phrases in the text should be defined to understand the meaning and purpose of communications. When people read or hear a simple text, these characteristics are dynamically found and associated with words to determine meaning and understanding. Language is very ambiguous, and many phrases can have several different implications on how a topic is handled or how a word in one sentence, sentence, or paragraph is coupled with other words. The context is assumed when people convey information.

Just think, for example, that a driver would want to utilize a human brain to plan a journey. He must know the best way to travel, of course. However, knowing what weather events are expected throughout his travel week would be much better. He also would like to predict any significant buildings to be avoided. It is also helpful to learn which lanes restrict Lorries weighing above 10 tons. The truck driver could solve these problems. It would, however, necessitate you to connect several networks, examine various datasets and ask specific queries. Even if the truck driver fills all responses, the best route based on its criteria is not connected to a specified c-point. Two weeks later, the same truck driver had very different inquiries. This time, after transporting packages, the truck driver may arrange his homecoming, and he seeks to develop a holiday for his preparations. To connect and interpret the incomplete knowledge he collects, the recipient (the truck driver) must look at the example of an expert on lung cancer who examines an MRI. While several MRIs give accurate information to detect a disease, numerous shades of grey are present. The expert may wish to analyze the performance of MRI with other patients with similar problems. The doctor has been treating

CHAPTER 7

Electronic Automation of Smart Computing

Abstract: Automation is not a new phenomenon, and it automates the mechanization that helps us learn, develop, decide and act in a context, like a human being in the new paradigm change as a result of emerging technologies. Recent improvements in processing capacity, historical data availability, low-cost sensors, and systems for transmitting high-speed data give rise to the possibility of imitating and automating a mature human brain function. Businesses increasingly rely on software robot systems that mimic how people perform a repetitive activity and eliminate the need for human involvement. However, these systems cannot judge or learn from past actions and consequences, thus confining the automation process to basic repeating process automation. Integrating cognitive characteristics in robotic software systems, which makes the business digital, can address this challenge. This chapter discusses the developments and the problems faced in using cognitive systems, architecture, applications, and cognitive models for electronics manufacturing. This chapter also discusses the cognitive computing principle to improve the knowledge base and the dependencies between these components.

Keywords: Abstraction representations, Computational techniques, Cognition program, Machine-Learning algorithms, Prefrontal cortex, Iterative process, Analyzed personality, Correlations, Databases, Data protection, Security, Memory structure, Electronic health records, Predictive analysis, Neural circuitry, Supervised learning, Preconceptions, Regression, Behavioral microprocessor, Unsupervised learning.

INTRODUCTION

This new paradigm refers to a collection of premises and algorithms in the cognitive computing system that answers queries, solves issues, and finds new insights. The corpus is the information used to constantly update this model based on its experiences and community feedback. A cognitive system is intended to employ a domain model to forecast possible results. A cognition program is proposed in several phases. Therefore, a cognitive system is created to construct data assumptions, analyze theoretical frameworks, and decide whether the evidence presented is available to address issues. A cognition system provides

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end-users with a robust approach to learning and selection by exploiting machine-learning algorithms, question analyses, and computational techniques on available details, which can be organized or unstructured. Cognitive systems have been developed to learn from their data experience. A model components system employs algorithms for learning machines to create models that answer queries and provide insight. The architecture of a cognitive system has the following qualities:

A prefrontal cortex may create many solutions for each problem and provide answers and observations with the appropriate level of confidence. The system upgrades the model continually based on user engagements and new information. With time, the prefrontal cortex is mechanized. This chapter explains the main components that allow cognitive computing systems to learn, determine their dependence and detail their procedures within each element [71].

MENTAL ABILITY OF SMART COMPUTING

A cognitive computing system provides an integrated information collector (the corpus) and interacts with the external world to collect and update possible external data. Cognitive systems offer a novel approach to getting insight from various information resources. The Foundation for Cognition Computation Cognitive systems may utilize speech recognition to comprehend text and require additional processing, in-depth learning and picture, speech and video, and position comprehension tools. This processing capability allows the cognitive system to interpret material in context and evaluate a particular field of knowledge. The intelligent system produces hypotheses and offers answers or insights with related levels of trust.

Moreover, a cognitive system must learn more about topics and businesses in-depth. The cognitive system's life cycle is an iterative process. Integrating the most outstanding professional practice and data training is necessary for this iterative process. The fundamental components of a mental calculation system are shown in Fig. (**1**). In practice, essential elements, APIs, and bundled services develop over time. However, these principles remain the cornerstone even when services are integrated into systems.

Start now with an analysis of the corpus to explore the design of the intelligent computer system. As the content is the foundation of knowledge for the memory structure, you will create a specific topic model [72].

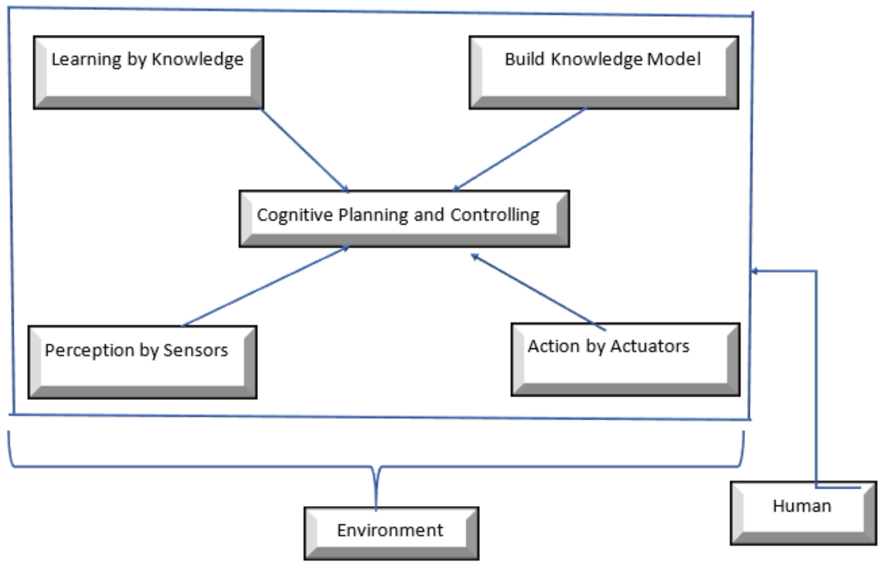

Fig. (1). Architecture of a cognitive system.

BUILDING THE CORPUS

A corpus is a microprocessor depiction of the whole domain or subject record. Experts in several areas utilize a corpus or corporate to analyze personality types or even establish the legitimacy of a specific piece for purposes like linguistic analysis. For instance, William Shakespeare's works may be an exciting corpus for someone studying literature during the 16th and 17th century French Renaissance. The Shakespearean canon and numerous other works covering his colleagues could be used by a scholar who studied theatre plays of the same period. Such a gathering can become easy if it originates from multiple sources, has different formats, and contains a massive volume of data unrelated to the investigated field. For example, someone who studies theatre shows might not be interested in Shakespeare's sonnets. It is just as essential to decide what to leave.

A corpus or company is the system's information to answer queries, find new patterns or correlations, and provide fresh insight into an advanced analytic application. However, a fundamental corpus must be developed and the data imported before deploying the system. The elements of this total corpus restrict the sorts of issues to be resolved, significantly affecting the system's effectiveness in organizing the data inside the canon. Therefore, before choosing the needed data sources, you need to properly know the region of your memory structure. What kind of issues would you like to solve? You may lack new and unexpected

CHAPTER 8

Representation of Knowledge in Taxonomies and Ontologies and their Application in Advance Analysis to Cognitive Computing

Abstract: This chapter focuses on how ontologies and semantic web technology can be used in artificial intelligence or systems engineering. Technological trends imply that future digital technology approaches and tools will use AI and ML technology. Logic-based reasoning and semantic modeling assist in classification, customization, and relationship detection but struggle to describe how decisions are made. Knowledge acquisition plays a vital role in using this form of AI. Ontologies are methods for mode modeling of reasoning domains required for digital fields instantiated in Digital System Models (DSM). They grow as digital twins and evolve with the physical instantiations of a DSM over time. Semantic innovations and ontologies codify knowledge of systems engineering as a prerequisite for reasoning using interoperable ontologies. This chapter explores the technologies behind advanced analytics and how they can be leveraged in a knowledge-driven cognitive environment. Advanced analytics help gaining deeper insights and predict outcomes more accurately and insightfully.

Keywords: Classifications and ontologies, Complexity, Conceptual clustering algorithm, Classification decisions, Descriptive analyses, Google investigators, Intellectual system, Logical notation, Minimal knowledge, MRI machine, Neural nets, Organizational learning, Object-oriented development, Predictive methods, Semantic webs, Sustainability, RDF, Representation knowledge, Syntax, Text analysis, URL.

INTRODUCTION

Data learning is fundamental to intelligent systems. If a system cannot exploit data without reprogramming to enhance its effectiveness, it is not regarded as a memory structure. But to do so, a wealth of data in the centre atmosphere must be made publicly available. The way a kid learns the universe through observation, experiences, and sometimes teaching is comparable. This section examines several essential pieces of knowledge in the organisation before examining complex and comprehensive methods to acquire knowledge: classifications and ontologies. Advanced analysis refers to a combination of approaches and algorith-

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ms to detect patterns in various degrees of complexity in big, complicated, or high-level data sets. It comprises complex predictive methods, forecasting, machine learning, neural nets, text analysis, and other modern technology for data mining. Some of the particular statistical approaches include random forest analysis, regression models and logistics analysis recommender systems, and time-series analyses in predictive stats. These analytical techniques assist in identifying trends and anomalies in vast amounts of data that anticipate organisational performance. Therefore, information systems are crucial in the long-term sustainability of a memory structure that can provide the appropriate answers to complicated queries and forecast results. This chapter covers the technology underpinning complex calculations and how they may be utilised in performing simulations based on an understanding. You may obtain more detailed insights and anticipate results more accurately and informatively using the proper degree of actionable insights [87].

REPRESENTING KNOWLEDGE

Information can contain facts or opinions. It should also incorporate standard knowledge management structures, such as ontologies and vocabularies, and connections, rules, or characteristics describing and categorising things (nouns). We may know, for example, that humans are animals and Robert is a person; therefore, Robert should have all the qualities animals have. We occasionally match learning to comprehension in humans, but computers aren't like that. Of course, without “understanding”, it is impossible to “know” much about a laptop.

Think about the cleverest persons you know for a minute. What makes somebody creative or innovative? It is more than a recollection of an encyclopedia. Intelligence is the capacity to gather, retain, evaluate, create, convey and use knowledge. One may conceive of a precocious youngster who may show symptoms of intellect before he has much information, without knowing much. In contrast, a person might know many facts but cannot use this information to achieve an objective [88].

Developing a Cognitive System

In constructing cognitive processes, there are several possible approaches. One effective method is the extensive use of data and analyzing patterns from those data without a specific inquiry. In 2012, a network of 16,000 processors was utilised. Google investigators randomly choose 10,000 pictures of YouTube films. In examining those photos in-depth, he identified a potential arrangement of shadings that sometimes looked distinct, seeking a more common sequence than a complex arrangement of pieces—regardless of colour, backdrop, pictorial qualities, and so on. It "found" a general model for cat pictures.

Although it was confirmed that patterns could be consistently detected in a large sample of data, it was merely a start. A more robust approach is taken in most intelligent computing devices. They are meant to teach users in a particular sector or domain, such as standard medical or customer services, and give value. One difficulty for the designers of cognitive systems is to capture and represent sufficient relevant information that will enable the system to increase or enhance its knowledge.

Each business and subject have its knowledge of history and language. These fields encompass many things, from medical systems and body components to motor parts in a preventive pilot training system. Each item might have specific regulations that regulate its interaction and behaviour. For example, an X-ray may have particular physical qualities as a distinct object type. Similarly, a wing nut in an aircraft part is connected with special regulations limiting how other components can be installed and serviced. To capture and convey this information, professionals need to sufficiently grasp their industry's terminology and rules to explain it to be formalised for machine processing [89].

However, enough information cannot be made available, even with the help of industry professionals, to develop a system that mimics a comprehensive grasp of a sector or a marketplace. The majority of intelligent functions, therefore, start with a relevant domain knowledge subset and then continuously expand and modify that fundamental model – with experience or training. This technique defines ontologies, focusing on a particular field of expertise.

The "cross-context" knowledge is another essential component in creating mathematical concepts. To attain greater levels of cognition, individuals or systems must be able to link data from several companies simultaneously. Humans, practically without effort, make this kind of association early in life. We learn how to bike and then use the weather, traffic, circumstances, *etc*., knowledge to drive safely and get where we plan to go. Does the cognitive system not propose materials or methods in our previous example on aeroplane components to connect the elements with safety and weather?

DEFINING TAXONOMIES, AND ONTOLOGIES FRAMEWORK

It is essential to clarify taxonomies and semantics before delving into specifics about maintaining information. Later, this is further discussed here, but definitions are now context-based. In a given research topic, taxonomy is a hierarchical method of collecting or selecting components.

CHAPTER 9

Innovation HCI Knowledge

Abstract: Design thinking has a significant influence on innovation in business, education, health, and other vital fields. This involves human-centered approaches lijke fast prototyping, and abductive reasoning. There are many parallels and contrasts between design visualized and a path to the innovative design of Human-Computer Interaction (HCI). In this chapter, we will discuss the method of Hasse diagrams for structured learning domains visualizing the progress of a learner through this domain and reducing attrition through early risk identification, improving learning performance and achievement levels, enabling more effective use of teaching time, and enhancing performance learning design/instructional design.

Keywords: Empirical analyses, Grammar-based methods, Hasse diagrams, HCI-KDD, Hashing method, Hyperbolic network trees, Internet slang, Linguistic detection techniques, LDA, Opinion mining, Parallel processing, Radar charts, Recommender systems, SVM, SHAP D2 algorithm, Semantic networks, Semantic compression, Vector space model, Vector space model, Web 2.0.

SOCIAL MEDIA PLATFORMS

Information extraction evaluates people's perceptions and attitudes towards various brands and organizations, goods, and even individuals and other writers use comparable 'image recognition. The user's growth of Web 2.0 and its contents has resulted in numerous modifications and exchanges of information. contents generated on Web 2.0 can contain a range of essential knowledge and views from consumer research, which can detect economic and hazard possibilities at a preliminary phase. The number of methods on the one side and the enormous volume of fast-increasing and dynamic elements are problems for quantitative consumer research on web 2.0.

In addition to the traditional problems that arise from processing natural languages and text, the identification and processing of views are compounded by different obstacles for recommender systems in social media platforms.

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• Noisy texts: user-created social media content tends to be fewer practitioners and academicians, casual, and errors in spelling. Such writings frequently employ emoticons, abbreviations, or an orthodoxy.

• Variations in languages: User-created writing often has irony and sarcasm; the text lacks relevant but secondary information about a particular subject.

• Relevance boilerplate: Web sites are generally covered in relevant information, such as adverts, browsing, or previews of other articles; debates and commentary can be diverted from the issues of non-relevance.

• Objective identifying: Search-based techniques to opinion mining typically have the difficulty of not necessarily matching the topic of the returned document. Web 2.0 is expressly the topic of many academic papers: Many studies covered weblog, for example, but most researched the relationship between blog postings and "real world" circumstances. In weblogs, just a few articles assess opinion mining approaches; no central guidance is provided for the utilized strategies. As for the categorization of blog feelings, examine several language characteristics with vocabulary and emotional elements and different learning algorithms to identify blog opinions. Surprisingly, little study has been discovered in discussion forums on opinion mining.

Microblogs – especially Twitter – seem to be quite interesting to academics, though several studies have been published focusing on microblogs. The major approaches to my thoughts about microblogs are supervised or semi-supervised studies. Although social network services such as Facebook are popular, limited research on opinion mining can be discovered in social networks. Several research articles deal with customer reviews, and not one particular technique appears to work best. Many writers utilize algorithms such as SVM or Naïve Bayes and come together with diverse approaches to improve the quality of image retrieval findings. LDA might be an excellent approach suggested an LDA model identifying together features and feelings. This paradigm posits that every word in one phrase covers a separate subject [100].

EMPIRICAL ANALYSIS

It is easy to inquire how the correct sample is drawn for the regulatory framework to start the econometric evaluation. In principle, a random sample is logical, but drawing a random sample is difficult. We have thus chosen to illustrate an example and construct a quota sample of self-selected sources. We specify the following restrictions to prevent confusion, systemic mistakes, and bias: We focus on one particular brand/company, Samsung, in your instance and on a specific timeframe for all social media outlets. We conduct a complete survey within this timeframe, where we draw up a random sample of the submissions because there are too many responses for a comprehensive survey. Because we do not wish to study the company's official posts, we rule out these posts. Four separate human labels categorized the data sets manually. Before labeling began, we discussed and set forth guidelines to ensure that labeling amongst these labelers is uniform. SPSS was used to do statistical computations. Criteria for evaluation. We must establish metrics to get different social media outlets. The indicators are based on two sources: (i) on single frequency based on analysis of contents and (ii) on the definition of opinions [101].

IMPACT ON OPINION MINING

The following implications for the machine translation process may be determined based on empirical observation:

Impacts on Opinion Mining Process

Numerous machine translation research articles presume that content is grammatically correct. However, the text created by users contains many errors, emoticons, and slang phrases on the Internet, as shown in the Empirical Analyses. Therefore, the preprocessing of Web 2.0 documents is appropriate and essential. In some situations, the text languages have changed on the same medium, *e.g.* Facebook posts published in English, Turkish, and other languages on the Deutsch Facebook site. In such circumstances, it is appropriate to apply linguistic detection techniques. Grammar-based methods are not generally acceptable because of grammatical errors. The data above demonstrate that the messages written by users contain slang and emoticons. These text sections might be an input to enhance the emotion categorization for feature creation. In addition, the term “Samsung Galaxy S3”, for example, is also called “Galaxy S3” and “SGS3”, making it more challenging to separate entities or features.

Social Networking Channel Features and Impacts. The table below provides a quick overview of the effects of each social media platform investigated:

EVALUATION EFFICIENCY OF SHAP D2 ALGORITHM

The primary goal of this chapter is to discuss current findings from research into more efficient algorithms for matching frequent patterns substrings and semantic decompression. As mentioned in the earlier articles describing the Sentence

CHAPTER 10

HCI: An Intelligent Learning Environment

Abstract: Society has evolved quickly, and individuals are continually forced to acquire new abilities *via*training. This means that education/training resources are substantially restricted; therefore, methods must be developed to tackle this problem. Intelligent Tutoring Systems (ITS) deployment is being proposed as a solution to address this problem. In addition, ITS makes it possible for users to learn and improve their abilities in a particular area. ITS adopts user actions and requirements in a non-intrusive and transparent manner to achieve this aim. The tastes and habits of the users must be known to deliver a tailored and adaptable solution. Therefore, the capacity to learn behavioural patterns becomes a crucial component for an ITS to succeed. In this article, we offer an ITS student model, which monitors the biometric conduct and style of the user throughout e-learning activities. A classification model supervises the student's work throughout this session. This chapter also emphasises the principles of intelligent learning differences for each activity. Information extraction techniques can automatically extract knowledge from the text by converting unstructured text into relational structures. To achieve this aim, traditional information extraction systems must rely on significant human involvement.

Keywords: Enhance Learning, Support Technology, LEI, Constructivist Learning Environment Scale, TICI, Digital Resources, Content Validity Ratio, SMART Classroom, Real-Time Interaction, Meta-Cognitive Skills, Knowledge Discovery Tool, Critical Thinking, Adaptive Problem-Solving, Open-Ended Learning Environment, Metacognitive Skills, Data Extraction Tool, Stack Overflow, Information Retrieval Technologies, Open Information Extraction, Web Corpus.

OPTIMIZING CLASSROOM ENVIRONMENT TO SUPPORT TECHNOLOGY-ENHANCED LEARNING

Scholars, educators, university officials, and school administrators have focused more on studying classroom settings during the last four decades. The physical layout of the classroom has been proven to impact both students' and instructors' conduct. A good classroom significantly impacts the students socially as well as academically. The three elements of assessing the learning environment are the physiological, social, and psychological components, with clear links between the

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psychosocial and physical environments. Learning Environment Stockpile (LEI), Constructivist Learning Environment Survey (CLES), and What Is Happening In This Class? (WIHIC) are list of questions in well-validated and reliable classroom setting instruments developed to measure students' preconceptions of class context or regulatory regime. While technology is advancing, technology-enhanced learning environments can range from simple computer classrooms to lavishly ordained classrooms with computer systems, LCD projectors, Internet access, and telecommunication technology, allowing remote and real-time access to a massive array of resources. The employment of computers and other digital devices in the classroom can alter the physical and psychological settings in both good and bad ways. Many studies have been conducted to quantify a technology-enhanced classroom environment. Tools such as the Constructivist Multimedia Learning Environment Survey (CMLES), The Technology Integrated Classroom Inventory (TICI), New Classroom Environment Instrument (NCEI) and the technology-rich Outcomes-focused Learning Environment Inventory (TROFLEI) have been suggested and validated.

These studies and tools may aid in understanding the physical and emotional needs of the students in a learning environment. Still, they couldn't tell you how to build and equip classrooms to promote successful and engaged learning. There is little study on maximizing today's student behaviour to meet the demands of the current generation of students[114].

Research Tools

Data was gathered using the ISTE Classroom Observation Tool (ICOT), as well as our Classroom Environment Questionnaire (CEQ) and Focus Group Interview Protocol (FGIP).

The ISTE Learning Outcomes Tool is a computer-based tool to assist researchers in assessing the type and level of technology integration in the classroom (ISTE).

The Classroom Environment Questionnaire (CEQ) was created using the SMART classroom paradigm, as illustrated in Fig. (**1**). Managing external conditions, educational materials, and student conduct entails a variety of designs and classroom management. The classroom's technology, systems, and resources should be simple to handle, including the classroom layout, equipment, surrounding environment, fire systems, network, *etc.* Digital resource accessibility refers to the ease with which students use digital money and expertise in the classroom, including utilising this data, content delivery, and access speed.

Real-time engagement and infrastructure networks enhance the capacity to assist classroom instructional and human-computer contact, including easy operation, seamless engagement, and proactive monitoring. Tracking the educational methodology in the classroom includes keeping track of the external surroundings, instructional method, and class participation. We created the CEQ based on the online educational model, consisting of 65 questions, including 11 questions about fundamental knowledge and 54 questions on classroom learning characteristics. We utilise the "content validity ratio" (CVR) to assess the questionnaire's validation. Five specialists (excellent instructors and topic specialists) were asked to rate the questionnaire's reliability [115].

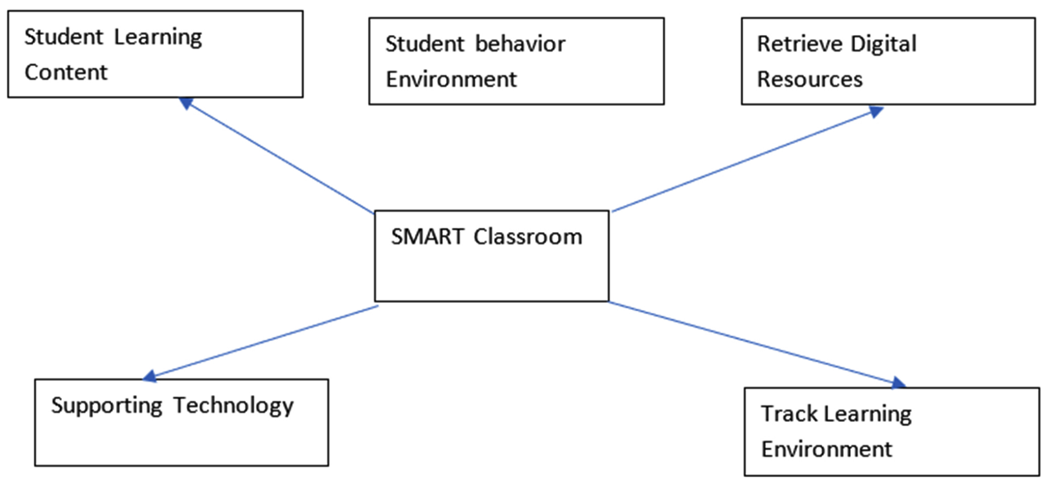

Fig. (1). Structure of SMART Classroom Model.

Focus group discussions are a versatile tool that may be used alone or in combination with other research strategies to help researchers dive deeper into the study of phenomena and better understand the research. The FGIP is divided into five sections based on the S.M.A.R.T. classroom model: presenting material, controlling the environment, obtaining materials through real-time interaction, and monitoring surroundings.

A SMART PROBLEM-SOLVING ENVIRONMENT

Instructional sequence or navigation, teaching assistant e-learning settings, or intelligent help for problem-solving are all examples of adaptive assistance in an innovative environment. For the latter group, an intellectual and educational climate is required to provide relevant tasks to learners and interfere in problem-solving. According to constructivist learning scientists, students should learn about real-world issues since real-world challenges encourage students to utilise their cognitive and meta-cognitive skills. On the other hand, traditional learning

CHAPTER 11

Data Visualisation and Data Analytics in HCI

Abstract: This chapter uses Light Detection and Ranging (LIDAR) technology field data to assess efficient terrain visualization. There are two algorithms for detailed computer rendering. The test results for the productivity of the two these algorithms or techniques are presented in the subsequent sections. In visual-spatial perception, the assessment of the results is ultimately examined. In this chapter, the model then uses the information to select the optimal level of details (LOD) to prevent visible changes in representation. The relationship between computer processing power and mental representation is critical for understanding these cognitive processes.

Keywords: 2D database system, 3D landsat imagery, Blind image quality index, Cloud optimization, Distinct quality management, Differential global positioning system, Electron beam, Hierarchical space segmentation, LiDAR system, Level-on-detail, Peak signal-to-noise ratio, Probabilistic data values, Quad trees, Root mean-square error, Stratified random, Spatial information, Vertex buffer objects.

ASSESSMENT OF LIDAR POINT CLOUD OPTIMIZED VISUALIZATION, BASED ON THE VISUAL PERCEPTIONS

Light Detection and Ranging (LIDAR) has been the primary technique for producing spatial data with continuous progress. LIDAR is a remotely sensed technique based on lasers that calculates the time lag between the propagation of the electron beam and the reception of the signal when the distance of a distant object is being determined. LIDAR systems may be installed on aeroplanes and can swiftly acquire high-precision and high-density surface information, as seen in Fig. (**1**). The Differential Global Positioning System (DGPS) service transmits correction signals to GPS navigation equipment on aeroplanes. The aircraft orientation uses the Inertial Measurement Unit (IMU) according to the aeroplane's location. LiDAR data consists of the terrain surface's three-dimensional bioprospecting dot clouds. By using narrow spectral laser light, LiDAR achieves better precision and depends less on the climate and lighting conditions. Moreover, LiDAR can penetrate the foliage and even capture the landscape underneath the plant because of its capacity to distinguish individual reflec-

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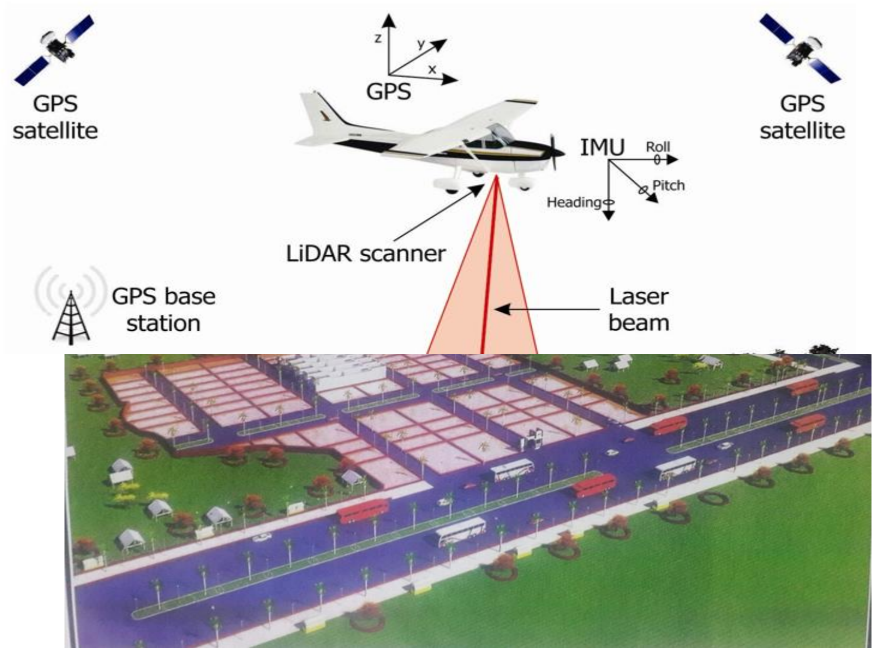

Fig. (1). Gathering the LiDAR data.

tions. Airborne LiDAR technology offers large amounts of spatial data, but it may be challenging to analyse and interactively see these massive points' clouds. Unfortunately, the longer it will take to display the more data, the more it induces a System lag. Children are especially vulnerable to visual deficiencies, which reduces user productivity while working with such systems. For the interactive visualization of LiDAR data, a practical computer-rendering approach is thus needed. Transparency abatement, double buffering, anti-aliasing, level-of-details, and a hierarchical subdivision have been created to decrease system lags. The system burden can only be balanced in real-time with the level-of-detail (LOD) method, so much so that no significant frame dips can ever be observed. LOD tries essentially to exchange spatial accuracy with chronological fidelity: more time is necessary for detailed architecture to appear. It is a nice compromise for the interactive graphic situation in an absolute sense [13]. The LOD is achieved when the item is near the viewer, and the object is remote or tiny. This dramatically reduces the graphical effort and maintains image quality without reducing the display's trustworthiness. However, LOD also has some critical disadvantages alongside its speed improvements. The crackling effect, which occurs when the graphical systems shift between different detail settings and flicker, is the most troublesome. An incorrect model for determining an appropriate detail level causes this optical artefact. To prevent this impact, a smooth visual transition in the middle of the path model for assessing the degree of visual information that a user may see. The model then chooses the best LOD to minimize visible changes. Finding a link between the computer's capability and aesthetic quality is critical in this regard [126].

LOD Management

As previously stated, the volume of data is the central issue when working with LiDAR datasets. Several tens of millions of points make up a typical LiDAR data collection. Graphic cards today are unable to store such large volumes of data structures. They cannot display a whole dataset utilizing real-time interactivity. As a result, a LOD strategy is needed. Furthermore, displaying three-dimensional geographic information on a two-dimensional screen distorts the subjective experience of the data. As a result, a LOD balance between technological and perceptual talents is required. LOD is always done with a well-organized data structure that simplifies quick scenes. In the next section, we will discuss database management and streamlining procedures [127].

LiDAR Data Organization

- In ASPRS LAS, a public image file for the exchange of spatial information and the data obtained by LiDAR technology is stowed. Without location information, LAS files hold point clouds using remote sensing. LiDAR airborne data is generally stored as flight swaths in LAS files. This means that the data is in strip form.

Hierarchical space segmentation divides data into smaller pieces and provides the basis for quick and efficient viewing of point clouds. While working with 3D Landsat imagery, we have a quadrant data structure, as LiDAR terrain description data is regarded as 2.5D information. A quadtree is a tree data structure in which each internal node has exactly four children. These are often used to partition a two-dimensional space by recursively subdividing it into four quadrants or regions. The root fills the entire area. The space hierarchies can be inefficient based on the point cloud's shape; space will serve continuously on behalf, and the stripe pattern is kept on all levels of the tree. Therefore, the root node is so split that the square form is approximated.

Our design is no longer a conventional quadrilateral with a root split see Fig. (**2**).

CHAPTER 12

HCI with Big Data Analytics

Abstract: In healthcare, education, large companies, and scientific research, extensive data have played a critical role. Big data analytics demand modern tools and technologies to store, process, and analyse large data volumes. Big data comprise extensive unstructured data, which needs to be examined in real-time before making use of it. Many academics are interested in advanced technologies and methods to tackle the problems in comprehensive data management. The business enterprises, public sector, and academic institutions have received considerable attention due to their Big Data. This chapter summarises the latest algorithms involved in Big Data processing and the associated features, applications, possibilities, and problems. This chapter also provides an overview of the state-of-the-art algorithms for processing big data and challenges in human-computer interaction with big data analytics.

Keywords: Astrophysical computations, Big data analytics, Cloud computing, Constraint satisfaction problem, Electronic medical records, FMRI, Geospatial modeling, Graph data, Internet of everything, IoT, Hadoop-based technologies, Hybrid clouds, MRI, Quantum mechanical medialization, RDBMS, Satellite imaging, Sensors, Text data, Radar, World wide web.

INTRODUCTION

Over the past 20 years, data creation speed and volume have increased considerably. An International Data Corporation (IDC) 2011 study says that the global data generation and storage size has grown to 9 times in past 5 years. Extensive data analysis often involves advanced skills and methodologies for storing, processing, and analysing large volumes of data. Big data consist of enormous amounts of unstructured data requiring advanced analysis in real-time. Many researchers are busy in developing advanced technologies and algorithms to tackle extensive data management problems. Yahoo has created Hadoop-based technologies and tools to collect and analyse big data to unearth new possibilities and hidden values from comprehensive data. Private businesses are also interested in large-scale information, and several government bodies have designated essential concepts for accelerating large-scale research and evaluation of data. Also, two prominent scientific organisations, such as nature and science, are looking into various ways to address the difficulties in processing big data. Due to

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big data, Google, Facebook, and Twitter have revolutionized our lives in recent years. Google handles about 100 Petabytes (PB), while the log data generated by Facebook are over 10 Petabytes a month. Baidu, a prominent Chinese firm, analyses 10 Petabytes (PB) of data, and Taobao, an alibi affiliate, provides 10 Terabytes (TB) of information each day for online trade. Significant data sources and appropriate machine-learning techniques are shown in Table **1**. State-of-the-art extensive data management methods and procedures are described [137].

Big Data and Its Market Value

Big data has played an essential role in nearly all fields, such as medicine, education, business, and scientific research. Big data and IoT have a significant link. IoT applications are often used to record or observe specific values to uncover hidden patterns and make better judgments. This metric is continuously sensed and stored in connected data shops when the gadget is connected to the internet. So, keeping large data sizes needs high-end devices and scalable storage solutions. The quantity of data to be saved and processed is a severe issue. The RBMS is commonly used to store traditional databases; however, day after day, the volume, speed, and range of sensor information increases in the direction of Exabyte. This calls for new tools and approaches to store, analyse, and show end-users vast sensor data. Therefore, big data technologies are frequently being employed to process this enormous volume of data [165]. This would enhance the Big Data analysis economy and market in the coming years. In the study 'Components Big Dati Market' (software and services), 'the big data market is forecasted to increase by 18,45% from US$28,65 trillion in 2016 to US$66,79 trillion by 2021'. The year 2015 was taken as the base year and 2016 as the expected year for the market estimates and forecasts were evaluated for the report. It displays 10V of extensive data [138].

Big Data in Healthcare

Big data analytics had a significant influence on healthcare industry throughout the past few decades. Health systems now embrace clinical data quickly, thus substantially increasing the quantity of searchable, and electronically reachable health records. Six Big Data instances have been used to lower patient costs for triages and emergency room visits during illnesses impacting the recent research. The cases involving Big data analytics have been split in further research into several areas, including assistance for clinical decisions (with a subclass of clinical information), administrations and provision, consumption patterns, and community services. It highlights how the health care system can be reformed based on Big Data analytics to pick a proper treatment course, enhance the quality of the treatment etc. A patient-centred approach was created based on a large-scale data framework to estimate health care (cost), effects (results), and reduced reception rates. The human-computer reporting system produces valuable answers in silicon medicine [139].

Cloud Computing with Big Data Analytics

Technology and computers have also transformed our lives by cloud computing. Cloud providers provide elements of cloud computing like Service Software (SaaS), Service Platform (PaaS), and Service Infrastructure (IaaS). The first cloud service provided for end customers in 2006 by Amazon was Amazon S4 Simple Centralized Repository. A range of cloud computing services are prevalent such as Apple, IBM, Joyent, Microsoft, Rackspace, Google, Cisco, Salesforce, com, or Verizon/Terremark [166]. Consumers use cloud technology *via* networked client devices on their desktop, cellphones, laptops, tablets, or any device supported by Ethernet such as Connected Home Gadgets. More cloud apps allow end-users to get to the cloud without specific software and applications. Web user interfaces like HTML5 and Ajax may make native apps comparable or better [140].

Layers of Big Data

Big data have played an essential role in all areas in recent decades [141]. This chapter defines how big data real-time applications are anticipated to expand in the future and how they will impact our everyday surroundings. Big data analytics have wide range of applications, in health and environmental sustainability, nature and natural phenomena, government and the community, business, financial and commercial systems, instant messaging, and the internet. Fig. (**1**) shows the significant data layers.

Hospitals and Healthcare Institutes

The clinical data are often classed into the following categories: electronic medical records (EMRs), medicinal data, data on imagery, personalised behavioural information and inclinations (including environmental variables, nutrition, and patterns of exercise), and records of financial and activity. Combining all this information accelerates considerable data growth and ensures substantial progress in well-being, service, and intervention. McKinsey Global Institute recently completed research that indicates that health informatics may generate over 300 billion dollars annually. Data is gathered at the time of attention of patients and stored in large-access distributed databases. Experienced

REFERENCES

[1] "The Big Data Payoff: Turning Big Data into Business Value", In: *Informatica and Capgemini.* 2016.

[2] V. Kayser, B. Nehrke, and D. Zubovic, "Data science as an innovation challenge: From big data to value proposition", *Technol. Innov. Manag. Rev,* vol. 8, no. 3, pp. 16-25, 2018. [http://dx.doi.org/10.22215/timreview/1143]

[3] M.S. Hopkins, and R. Shockley, "Big data, analytics and the path from insights to value", *MIT Sloan Manag. Rev.,* 2011.

[4] Harvard Business Review, The Enterprise Lacks a Big Data Strategy for IoT Transformation, pp. 1-12, 2017.

[5] S. Lavalle, M. S. Hopkins, E. Lesser, R. Schockley, and N. Krushcwitz, "Analytics: The new path to value", *IBM Global Business Services,* 2010.

[6] S. Viaene, and A. Van den Bunder, "The secrets to managing business analytics projects", *MIT Sloan Manag. Rev.,* pp. 65-69, 2011.

[7] A. Chebotko, A. Kashlev, and S. Lu, "A big data modeling methodology for apache cassandra", *2015 IEEE International Congress on Big Data,* pp. 238-245, 2015. [http://dx.doi.org/10.1109/BigDataCongress.2015.41]

[8] A. Fink, R. Guzzo, and S. Roberts, *Big Data at Work: Lessons from the Field.*. Society for Industrial and Oranizational Pshchology, 2017.

[9] S. Nalchigar, and E. Yu, "Business-driven data analytics: A conceptual modeling framework", *Data Knowl. Eng.,* vol. 117, pp. 359-372, 2018. [http://dx.doi.org/10.1016/j.datak.2018.04.006]

[10] M.A. Berry, and G.S. Linoff, "Mastering data mining: The art and science of customer relationship management", *Ind. Manage. Data Syst.,* vol. 100, no. 5, pp. 245-246, 2000. [http://dx.doi.org/10.1108/imds.2000.100.5.245.2]

[11] J. Horkoff, D. Barone, L. Jiang, E. Yu, D. Amyot, A. Borgida, and J. Mylopoulos, "Strategic business modeling: Representation and reasoning", *Softw Syst Model,* vol. 13, no. 3, pp. 1015-1041, 2014. [http://dx.doi.org/10.1007/s10270-012-0290-8]

[12] P. Giorgini, S. Rizzi, and M. Garzetti, "Goal-oriented requirement analysis for data warehouse design", *DOLAP '05: Proceedings of the 8th ACM international workshop on Data warehousing and OLAP,* pp. 47-56, 2005. [http://dx.doi.org/10.1145/1097002.1097011]

[13] P. Chapman, J. Clinton, R. Kerber, T. Khabazat, T. Reinartz, C. Shearer, and R. Wirth, "CRISP-DM 1.0 Step-by-step data mining guide", *SPSS Inc,* vol. 9, no. 13, pp. 1-73, 2000.

[14] D. Te'eni, J. Carey, and P. Zhang, *Human Computer Interaction: Developing Effective Organizational Information Systems.*. John Wiley & Sons: Hoboken, 2007.

[15] B. Shneiderman, and C. Plaisant, *Designing the User Interface: Strategies for Effective Human-Computer Interaction.*. 4th ed Pearson/Addison-Wesley: Boston, 2004.

[16] J. Nielsen, *Usability Engineering.*. Morgan Kaufman: San Francisco, 1994.

[17] D. Te'eni, "Designs that fit: An overview of fit conceptualization in HCI", In: P. Zhang, D. Galletta, Eds., *Human-Computer Interaction and Management Information Systems: Foundations.*. M.E. Sharpe: Armonk, 2006.

[18] A. Chapanis, "Man Machine Engineering, Wadsworth, Belmont (1965). D. Norman, "Cognitive Engineering"", In: D. Norman, S. Draper, Eds., *User Centered Design: New Perspective on Human-*

Kuldeep Singh Kaswan, Anupam Baliyan, Jagjit Singh Dhatterwal & Om Prakash Kaiwartya

Computer Interaction.. Lawrence Erlbaum: Hillsdale, 1986.

[19] R.W. Picard, "Affective Computing", MIT Press: Cambridge, 1997.

[20] J.S. Greenstein, "Pointing devices", In: M.G. Helander, T.K. Landauer, P. Prabhu, Eds., *Handbook of Human-Computer Interaction.* Elsevier Science: Amsterdam, 1997. [http://dx.doi.org/10.1016/B978-044481862-1.50121-7]

[21] B.A. Myers, "A brief history of human-computer interaction technology", *Interactions,* vol. 5, no. 2, pp. 44-54, 1998. [http://dx.doi.org/10.1145/274430.274436]

[22] B. Shneiderman, *Designing the User Interface: Strategies for Effective Human-Computer Interaction.* 3rd ed Addison Wesley Longman: Reading, 1998.

[23] A. Murata, "An experimental evaluation of mouse, joystick, joycard, lightpen, trackball and touchscreen for Pointing - Basic Study on Human Interface Design", *Proceedings of the Fourth International Conference on Human-Computer Interaction,* pp. 123-127, 1991.

[24] L.R. Rabiner, *Fundamentals of Speech Recognition.*. Prentice Hall: Englewood Cliffs, 1993.

[25] N. Carr, "ls Google making us stupid?", *Atlantic Monthly*, vol. 302, no. 1, 2008.

[26] S. Brin, and L. Page, "The anatomy of a large-scale hypertextual Web search engine", *Comput. Netw. ISDN Syst.,* vol. 30, no. 1-7, pp. 107-117, 1998. [http://dx.doi.org/10.1016/S0169-7552(98)00110-X]

[27] A. Aizawa, "An information-theoretic perspective of tf–idf measures", *Inf. Process. Manage.,* vol. 39, no. 1, pp. 45-65, 2003. [http://dx.doi.org/10.1016/S0306-4573(02)00021-3]

[28] S. Deerwester, S.T. Dumais, G.W. Furnas, T.K. Landauer, and R. Harshman, "Indexing by latent semantic analysis", *J. Am. Soc. Inf. Sci.,* vol. 41, no. 6, pp. 391-407, 1990. [http://dx.doi.org/10.1002/(SICI)1097-4571(199009)41:6<391::AID-ASI1>3.0.CO;2-9]

[29] D.A. Ferrucci, "Introduction to “This is Watson”", *IBM J. Res. Develop.,* vol. 56, no. 3–4, 2012.

[30] S.B. McGrayne, *The Theory that Would Not Die: How Bayes' Rule Cracked the Enigma Code, Hunted Down Russian Submarines, and Emerged Triumphant from Two Centuries of Controversy*. Yale University Press: New Haven, 2011.

[31] B. MacCartney, and C.D. Manning, "Natural logic for textual inference", *Proceedings of the ACL-PASCAL Workshop on Textual Entailment and Paraphrasing,* pp. 193-200, 2007. [http://dx.doi.org/10.3115/1654536.1654575]

[32] K. Myers, P. Berry, J. Blythe, K. Conley, M. Gervasio, D.L. McGuinness, D. Morley, A. Pfeffer, M. Pollack, and M. Tambe, "An intelligent personal assistant for task and time management", *AI Mag.,* vol. 28, no. 2, pp. 47-61, 2007.

[33] J. Ginsberg, M.H. Mohebbi, R.S. Patel, L. Brammer, M.S. Smolinski, and L. Brilliant, "Detecting influenza epidemics using search engine query data", *Nature,* vol. 457, no. 7232, pp. 1012-1014, 2009. [http://dx.doi.org/10.1038/nature07634] [PMID: 19020500]

[34] R. Vivek, and M. Kevin, *The Two-Second Advantage.* Random House: New York, 2011.

[35] P. Miller, *Smart Swarm.* Collins Books: London, 2010.

[36] J. Kennedy, and R. Eberhart, "Particle swarm optimisation", *Proceedings of IEEE International Conference on Neural Networks,* 1995.

[37] H. Abbass, T. Deborah, S. Kirby, and M. Ellejmi, "Brain traffic integration", *Air Traffic Technol. Int.,* vol. 2013, pp. 34-39, 2013.

[38] H. Abbass, J. Tang, R. Amin, M. Ellejmi, and S. Kirby, "Augmented cognition using real-time EEG-based adaptive strategies for air traffic control", *International Annual Meeting of the Human Factors*

and Ergonomic Society, 2014

[39] H. Abbass, J. Tang, R. Amin, M. Ellejmi, and S. Kirby, "The computational air traffic control brain: computational red teaming and big data for real-time seamless brain-traffic integration J", *Air Traffic Control,* vol. 56, no. 2, pp. 10-17, 2014.

[40] S. Alam, H.A. Abbass, and M. Barlow, "Atoms: air traffic operations and management simulator", *IEEE Trans. Intell. Transp. Syst.,* vol. 9, no. 2, pp. 209-225, 2008. [http://dx.doi.org/10.1109/TITS.2008.922877]

[41] S. Alam, K. Shafi, H.A. Abbass, and M. Barlow, "An ensemble approach for conflict detection in free flight by data mining", *Transp. Res., Part C Emerg. Technol.,* vol. 17, no. 3, pp. 298-317, 2009. [http://dx.doi.org/10.1016/j.trc.2008.12.002]

[42] R. Amin, J. Tang, M. Ellejmi, S. Kirby, and H.A. Abbass, "Computational red teaming for correction of traffic events in real time human performance studies", *USA/Europe ATM R&D Seminar, Chicago,* 2013.

[43] R. Amin, J. Tang, M. Ellejmi, S. Kirby, and H.A. Abbass, "An evolutionary goal-programming approach towards scenario design for air-traffic human-performance experiments", *IEEE Symposium on Computational Intelligence in Vehicles and Transportation Systems (CIVTS),* pp. 64-71, 2013. [http://dx.doi.org/10.1109/CIVTS.2013.6612291]

[44] R. Amin, J. Tang, M. Ellejmi, S. Kirby, and H.A. Abbass, "Trading-off simulation fidelity and optimization accuracy in air-traffic experiments using differential evolution", *IEEE Congress on Evolutionary Computation (CEC)*. 2014, Beijing, China. [http://dx.doi.org/10.1109/CEC.2014.6900573]

[45] R. Calder, J. Smith, A. Courtemanche, J. Mar, and A.Z. Ceranowicz, "Modsaf behavior simulation and control", *Proceedings of the Conference on Computer Generated Forces and Behavioral Representation,* 1993.

[46] K. Deb, A. Pratap, S. Agarwal, and T. Meyarivan, "A fast and elitist multiobjective genetic algorithm: NSGA-II", *IEEE Trans. Evol. Comput.,* vol. 6, no. 2, pp. 182-197, 2002. [http://dx.doi.org/10.1109/4235.996017]

[47] G. Dowek, A. Geser, and C. Munoz, "Tactical conflict detection and resolution in a 3D airspace", *Proceedings of the 4th USA/Europe ATM R&D Seminar, Santa Fe,* 2001.

[48] M.R. Endsley, "Measurement of situational awareness in dynamic systems", *Hum. Factors,* vol. 37, no. 1, pp. 65-84, 1995. [http://dx.doi.org/10.1518/001872095779049499]

[49] H.A. Abbass, S. Baker, A. Bender, and R. Sarker, "Identifying the fleet mix in a military setting", *The Second International Intelligent Logistics Systems Conference,* pp. 22-23, 2006.

[50] H. Abbass, A. Bender, S. Gaidow, and P. Whitbread, "Computational red teaming: past, presentand future", *IEEE Comput. Intell. Mag.,* vol. 6, no. 1, pp. 30-42, 2011. [http://dx.doi.org/10.1109/MCI.2010.939578]

[51] S. Baker, A. Bender, H. Abbass, and R. Sarker, "A scenario-based evolutionary scheduling approach for assessing future supply chain fleet capabilities", In: *Evolutionary Scheduling*. Springer: Berlin, pp. 485-511, 2007. [http://dx.doi.org/10.1007/978-3-540-48584-1_18]

[52] E.P. Blasch, and S. Plano, "JDL level 5 fusion model: User refinement issues and applicationsin group tracking", *Signal Processing, Sensor Fusion, and Target Recognition XI,* 2002. [http://dx.doi.org/10.1117/12.477612]

[53] E. Blasch, and S. Plano, "DFIG level 5 (user refinement) issues supporting situational assessmentreasoning", 2005 8th International Conference on Information Fusion, 2005, Philadelphia, PA, USA.

[54] D. Bowley, P. Comeau, R. Edwards, P.J. Hiniker, G. Howes, R.A. Kass, P. Labbé, C. Morris, R. Nunes-Vaz, and J. Vaughan, *Guide for Understanding and Implementing Defense Experimentation GUIDEx The Technical Cooperation Program.* TTCP, 2006.

[55] C. Bowman, A. Steinberg, and F. White, "Revisions to the jdl model", *Joint NATO/IRIS Conference Proceedings,* 1998.

[56] L. Breiman, J. Friedman, C.J. Stone, and R.A. Olshen, *Classification and Regression Trees.* 1st ed Chapman and Hall/CRC: New York, 1984.

[57] C.E. Brodley, and P.E. Utgoff, "Multivariate decision trees", *Mach. Learn.,* vol. 19, no. 1, pp. 45-77, 1995.
[http://dx.doi.org/10.1007/BF00994660]

[58] C.S. Choo, C.L. Chua, and S.H.V. Tay, "Automated red teaming: A proposed framework for military application", *Proceedings of the 9th Annual Conference on Genetic and Evolutionary Computation,* pp. 1936-1942, 2007.
[http://dx.doi.org/10.1145/1276958.1277345]

[59] J.S. Dahmann, R.M. Fujimoto, and R.M. Weatherly, "The department of defense high levelarchitecture", *Proceedings of the 29th Conference on Winter Simulation*. 1997, pp. 142-149, Washington, DC, USA.
[http://dx.doi.org/10.1145/268437.268465]

[60] G.B. Dantzig, *Linear Programming and Extensions.* Princeton University Press: Princeton, 1998.

[61] C.O. Director, *Plans defence capability development manual.* Australian Department of Defence, 2006.

[62] U. Fayyad, G. Piatetsky-Shapiro, and P. Smyth, "Knowledge discovery and data mining: Towardsa unifying framework", In: U. Fayyad, G. Piatetsky-Shapiro, P. Smyth, R. Uthurusamy, Eds., *Advances in Knolwedge Discovery and Data Mining*, AAI/MIT Press: Cambridge, pp. 1-36, 1996.

[63] F. Frankel, and R. Reid, "Big data: Distilling meaning from data", *Nature,* vol. 455, no. 7209, pp. 30-30, 2008.
[http://dx.doi.org/10.1038/455030a]

[64] G.W. Greenwood, and A.M. Tyrrell, *Introduction to Evolvable Hardware: A Practical Guide for Designing Self-adaptive Systems.,* vol. Vol. 5. Wiley: New York, 2006.
[http://dx.doi.org/10.1002/0470049715]

[65] A. Ilachinski, "Enhanced ISAAC neural simulation toolkit (EINSTein): An artificial-lifelaboratory for exploring self-organized emergence in land combat (U). Center for Naval Analyses", *Beta-Test Users Guide,* vol. 1101, no. 610, p. 10, 1999.

[66] P.H. Jacobs, N.A. Lang, and A. Verbraeck, "Web-based simulation 1: D-sol; a distributed javabased discrete event simulation architecture", *Proceedings of the 34th Conference on Winter Simulation: Exploring New Frontiers,* pp. 793-800.

[67] Y. Jin, B. Hammer, "Computational intelligence in big data", *IEEE Comput. Intell. Mag.*, vol. 9, no. 3, pp. 12-13, 2014.

[68] G.V. Kass, "An exploratory technique for investigating large quantities of categorical data", *J. R. Stat. Soc. Ser. C Appl. Stat.,* vol. 29, no. 2, pp. 119-127, 1980.

[69] M. Kirley, H. Abbass, and R. McKay, "Diversity mechanisms in pitt-style evolutionary classifiersystems", In: E. Triantaphyllou, G. Felici, Eds., *Data Mining and Knowledge Discovery Approaches Based on Rule Induction Techniques, Massive Computing.,* vol. 6. Springer: New York, 2006, pp. 433-457.
[http://dx.doi.org/10.1007/0-387-34296-6_13]

[70] F. Kuhl, J. Dahmann, and R. Weatherly, "Creating computer simulation systems: An introduction to the high-level architecture", Prentice Hall: PTR, 2000.

[71] M. Lauren, N. Silwood, N. Chong, S. Low, M. McDonald, C. Rayburg, B. Yildiz, S. Pickl, and R. Sanchez, "Maritime force protection study using mana and automatic co-evolution (ACE). In: Scythe", *Proceedings and Bulletin of the International Data Farming Community,* vol. 6, pp. 2-6, 2009.

[72] T.S. Lim, W.Y. Loh, and Y.S. Shih, "A comparison of prediction accuracy, complexity, and trainingtime of thirty-three old and new classification algorithms", *Mach. Learn.,* vol. 40, no. 3, pp. 203-228, 2000.
[http://dx.doi.org/10.1023/A:1007608224229]

[73] W.Y. Loh, and Y.S. Shih, "Split selection methods for classification trees", *Stat. Sin.,* vol. 7, no. 4, pp. 815-840, 1997.

[74] M. Mehta, R. Agrawal, and J. Rissanen, "Sliq: A fast scalable classifier for data mining", In: P. Apers, M. Bouzeghoub, G. Gardarin, Eds., *Advances in Database Technology–EDBT '96.*, vol. 1057. Springer: Berlin, Heidelberg, 1996, pp. 18-32.
[http://dx.doi.org/10.1007/BFb0014141]

[75] M.E. Porter, "What is strategy?", *Harv. Bus. Rev,* vol. 74, no. 6, pp. 61-78, 1996.

[76] J.R. Quinlan, "Induction of decision trees", *Mach. Learn.,* vol. 1, no. 1, pp. 81-106, 1986.
[http://dx.doi.org/10.1007/BF00116251]

[77] aJ.R. Quinlan, *Programs for Machine Learning.*. Morgan Kaufmann: San Francisco, 2011, p. 30.BP. Russom, *big data analytics*TDWI Best Practices Report, Fourth Quarter, .

[78] J.C. Shafer, R. Agrawal, and M. Mehta, "Sprint: A scalable parallel classifier for data mining", *Proceedings of the 22th International Conference on Very Large Data Bases,* vol. 96, pp. 544-555, 1996.

[79] K. Shvachko, H. Kuang, S. Radia, and R. Chansler, "The hadoop distributed file system", *2010 IEEE 26th Symposium on Mass Storage Systems and Technologies (MSST),* 2010 Incline Village, NV, USA.
[http://dx.doi.org/10.1109/MSST.2010.5496972]

[80] S. Tzu, *The art of war.* Oxford University: New York, p. 65, 1963.

[81] J. Venner, and S. Cyrus, *Pro Hadoop.,* vol. 1. Springer: Berlin, 2009.
[http://dx.doi.org/10.1007/978-1-4302-1943-9]

[82] T. White, *Hadoop: The Definitive Guide.* O'Reilly Media: Sebastopol, 2009.

[83] A. Yang, H.A. Abbass, and R. Sarker, "Evolving agents for network centric warfare", *Proceedings of the 2005 Workshops on Genetic and Evolutionary Computation*, 2005, pp. 193-195 New York.

[84] A. Yang, H.A. Abbass, and R. Sarker, "Landscape dynamics in multi-agent simulation combatsystems", In: *AI 2004: Advances in Artificial Intelligence*, Springer: Berlin, pp. 39-50, 2005.

[85] Ang Yang, H.A. Abbass, and R. Sarker, "Characterizing warfare in red teaming", *IEEE Trans. Syst. Man Cybern. B Cybern.,* vol. 36, no. 2, pp. 268-285, 2006.
[http://dx.doi.org/10.1109/TSMCB.2005.855569] [PMID: 16604725]

[86] A. Yang, H.A. Abbass, and R. Sarker, "How hard is it to red team?", In: H.A. Abbass, D. Essam, Eds., *Applications of Information Systems to Homeland Security and Defense.* IGI Global: Hershey, PA, 2006, p. 46.
[http://dx.doi.org/10.4018/978-1-59140-640-2.ch003]

[87] Y. Zhai, Y.S. Ong, and I.W. Tsang, "The emerging? Big dimensionality?", *IEEE Comput. Intell. Mag.,* vol. 9, no. 3, pp. 14-26, 2014.
[http://dx.doi.org/10.1109/MCI.2014.2326099]

[88] L. Chung, B.A. Nixon, E. Yu, and J. Mylopoulos, *Non-Functional Requirements in software Engineering.,* 1999.

[89] F. Fonseca, "The double role of ontologies in information science research", *J. Am. Soc. Inf. Sci. Technol.,* vol. 58, no. 6, pp. 786-793, 2007.

[http://dx.doi.org/10.1002/asi.20565]

[90] Wilson TD. "The nonsense of knowledge management", Info Res., vol. 8, no. 1, pp. 8-1, 2002.

[91] R. Frigg, "Models in science", In: The Stanford *Encyclopedia of Philosophy*, ed. Edward N. Zalta, 2006.

[92] B. Smith, Ontology and information systems., 2003. Available from: http://www.ontology.buffalo.edu/ontology(PIC).pdf

[93] G. Guizzardi, *"Ontological foundations for structural conceptual models"*, PhD Thesis, University of Twente, Twente, NL, Centre for Telematics and Information Technology, 2005.

[94] N. Kaza, and L.D. Hopkins, "Ontology for land development decisions and plans", In: J. Teller, J. Lee, C. Roussey, Eds., *Ontologies for Urban Development: Interfacing Urban Information Systems. Studies in Computational Intelligence,* vol. 61. Springer Verlag, 2007, pp. 143-156. [http://dx.doi.org/10.1007/978-3-540-71976-2_5]

[95] J. Lee, and D. McMeel, ""Pre-ontology" considerations for communication in construction", In: J. Teller, J. Lee, C. Roussey, Eds., *Ontologies for Urban Development: Interfacing Urban Information Systems. Studies in Computational Intelligence*, vol. 61. University of Geneva 6. Springer Verlag, pp. 143-156, 2007.

[96] P. Buitelaar, P. Cimiano, and B. Magnini, "Ontology learning from text: An overview", In: P. Buitelaar, P. Cimiano, B. Magnini, Eds., *Ontology Learning from Text: Methods, Evaluation and Applications Frontiers in Artificial Intelligence and Applications Series.,* vol. 123. IOS Press: Amsterdam, 2005.

[97] D.B. Lenat, and R.V. Guha, *1990. Building Large Knowledge-based Systems.* Addison-Wesley: Reading, MA, 2013.

[98] N.K. Jain, "Live multilingual thinking machine", *J. Exp. Theor. Artif. Intell.,* vol. 25, no. 4, pp. 575-587, 2013.

[99] J.N.K. Sarika, "Learning techniques in extended hierarchical censored production rules (EHCPRs) system", *Artif. Intell. Rev.,* vol. 38, no. 2, pp. 97-117, 2012.

[100] S. Jain, and S. Mishra, "Knowledge representation with ontology", *Proceedings of International Conference on Advances in Computer Engineering & Applications (ICACEA-2014),* 2014.

[101] J. Gregory, J.E. Mattison, and C. Linde, "Naming notes: Transitions from free text to structured entry", *Methods Inf. Med.,* vol. 34, no. 01/02, pp. 57-67, 1995. [http://dx.doi.org/10.1055/s-0038-1634580] [PMID: 9082139]

[102] A. Holzinger, A. Kainz, G. Gell, M. Brunold, and H. Maurer, "Interactive computer assisted formulation of retrieval requests for a medical information system using an intelligent tutoring system", *World Conference on Educational Multimedia, Hypermedia and Telecommunications,* pp. 431-436, 2000.

[103] C. Lovis, R.H. Baud, and P. Planche, "Power of expression in the electronic patient record: Structured data or narrative text?", *Int. J. Med. Inform.,* vol. 58-59, pp. 101-110, 2000. [http://dx.doi.org/10.1016/S1386-5056(00)00079-4] [PMID: 10978913]

[104] A. Attfield, and S. Attfield, "Interacting with information", *Synthesis Lectures on Human-Centered Informatics,* vol. 3, no. 1, pp. 1-99, 2010. [http://dx.doi.org/10.1007/978-3-031-02189-3]

[105] A. Holzinger, "On knowledge discovery and interactive intelligent visualization of biomedical data", In: *Challenges in Human Computer Interaction & Biomedical Informatics,* 2012.

[106] R. Beale, "Supporting serendipity: Using ambient intelligence to augment user exploration for data mining and web browsing", *Int. J. Hum. Comput. Stud.,* vol. 65, no. 5, pp. 421-433, 2007. [http://dx.doi.org/10.1016/j.ijhcs.2006.11.012]

[107] P. Funk, and N. Xiong, "Case-based reasoning and knowledge discovery in medical applications with time series", *Comput. Intell.,* vol. 22, no. 3-4, pp. 238-253, 2006. [http://dx.doi.org/10.1111/j.1467-8640.2006.00286.x]

[108] A. Holzinger, R. Scherer, M. Seeber, J. Wagner, and G. M¨ uller-Putz, "Computational sensemaking on examples of knowledge discovery from neuroscience data: Towards enhancing stroke rehabilitation", In: Böhm, C., Khuri, S., Lhotská, L., Renda, M.E. eds., Information Technology in Bio- and Medical Informatics (ITBAM), *Lecture Notes in Computer Science*, vol 7451, 2012, Springer, Berlin, Heidelberg.

[109] M.M. Waldrop, "Natural language understanding: Language is more than words; "meaning" depends on context, and "understanding" requires a vast body of knowledge about the world", *Science,* vol. 224, no. 4647, pp. 372-374, 1984. [http://dx.doi.org/10.1126/science.224.4647.372] [PMID: 17741209]

[110] J. Weizenbaum, "ELIZA—a computer program for the study of natural language communication between man and machine", *Commun. ACM,* vol. 9, no. 1, pp. 36-45, 1966. [http://dx.doi.org/10.1145/365153.365168]

[111] A.M. Turing, "Computing machinery and intelligence", *Mind,* vol. LIX, no. 236, pp. 433-460, 1950. [http://dx.doi.org/10.1093/mind/LIX.236.433]

[112] E. Yndurain, D. Bernhardt, and C. Campo, "Augmenting mobile search engines to leverage context awareness", *IEEE Internet Comput.,* vol. 16, no. 2, pp. 17-25, 2012. [http://dx.doi.org/10.1109/MIC.2012.17]

[113] R.A.A. Erhardt, R. Schneider, and C. Blaschke, "Status of text-mining techniques applied to biomedical text", *Drug Discov. Today,* vol. 11, no. 7-8, pp. 315-325, 2006. [http://dx.doi.org/10.1016/j.drudis.2006.02.011] [PMID: 16580973]

[114] W.B. Lee, Y. Wang, W.M. Wang, and C.F. Cheung, "An unstructured information management system (UIMS) for emergency management", *Expert Syst. Appl.,* vol. 39, no. 17, pp. 12743-12758, 2012. [http://dx.doi.org/10.1016/j.eswa.2012.02.037]

[115] M. Johnson, P. Hollins, S. Wilson, and O. Liber, "Towards a reference model for the personal learning environment", *Proceedings of the 23rd annual ascilite conference Who's learning? Whose technology,* 2006.

[116] R. Koper, *Conditions for effective smart learning environments. Smart Learning Environments 2014 1:5.* SpringerOpen, 2014.

[117] A. Mikroyannidis, S. Kroop, and M. Wolpers, "Personal learning environments (PLEs): Visions and concepts", In: *Responsive Open Learning Environments.* Springer International Publishing, 2015, pp. 1-16.

[118] C. Kinshuk, N-S. Chen, I-L. Cheng, and S.W. Chew, "Evolution is not enough: Revolutionizing current learning environments to smart learning environments", *Int. J. Artif. Intell. Educ.,* vol. 26, no. 2, pp. 561-581, 2016. [http://dx.doi.org/10.1007/s40593-016-0108-x]

[119] F. Wild, P. Scott, P. Lefrere, J. Karjalainen, K. Helin, A. Naeve, and E. Isaksson, "Towards data exchange formats for learning experiences in manufacturing workplaces", *CEUR Workshop Proceedings,* vol. 1238, 2014.

[120] E. Isaksson, A. Naeve, and P. Lefrère, "Performance augmentation through ubiquitous and adaptive learning and work environments", In: *State-of-the-Art and Future Directions of Smart Learning.* Springer Singapore, 2016, pp. 315-319. [http://dx.doi.org/10.1007/978-981-287-868-7_39]

[121] Available from: http://www.interoute.com/what-iaas (Accessed on: 2016-04-28).

[122] Y. Amanatullah, C. Lim, H.P. Ipung, and A. Juliandri, "Toward cloud computing reference architecture: Cloud service management perspective", *International Conference on ICT for Smart Society,* pp. 34-37, 2013.

[123] K. O'Hara, R. Harper, H. Mentis, A. Sellen, and A. Taylor, *On the naturalness of touchless: Putting the "interaction" back into NUI. ACM Transactions on Computer-Human Interaction (TOCHI) 20.1, article no. 5.* ACM: New York, 2013. [http://dx.doi.org/10.1145/2442106.2442111]

[124] T. Koschmann, K. Kuutti, and L. Hickman, "The concept of breakdown in Heidegger, Leont'ev, and Dewey and its implications for education", *Mind Cult. Act.,* vol. 5, no. 1, pp. 25-41, 1998. [http://dx.doi.org/10.1207/s15327884mca0501_3]

[125] B. Latour, *Pandora's Hope: Essays on the Reality of Science Studies.*. Harvard University Press: Cambridge, 1999.

[126] H. Vieritz, C. Ullrich, E. Isaksson, H-C. Schmitz, V. von der Heiden, K. Borau, R. Shen, M. Palmér, T. Lind, M. Laaksoharju, and M. Palmér, "Using widget bundles for formal learning in higher education", In: *Responsive Open Learning Environments.*. Springer International Publishing, 2015, pp. 79-113.

[127] C. Briese, P. Norbert, and P. Dorninger, "Applications of the robust interpolation for DTM determination", *Int. Arch. Photogramm. Remote Sens. Spat. Inf. Sci,* vol. 34, pp. 55-61, 2002.

[128] B.R. Lienert, S.K. Sharma, and J.N. Porter, "Real time analysis and display of scanning lidar scattering data", *Mar. Geod.,* vol. 22, no. 4, pp. 259-265, 1999. [http://dx.doi.org/10.1080/014904199273399]

[129] D. Mongus, and B. Žalik, "Parameter-free ground filtering of LiDAR data for automatic DTM generation", *ISPRS J. Photogramm. Remote Sens.,* vol. 67, pp. 1-12, 2012. [http://dx.doi.org/10.1016/j.isprsjprs.2011.10.002]

[130] A. Wehr, and U. Lohr, "Airborne laser scanning—an introduction and overview", *ISPRS J. Photogramm. Remote Sens.,* vol. 54, no. 2-3, pp. 68-82, 1999. [http://dx.doi.org/10.1016/S0924-2716(99)00011-8]

[131] D. Mongus, and B. Žalik, "Efficient method for lossless LIDAR data compression", *Int. J. Remote Sens.,* vol. 32, no. 9, pp. 2507-2518, 2011. [http://dx.doi.org/10.1080/01431161003698385]

[132] Å. Persson, U. Söderman, J. Töpel, and S. Ahlberg, "Visualization and analysis of fullwaveform airborne laser scanner data", *Int. Arch. Photogramm. Remote Sens. Spat. Inf. Sci,* vol. 36, pp. 103-108, 2005.

[133] R.L. Gregory, *Eye and Brain: The psychology of seeing.* Princeton University Press, 1997.

[134] D. Bartz, M. Meißner, and T. Hüttner, "OpenGL-assisted occlusion culling for large polygonal models", *Comput. Graph.,* vol. 23, no. 5, pp. 667-679, 1999. [http://dx.doi.org/10.1016/S0097-8493(99)00090-4]

[135] E.J. Scher Zagier, "A human's eye view", *XRDS: Crossroads, The ACM Magazine for Students,* vol. 3, no. 4, pp. 8-12, 1997. [http://dx.doi.org/10.1145/270955.270965]

[136] Ning Liu, Houzhi Jin, and A.P. Rockwood, "Antialiasing by gaussian integration", *IEEE Comput. Graph. Appl.,* vol. 16, no. 3, pp. 58-63, 1996. [http://dx.doi.org/10.1109/38.491186]

[137] D. Luebke, M. Reddy, J.D. Cohen, A. Varshney, B. Watson, and R. Huebner, *Level of detail for 3D graphics.*. Morgan Kaufmann, 2002.

[138] J. Bittner, P. Wonka, and M. Wimmer, "Visibility preprocessing for urban scenes using line space subdivision", *Proceedings of Ninth Pacific Conference on Computer Graphics and Applications*,

Tokyo, Japan, pp. 276-284, 2001.
[http://dx.doi.org/10.1109/PCCGA.2001.962883]

[139] R.J. Byrd, S.R. Steinhubl, J. Sun, S. Ebadollahi, and W.F. Stewart, "Automatic identification of heart failure diagnostic criteria, using text analysis of clinical notes from electronic health records", *Int J Med Inform,* vol. 83, no. 12, pp. 983-992, 2014.
[http://dx.doi.org/10.1016/j.ijmedinf.2012.12.005]

[140] S.O. Fageeri, and R. Ahmad, "An efficient log file analysis algorithm using binary-based data structure", *Procedia Soc. Behav. Sci.,* vol. 129, pp. 518-526, 2014.
[http://dx.doi.org/10.1016/j.sbspro.2014.03.709]

[141] R. Feldman, "Techniques and applications for sentiment analysis", *Proceedings of the 2014 IEEE International Congress on Big Data,* pp. 64-71, 2013.
[http://dx.doi.org/10.1145/2436256.2436274]

[142] D. Lopez, and M. Gunasekaran, "Assessment of vaccination strategies using fuzzy multi-criteria decision making", *Proceedings of the Fifth International Conference on Fuzzy and Neuro Computing (FANCCO-2015),* pp. 195-208, 2015.
[http://dx.doi.org/10.1007/978-3-319-27212-2_16]

[143] D. Lopez, M. Gunasekaran, B.S. Murugan, H. Kaur, and K.M. Abbas, "Spatial big data analytics of influenza epidemic in Vellore, India", *In Big Data (Big Data), 2014 IEEE International Conference,* pp. 19-24, 2014.

[144] D. Lopez, and G. Manogaran, "Big Data Architecture for Climate Change and Disease Dynamics", S. Geetam, E. Tomar, Eds., *The Human Element of Big Data: Issues, Analytics, and Performance,* CRC Press: USA, 2016.

[145] D. Lopez, and G. Manogaran, "Modelling the H1N1 influenza using mathematical and neural network approaches", *Biomed. Res..* vol. 28, no. 8, pp. 3711-3715, 2017.

[146] D. Lopez, and G. Sekaran, "Climate change and disease dynamics - A big data perspective", *Int. J. Infect. Dis.,* vol. 45, pp. 23-24, 2016.
[http://dx.doi.org/10.1016/j.ijid.2016.02.084]

[147] G. Manogaran, and D. Lopez, "Health data analytics using scalable logistic regression with stochastic gradient descent", *Int. J. Adv. Intell. Paradig.,* vol. 9, pp. 1-15, 2016.

[148] G. Manogaran, and D. Lopez, "Spatial cumulative sum algorithm with big data analytics for climate change detection", *Comput. Electr. Eng.,* vol. 65, pp. 207-221, 2017.

[149] G. Manogaran, and D. Lopez, "Disease surveillance system for big climate data processing and dengue transmission", *Int. J. Ambient Comput. Intell.,* vol. 8, no. 2, pp. 88-105, 2017.
[http://dx.doi.org/10.4018/IJACI.2017040106]

[150] G. Manogaran, and D. Lopez, "A Gaussian process based big data processing framework in cluster computing environment", *Cluster Comput.,* vol. 21, pp. 189-204, 2017.

[151] G. Manogaran, D. Lopez, C. Thota, K.M. Abbas, S. Pyne, and R. Sundarasekar, "Big data analytics in healthcare Internet of Things", In: *Innovative Healthcare Systems for the 21st Century.* Springer International Publishing, 2017.

[152] G. Manogaran, C. Thota, and M.V. Kumar, "Meta cloud data storage architecture for big data security in cloud computing", *Procedia Comput. Sci.,* vol. 87, pp. 128-133, 2016.
[http://dx.doi.org/10.1016/j.procs.2016.05.138]

[153] G. Manogaran, C. Thota, D. Lopez, and R. Sundarasekar, "Big data security intelligence for healthcare industry 4.0", In: *Cybersecurity for Industry 4.0..* Springer International Publishing, 2017, pp. 103-126.
[http://dx.doi.org/10.1007/978-3-319-50660-9_5]

[154] G. Manogaran, C. Thota, D. Lopez, V. Vijayakumar, K.M. Abbas, and R. Sundarsekar, "Big data

knowledge system in healthcare", In: *Internet of Things and Big Data Technologies for Next Generation Healthcare..* Springer International Publishing, 2017, pp. 133-157. [http://dx.doi.org/10.1007/978-3-319-49736-5_7]

[155] H. Müller, N. Michoux, D. Bandon, and A. Geissbuhler, "A review of contentbased image retrieval systems in medical applications—clinical benefits and future directions", *Int. J. Med. Inform.,* vol. 73, no. 1, pp. 1-23, 2004. [http://dx.doi.org/10.1016/j.ijmedinf.2003.11.024]

[156] S. Parthasarathy, Y. Ruan, and V. Satuluri, "Community discovery in socialnetworks: Applications, methods and emerging trends", In: C.C. Aggarwal, Ed., *Social network data analytics..* Springer: United States, 2011, pp. 79-113. [http://dx.doi.org/10.1007/978-1-4419-8462-3_4]

[157] aI. T. Robertson, "Human information-processing strategies and style", *Behav. Inf. Technol.,* vol. 4, no. 1, pp. 19-29, 1985. [http://dx.doi.org/10.1080/01449298508901784] b"Interaction design: Beyond human-computer interaction", *netWorker. The Craft of Network Computing,* vol. 11, no. 4, p. 34, 2007. [http://dx.doi.org/10.1080/01449298508901784]

[158] "Video analytics for business intelligence", In: Object Detection and Tracking., vol. 409, Springer: Berlin, Heidelberg, 2012. [http://dx.doi.org/10.1007/978-3-642-28598-1]

[159] S. Sharma, and M. Sethi, "Implementing collaborative filtering on large scale data using hadoop and mahout, international research", *J. Eng. Technol.,* vol. 2, no. 4, 2015.

[160] L. Tang, and H. Liu, "Community detection and mining in social media", *Synthesis Lectures on Data Mining and Knowledge Discovery,* vol. 2, no. 1, pp. 1-137, 2010. [http://dx.doi.org/10.1007/978-3-031-01900-5]

[161] R. Varatharajan, G. Manogaran, M.K. Priyan, V.E. Balaş, and C. Barna, "Visual analysis of geospatial habitat suitability model based on inverse distance weighting with paired comparison analysis", *Multimedia Tools Appl.,* vol. 77, pp. 17573-17593, 2017.

[162] R. Varatharajan, G. Manogaran, M.K. Priyan, and R. Sundarasekar, "Wearable sensor devices for early detection of Alzheimer disease using dynamic time warping algorithm", *Cluster Comput.,* vol. 21, pp. 681-690, 2017.

[163] L. Wang, and A.S.M. Sajeev, "Roller interface for mobile device applications", *Proceedings of the eight Australasian conference on User interface,* vol. 64, pp. 7-13, 2007.

[164] T.T. Wu, Y.F. Chen, T. Hastie, E. Sobel, and K. Lange, "Genome-wide association analysis by lasso penalized logistic regression", *Bioinformatics,* vol. 25, no. 6, pp. 714-721, 2009. [http://dx.doi.org/10.1093/bioinformatics/btp041] [PMID: 19176549]

[165] M.M. Rana, "IoT-based electric vehicle state estimation and control algorithms under cyber attacks", *IEEE Internet Things J.,* vol. 7, no. 2, pp. 874-881, 2020. [http://dx.doi.org/10.1109/JIOT.2019.2946093]

[166] M.M. Rana, W. Xiang, and E. Wang, "IoT-based state estimation for microgrids", *IEEE Internet Things J.,* vol. 5, no. 2, pp. 1345-1346, 2018. [http://dx.doi.org/10.1109/JIOT.2018.2793162]

[167] M.M. Rana, W. Xiang, E. Wang, X. Li, and B.J. Choi, "Internet of things infrastructure for wireless power transfer systems", *IEEE Access,* vol. 6, pp. 19295-19303, 2018. [http://dx.doi.org/10.1109/ACCESS.2018.2795803]

[168] M.M. Rana, and W. Xiang, "IoT communications network for wireless power transfer system state estimation and stabilization", *IEEE Internet Things J.,* vol. 5, no. 5, pp. 4142-4150, 2018. [http://dx.doi.org/10.1109/JIOT.2018.2852003]

SUBJECT INDEX

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