
WHO RUNS THE WORLD: DATA

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PREFACE

Who Runs the World: DATA

In ancient times, possessing a land and gold was the most important asset in the world. In the 21st century, “Data” is becoming the most important asset. As data activities continue to increase in speed, scale and variety, data Science and Data Analytics is becoming the new phenomenon of the 21st century. In fact, Data is considered to be the gold of the 21st Century and “data” is changing the face of our world. The organizations are becoming bigger and bigger and need a large amount of data to process for creating a business insight or intelligence. As more and more companies worldwide start offering products and services online, companies need to not only process information quickly but also to get insight about the needs, expectations, transactional behavior and responses of the customers. This mandates the companies to deal with “Data” effectively. Nowadays, “Data” is in various forms such as; texts, documents, online books, music, videos on number of different platforms such as; social media, transactional websites and many other internet based online forums.

The “Data” explosion is creating newer exciting opportunities for companies and individuals at the same time, it is also creating concerns and challenges. This edited book presents the research work of several researchers who are working in the data science related areas. The book comprises 15 chapters. A brief abstract of each chapter is provided below:

Material Information Carriers: Historical Development

Róbert Jáger, Matej Bel University, Slovakia

In this study, we will briefly try to describe what material information carriers were like in each period of the development of human society, what the advantages or disadvantages of these carriers were, and how society changed with the change of the material information carriers themselves. In conclusion, we will highlight an interesting fact of current development: the digitization of material information carriers, the separation of the information itself from its material carrier, and the risk that it will face in the future. In the first part of this study we describe Material information carriers in prehistoric times and in antiquity. Specifically, we focus on the development and use of material information carriers in Ancient Egypt, Mesopotamia and compare them with the development in European communities, which reached a similar level of civilization in the later period. In the second part, we pay attention

to the issue of using material information carriers in the Middle Ages. We show how the material carriers changed in the given period. In the third part of this study, we pay attention to the issue of using material information carriers in modern times. In particular, we point out the risks of the current state of information storage in information systems. The study primarily uses methods of description, analysis, synthesis, comparison, abstraction, and generalization.

Astronomical Data

Hulusi Gülseçen, İstanbul University, Turkey

Hasan H. Esenoğlu, İstanbul University, Turkey

Space telescopes have increased the quality of data collection for today's astronomy. In parallel to this, obtaining high quality data with high technology and good resolution focal plane detectors in accordance with the developments in material science in the ground-based observations has been achieved. With the new generation of ground based and space observations, global campaigns also brought continuity in data acquisition and increased performance. Finally, the fact that theoretical outputs can be made to allow in today's technology, for example, the detection of gravitational waves in the universe and these add new ones to the existing data. In addition, there has been a significant increase in data archiving, reduction and processing together with the number and variety of data collection tools. Astronomers have been able to overcome the facilitation in these processes in their own way: manpower waste has been reduced with autonomous telescopes, the data has been transformed into informatics (astroinformatics) with pipelines, the workload has been reduced to large masses by establishing a virtual observatory, and finally smart applications have been opened with the provided big data and new open areas have been reached with a future such as data mining. In this way, there has been progress in solving many astronomical events in the universe. This chapter is organized in two subsections. In first, we are discussing how to solve problems in astronomy by using big data. In the second, we mention about big data sources in astronomy. The importance of data in astronomy, sources of data, big data in regards to the discovery of universe and analyzing data are the topics discussed in these subsections.

Data Storage in the Decentralized World: Blockchain and Derivatives

Enis Karaarslan, Mugla Sitki Kocman University, Turkey.

Enis Konacaklı, Eskisehir Technical University, Turkey.

We have entered an era where the importance of decentralized solutions has become more obvious. Blockchain technology and its derivatives are distributed ledger technologies that keep the registry of data between peers of a network. This ledger is secured within a successive over looping cryptographic chain. The accomplishment of the Bitcoin cryptocurrency proved that blockchain technology and its derivatives could be used to eliminate intermediaries and provide security for cyberspace. However, there are some challenges in the implementation of blockchain technology. This chapter first explains the concept of blockchain technology and the data that we can store therein. The main advantage of blockchain is the security services that it provides. This section continues by describing these services.. The challenges of blockchain; blockchain anomalies, energy consumption, speed, scalability, interoperability, privacy and cryptology in the age of quantum computing are described. Selected solutions for these challenges are given. Remarkable derivatives of blockchain, which use different solutions (directed acyclic graph, distributed hash table, gossip consensus protocol) to solve some of these challenges are described. Then the data storage in blockchain and evolving data solutions are explained. The comparison of decentralized solutions with the centralized database systems is given. A multi-platform interoperable scalable architecture (MPISA) is proposed. In the conclusion we include the evolution assumptions of data storage in a decentralized world.

Data in the Context of Industry 4.0

Fatma Öney KOÇOĞLU, İstanbul University, Turkey

Denizhan DEMİRKOL, Aydın Adnan Menderes University, Turkey

Today, every sector, not least industry, has been affected by the development of technology. With the breakthrough development of technology, Industry 4.0 has emerged with the concept of big data. Data is the most important element in the process of creating information. This study aims to deal with the subject of Industry 4.0 which has attracted great interest in the global field in the context of big data. Studies concerning Industry 4.0 and related data are examined in our study through a systematic literature review. Web of Science database and “industry 4.0 and data” keywords were used for our article search. A preliminary evaluation was performed for 20 articles meeting the objective of this study which were selected for

detailed examination. When the studies on Industry 4.0 and data are analyzed, we can determine that studies with big data, digitalization, internet of things, digital twin, cyber-physical systems, smart factories and cloud computing are prominent. Moreover, when the countries where the articles were published were analyzed, it was found that China was the most cited and studied country in this field. It is believed that the results of this examination will enlighten people working in this field and direct future studies.

Big Data Governance

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Information processing in a traditional way focuses on relatively stable structured data, repeatable processes as well as on operations in Business Intelligence systems. However, nowadays more and more popular, big data, defined as huge volumes of data available in varying degrees of complexity, generated at different velocities, and varying degrees of ambiguity, cannot be processed using traditional methods and technologies. Some people argue that suitable IT (Information Technology) infrastructure for big data processing is not yet widely developed nor implemented to discuss the big data architecture implementation benefits, risks, and opportunities. Nevertheless, this paper is to present the big data governance issues. Particularly, within the proposed theme, the author discusses the big data system architecture and development strategy. The last part of the paper includes a proposal of a big data architecture model as well as a design of balanced scorecard objectives and measures specification to support the big data governance at public services business organizations. As usual, there are two main research methods, i.e., literature review and the analysis of case studies. The first provides an overview of the existing knowledge and the second permits for contextualization of the proposed models. Beyond that, the paper includes definitions of the key concepts and enables to extend the knowledge base in the research area.

A Core Problem with Human Data Processing: Epistemic Circularity in Action

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Managers are expected to solve critical problems of our society in an efficient manner and in ways so that the problems remain solved. In order to accomplish this, the managers are provided with vast amounts of resources including mountains of data and a wide variety of problem-solving methods available. On the other hand, the effectiveness of social and organizational problem solving is far from satisfactory and this lack of effectiveness is

ubiquitous. One reason of this ineffectiveness we claim has to do with how the human mind works. The inherent capabilities and limitations of human mind coupled with social-cognitive skills lead to sub-par problem solving. An especially counterproductive problem solving approach used by managers is setting and attempting to solve problems using erroneous cognitive skills that not only fails to include relevant data but also uses the existing data in a counterproductive manner. The very data processing skills of managers make problem solving a dead end for the actors involved at great cost to them and to the society.

This chapter looks at a core human data processing problem that renders the available data and techniques ineffective. Epistemic Circularity disregards all the disconfirming or threatening data and fails to include it in the problem solution. Epistemic Circularity thus renders the relevant data useless in developing effective solutions. Easy knowledge, a product of epistemic circularity, leads to ineffective problem solving which in many cases result in exacerbated problems and counterproductive consequences.

Data Pre-processing in Text Mining

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The fact that any kind of user has the ability to generate data with great ease at any time causes an increase in the importance of data mining. Considering the reality that the vast majority of the available data is composed of unstructured data and that the data in the text type is outnumbering, it proves the increasing interest in text mining and the abundance of studies in this field. However, in order to be able to examine an unstructured data type like text, which is quite different from machine language, it is necessary to make this data more structured and make the machine work. At this point, the data pre-processing step, which covers a large part of the entire text mining process, is of great importance. In this chapter, it is aimed to explain the text pre-processing phase on a basic level by supporting this using visuals. In doing so, it is primarily planned to focus on text mining and to explain in detail the characteristics of the data processed. In this context, it is aimed to explain the data pre-processing steps followed in order to overcome these difficulties by examining the difficulties created by the data in question. As a result, this chapter is a descriptive review of the data pre-processing phase in text mining, which covers some of the studies previously conducted on this subject.

Big Data in Education: A Case Study on Predicting E-learning Readiness of Learners with Data Mining Techniques

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Since the term “personalized learning” became popular, smart features have begun to be integrated into the e-learning environment. Data mining and machine learning algorithms are used to analyze big data stored in an e-learning system to make predictions to improve course quality or learners’ performance. From the learners’ perspective, it might now be considered possible for everybody to benefit from e-learning by considering their personal interests or their own specific development plan as long as the course contents are available in the system. In addition, in an e-learning environment there is no limitation on the time and place where a course can be attended and a program completed. However, it is just not that simple. Today not the only, but by far the most important, requirement is still the readiness of the learners to study in an e-learning system. The aim of this chapter is to predict the e-learning readiness of learners using data mining techniques and to provide feedback for institute managers and admin personnel of e-learning systems which are intended to be used in an institution. According to the results of this study, the highest accuracy value (0.831) is obtained with C4.5 Decision Tree Algorithm. While students, who agree and strongly agree with the statement “My studying/research area is appropriate for e-learning” are classified as ready to attend an e-learning course, students who disagree with the same statement are classified as not ready to attend an e-learning course. Students who strongly disagree with the statements “My studying/research area is appropriate for e-learning” and “E-learning is better than face to face learning”, are also classified as not ready to attend an e-learning course.

The Value of Data for Improving Effectiveness of Campus Courses: The Case of Hybrid MOOCs

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In recent years with the advances in technology, learners started to learn various concepts in informal learning environments apart from the official traditional learning programs.

We describe such learning environments as part of the Personal Learning Environment (PLE) approach. One great resource for these environments is using Massive Open Online Course (MOOC). Learners can learn any subject by enrolling in MOOCs easily and develop themselves by reaching their personal learning goals. But in such an informal learning environment, it would be hard to manage the learning process. Learners need some ability to manage this process that is called “self-regulation”. There seem to be some problems in both fully face to face learning (like difficulties in following courses), and fully online MOOCs (like lack of interaction). So, a midway approach is a hybrid MOOC that is a combination of both methods. Literature and author experiences indicated that this method would make learning more effective. However, there is a need for improving the method with proper data management. We provide a list of data collection methods in hybrid MOOCs and explain how this data helped us to improve the learning process. In the PLE approach, students need data to shape their learning process, similarly instructors need to obtain data with various strategies and reshape the course structure by using this data. We think that in education, data usage is somehow limited, but it is required for making it more efficient.

Intelligent Tutoring of Learners in E-learning systems and Massive Open Online Courses (MOOC)

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In the last few years, many terms related to learning environments have emerged. Each one of these terms is distinguished by a set of criteria such as the target audience, the duration of learning, the type and nature of the educational content, the manner of dissemination of knowledge, etc. Unfortunately, lack of support for the learners seems to be a serious frequently faced problem in these environments, which requires special attention. Among proposed solutions, tutoring seems to be a convenient candidate for this problem. Tutoring involves offering assistance to learners that are in need for help. Regardless the nature of this assistance (pedagogical, social, etc.), it can be delivered in many forms: advice, guidance or even recommendation. And while tutoring has been applied for decades in traditional e-learning environments, its application in new systems such as Massive Open Online Courses (MOOC) is still under study. In fact, a considerable number of studies driven on MOOCs had reported the problem of learners’ dropout. Several reasons can be listed as

causes of such a problem. Among these reasons, we can find learners' isolation as well as learners' loss of motivation. This same problem has been reported by researchers working in the field of Computer-based Environments for Human Learning.

In this article, we propose a new vision on how to apply an intelligent tutoring process in human learning systems in general and in MOOCs in particular. This new vision is based on the behaviors and skills of learners. This activity can take many forms and can be carried out by different types of actors (teachers, learners, etc.).

Smart House: Data Gathering and Analysis

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In modern society, the concept of “smart house” is increasingly being heard. At present, it is generally acceptable that a smart house has efficient building management, local management and business management systems. A smart house increases the business value of the environment created by the adaptability and flexibility provided by the location and the communication systems. There are many opinions on how we should understand the concept of a smart house. Some people believe this is a modern home audience, others think it's a fully designed home cable system. There are some who guess that this reflects modern telecommunication systems, etc. Everything that has been mentioned really reflects only part of the “smart home” possibilities. Smart House introduces a modern, robust automated system that allows to integrate all of the main operating subsystems such as: energy supply, supply of gas and water, lighting system, heating systems, microclimate systems, other remote controls. The smart houses are often pointed as one of the main constituents of smarter living environments. The chapter provides the smart house definition, criteria defining smart building, smart house technology explanation, examples of smart houses in different countries, smart house data model, building progress and analysis of smart building automation and control systems (applying SWOT analysis method).

Privacy for Enterprises in Data Age

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The world we live in is now becoming increasingly virtual. We all interact with this new age which we can describe as the digital age. We shop online, we communicate with people via

social media, we are informed at any time through the devices that are in our hands about goings-on, whether we like it or not, we have become a part of this globalized and digitalized world. Data can be described as the structure of the digitalized world. In each interaction between us and the tools which we use, we create data or we cause data transferring or we can be a small part of a large data collection because of our presence in a platform on the internet. Certainly, this close relationship can reveal our private life in some situations. Most of the time, we are exposed to situations where our private information is collected, used, and processed without our permission. Sometimes we cannot even notice the violation of one of the most fundamental rights and freedoms we can define as privacy. This literature survey study is based on the fundamentals of information security, and it seeks answers to these questions: Why does our personal information need protection? What kind of information should be protected? What is the situation regarding the data privacy in Turkish and world law? What kind of laws have been passed upon the privacy of tax from past to today? What are the perspectives, opinions on protection of personal data in Turkey and Europe? What is the importance of data privacy for the business sectors? We also believe that this study will raise awareness on this matter.

Data Collection Approaches for Artificial Intelligence Applications in Healthcare

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As in all other fields, research in the field of artificial intelligence is rapidly continuing in the field of health. As a result of this research, the importance of data comes to the fore. In this study, which includes data collection approaches in the field of health, we aim to emphasize the importance of data in this field and to contribute to the more conscious handling of the data to be used in artificial intelligence applications at every stage. For this purpose, the definition of data and how to distinguish information and knowledge are mentioned. The characteristics of data and data collection methods are also mentioned, and an attempt is made to emphasize the importance of health data collection in artificial intelligence research. As a result of this study, we believe that all personnel working in data-related departments and the health field, where the moment is vital, must receive training on collecting, storing, sharing data, and data security in particular. In our study we emphasize that especially the people who produce and consume data must have the awareness and morality for every step of data collection and handling, and that this issue should be prioritized in the field of health.

Technological Transformation Process from Electronic Intelligence to Cyber Intelligence

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Throughout the whole of human history, concepts such as defense, security, safety and intelligence have been very important for human beings on a personal level, and for human communities in general. The sociological transformation that came as a result of these processes played a key role in the development of science and technology. Thanks to the developments in electronic science during the 20th century, systems using electromagnetic energy have come to the fore.

This development process which started with systems such as telephones, radios and radars has eventually been used in many different areas such as air defense systems, guided missiles, early warning receivers, communication systems, and computers. For this reason, the control and active use of what can be called the electromagnetic spectrum in short, has been an important factor in all kinds of activities. By the 21st century, almost all of the systems used in this process began to operate in a cyberspace environment and became software controlled. The concept of the target intelligence needed in this transformation process has changed dimensions and shifted from electronic intelligence to cyber intelligence.

This study will focus on the transformation of the electronic intelligence process, which is an indispensable element of the 20th century, into the concept of cyber intelligence in the 21st century.

Automatic Measurement of The Morphological Characteristics of Honeybees by A Computational Program

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The use of Big data related to the breeding of honey bees, when administered and processed effectively, will encourage the development of knowledge-based beekeeping, create new markets and business opportunities and further encourage the development of this industry. There have been attempts to fully automate the process of measuring the morphological characteristics of bees (at this stage there are conversions for Measuring wings), but this process for other parts are still completed manually. A survey was made of the possibilities

to automate the process of measuring the morphological characteristics in honeybees and the proposed algorithm and program to implement it. Color characteristics of parts of the bee body - tergite and proboscis, through which they can be separated from the background of the image, are analyzed and measured. Distances are determined between the values of the colour components of the object and background. From statistical analysis, it is found that S and V colour components of the HSV colour model are appropriate for the separation of an object from the background . Algorithms and a program in Matlab environment for separating tergite and proboscis from the background of the image and definition of their main sizes are developed. From the analysis of the results, it is found that the major influence on the accuracy of the measurement is of the bee in the image.

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