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Advanced Recent Trends in Computing & Information Technology

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***Abstract* – 21st century has been defined by application of and advancement in information technology. Information technology has become an integral part of our daily life. Information technology has served as a big change agent in different aspect of business and society. It has proven game changer in resolving economic and social issues. Information technology has been one of the most encouraging research areas throughout the globe over the past two decades. From commerce and government to scientific discovery, healthcare, education, entertainment, and environmental management, information technology is indispensable and will continue to fuel further advances in all facets of human endeavours. The focus is mainly on the intelligent computing techniques as well as the emerging applications of information technology. Its aim is to unify the picture of contemporary intelligent computing techniques as an integral concept that highlights the trends in advanced computational intelligence and bridges theoretical research with applications.**

INTRODUCTION

21st century has been defined by application of and advancement in information technology. Information technology has become an integral part of our daily life. Information technology has served as a big change agent in different aspect of business and society. It has proven game changer in resolving economic and social issues.

Information technology has been one of the most encouraging research areas throughout the globe over the past two decades. From commerce and government to scientific discovery, healthcare, education, entertainment, and environmental management, information technology is indispensable and will continue to fuel further advances in all facets of human endeavours.

The focus is mainly on the intelligent computing techniques as well as the emerging applications of information technology. Its aim is to unify the picture of contemporary intelligent computing techniques as an integral concept that highlights the trends in advanced computational intelligence and bridges theoretical research with applications.

Advancement and application of information technology are ever changing. Some of the trends in the information technology that needs mention are:

- Artificial intelligence
- Computational neuroscience and bioscience
- Cloud computing
- Decision support systems
- Evolutionary computing
- Human computer interface
- Intelligent business computing
- Intelligent control and automation
- Intelligent fault diagnosis
- Intelligent sensor networks
- Knowledge discovery and data mining
- Next generation Internet
- Machine learning theory and methods
- Pattern recognition
- Reasoning and expert systems
- Soft computing
- Speech, image, and video processing
- The Internet of things
- Virtual reality and human-computer Interaction

1. ARTIFICIAL INTELLIGENCE:

The theory and development of computer systems able to perform tasks normally requiring human intelligence, such as visual perception, speech recognition, decision-making, and translation between languages. The machines haven't taken over. Not yet at least. However, they are seeping their way into our lives, affecting how we live, work and entertain ourselves. From voice-powered personal assistants like Siri and Alexa, to more underlying and fundamental technologies such as behavioural algorithms, suggestive searches and autonomously-powered self-driving vehicles boasting powerful predictive capabilities, there are several examples and applications of artificial intelligence in use today. A true artificially-intelligent system is one that can learn on its own. We're talking about neural networks from the likes of Google's DeepMind, which can make connections and reach meanings without relying on pre-defined behavioural algorithms. True A.I. can improve on past iterations, getting smarter and more aware, allowing it to

enhance its capabilities and its knowledge. The truth is that, whether or not true A.I. is out there or is actually a threat to our existence, there's no stopping its evolution and its rise. Humans have always fixated themselves on improving life across every spectrum, and the use of technology has become the vehicle for doing just that. And although the past 100 years have seen the most dramatic technological upheavals to life than in all of human history, the next 100 years is set to pave the way for a multi-generational leap forward.

This will be at the hands of artificial intelligence. A.I. will also become smarter, faster, more fluid and human-like thanks to the inevitable rise of quantum computing. Quantum computers will not only solve all of life's most complex problems and mysteries regarding the environment, aging, disease, war, poverty, famine, the origins of the universe and deep-space exploration, just to name a few, it'll soon power all of our A.I. systems, acting as the brains of these super-human machines.

2. CLOUD COMPUTING:

Cloud will provide the digital infrastructure of tomorrow's cities, where an estimated 6 billion of the world's population will live by 2045. Smart elevators and parking lots, driverless cars and drone taxis, trains and subways, farms and power plants -- all will be safer and better managed, thanks to the cloud's ability to store and analyze data.

The cloud will also be transformative for companies, especially small and mid-sized businesses, as data analytics, artificial intelligence and other capabilities become available as services. Because each industry has different needs, Huawei, a global tech company where I head up the communications team, is working on what we call the Industry Cloud: thousands of distinct, separate clouds, all working in concert across a digital ecosystem of different industry verticals. For example:

• A commercial aviation cloud will help airlines manage ground operations such as maintenance, fueling, baggage handling, and cabin cleaning, thereby increasing efficiency and helping flights take off on time.

• A utilities cloud will automatically repair faults in the power grid to ensure that homes and businesses get the electricity they need.

• A banking cloud will let financial institutions scan thousands of transactions per second to prevent fraud.

• Regardless of industry or size, all companies need digital infrastructure to support their business operations. But cloud will change ICT from a support system into a production system. For example, OpenDesk, a London-based company, uploads furniture designs to the cloud and lets customers download the designs and manufacture the furniture locally. This lowers shipping and inventory costs, while reducing the company's carbon footprint.

3. HUMAN COMPUTER INTERACTION

Humans interact with computers in many ways; the interface between humans and computers is crucial to facilitating this interaction. Desktop applications, internet browsers, handheld computers, and computer kiosks make use of the prevalent graphical user interfaces (GUI) of today.[5] Voice user interfaces (VUI) are used for speech recognition and synthesizing systems, and the emerging multi-modal and Graphical user interfaces (GUI) allow humans to engage with embodied character agents in a way that cannot be achieved with other interface paradigms. The growth in human-computer interaction field has been in quality of interaction, and in different branching in its history. Instead of designing regular interfaces, the different research branches have had a different focus on the concepts of multimodality rather than unimodality, intelligent adaptive interfaces rather than command/action based ones, and finally active rather than passive interfaces. For instance, more recently, sensors like video cameras and eye trackers can be used to feed physiological information of humans back to computer systems.Such information can be used by computers to dynamically adapt content of interfaces. Thus, computers could develop responsiveness to cognitive load and human emotion.

4. EVOLUTIONARY COMPUTING

In computer science, evolutionary computation is a family of algorithms for global optimization inspired by biological evolution, and the subfield of artificial intelligence and soft computing studying these algorithms. In technical terms, they are a family of population-based trial and error problem solvers with a metaheuristic or stochastic optimization character.
In evolutionary computation, an initial set of candidate solutions is generated and iteratively updated. Each new generation is produced by stochastically removing less

desired solutions, and introducing small random changes. In biological terminology, a population of solutions is subjected to natural selection (or artificial selection) and mutation. As a result, the population will gradually evolve to increase in fitness, in this case the chosen fitness function of the algorithm.

Evolutionary computation techniques can produce highly optimized solutions in a wide range of problem settings, making them popular in computer science. Many variants and extensions exist, suited to more specific families of problems and data structures. Evolutionary computation is also sometimes used in evolutionary biology as an in silico experimental procedure to study common aspects of general evolutionary processes.

5. DECISION SUPPORT SYSTEMS

A decision support system (DSS) is an information system that supports business or organizational decision-making activities. DSSs serve the management, operations and planning levels of an organization (usually mid and higher management) and help people make decisions about problems that may be rapidly changing and not easily specified in advance—i.e. unstructured and semi-structured decision problems. Decision support systems can be either fully computerized or human-powered, or a combination of both.

While academics have perceived DSS as a tool to support decision making process, DSS users see DSS as a tool to facilitate organizational processes.[1]Some authors have extended the definition of DSS to include any system that might support decision making and some DSS include a decision-making software component; Sprague (1980)[2] defines a properly termed DSS as follows:

1. DSS tends to be aimed at the less well structured, underspecified problem that upper level managers typically face;
2. DSS attempts to combine the use of models or analytic techniques with traditional data access and retrieval functions;
3. DSS specifically focuses on features which make them easy to use by non-computer-proficient people in an interactive mode; and
4. DSS emphasizes flexibility and adaptability to accommodate changes in the environment and the decision making approach of the user.

DSSs include knowledge-based systems. A properly designed DSS is an interactive software-based system intended to help decision makers compile useful information from a combination of raw data, documents, and personal knowledge, or business models to identify and solve problems and make decisions.

6. PATTERN RECOGNITION

Pattern recognition is a branch of machine learning that focuses on the recognition of patterns and regularities in data Machine learning is the common term for supervised learning methods and originates from artificial intelligence.
The terms pattern recognition, machine learning, data mining and knowledge discovery in databases (KDD) are hard to separate, as they largely overlap in their scope.
In pattern recognition, there may be a higher interest to formalize, explain and visualize the pattern, while machine learning traditionally focuses on maximizing the recognition rates.
An example of pattern recognition is classification, which attempts to assign each input value to one of a given set of classes (for example, determine whether a given email is "spam" or "non-spam").

7. SPEECH , IMAGE AND VIDEO PROCESSING

7.1 Speech Processing

This is the study of speech signals and the processing methods of these signals. The signals are usually processed in a digital representation, so speech processing can be regarded as a special case of digital signal processing, applied to speech signal. Aspects of speech processing includes the acquisition, manipulation, storage, transfer and output of speech signals. The input is called speech recognition and the output is called speech synthesis.

7.2 Digital image processing

It is the use of computer algorithms to perform image processing on digital images. As a subcategory or field of digital signal processing, digital image processing has many advantages over analog image processing. It allows a much wider range of algorithms to be applied to the input data and can avoid problems such as the build-up of noise and signal distortion during processing. Since images are defined over two dimensions (perhaps more) digital image processing may be modeled in the form of multidimensional systems.

Digital image processing allows the use of much more complex algorithms, and hence, can offer both more sophisticated performance at simple tasks, and the implementation of methods which would be impossible by analog means.

In particular, digital image processing is the only practical technology for:

- Classification
- Feature extraction
- Multi-scale signal analysis
- Pattern recognition
- Projection

7.3 Video Processing

In electronics engineering, video processing is a particular case of signal processing, which often employs video filters and where the input and output signals are video files or video streams. Video processing techniques are used in television sets, VCRs, DVDs, video codecs, video players, video scalers and other devices. For example—commonly only design and video processing is different in TV sets of different manufactures.

8. SOFT COMPUTING

In computer science, soft computing (sometimes referred to as computational intelligence, though CI does not have an agreed definition) is the use of inexact solutions to computationally hard tasks such as the solution of NP-complete problems, for which there is no known algorithm that can compute an exact solution in polynomial time. Soft computing differs from conventional (hard) computing in that, unlike hard computing, it is tolerant of imprecision, uncertainty, partial truth, and approximation. In effect, the role model for soft computing is the human mind.

CONCLUSION:

In the above context, we have highlighted latest technological trends which are used in day-to-day life. We have explained in brief some of the vital technologies like Artificial Intelligence and Cloud Computing. Advancements in these trends of computing help make processes easier in every sector or industry making life much simpler. Switching and adapting to these trends will help improve a country's economic growth.

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