Throughout time, information technology has continuously improved on how we process, retrieve, and distribute data. New types of technology are continuously being developed and implemented to aid all different enterprises, such as some discussed in this book, being information and knowledge quality, facial recognition, cloud computing, sustainable development, artificial intelligence, and many more. It is important to understand the successful uses of information technology and also mismanagement of information technology in order to improve future implementations in all types of settings. Contemporary Advancements in Information Technology Development in Dynamic Environments discusses progressive research in interdisciplinary areas of information technology relating to the ever-changing world.

The book is organized into 17 chapters. A brief description of each of the chapters can be found below:

Chapter 1, “Knowledge-Based E-Government Solutions in Dynamic Environment,” by Andrea Köö, Barna Kovács, and András Gábor, the selected change management strategy and the corresponding knowledge management strategy and their IT support are analyzed from the public administration point of view. SAKE (FP6 IST-2005-027128) and SMART projects (LLP 201-1-ES1-LEO05-49395) approaches and IT solutions are discussed to demonstrate the strategic view and to solve the knowledge management and change management related problems and challenges in public administration. Pilots of the projects are focusing on the challenge of dynamically matching educational system offer and job market demand. SAKE provides holistic framework and tool for an agile knowledge-based e-government, while SMART offers an innovative learning environment that will match labour market needs with the training offer.

Chapter 2, “Effects of Perceived Information Quality, Perceived System Quality, and Perceived Flow on Mobile Social Networking Sites (SNS) Users’ Trust,” by Norazah Mohd Suki and Norbayah Mohd Suki examines the effects of perceived information quality, perceived system quality, and perceived flow on mobile Social Networking Sites (SNS) users’ trust. Pearson correlations via SPSS 21.0 computer program was used for data analysis as it has the ability to ensure the consistency of the model with the data, to provide information necessary to scrutinize the study hypotheses, and to estimate associations among constructs. Each correlation coefficient was assessed as significant at the 0.01 level, and the overall model was determined to fit the data well as multicollinearity was absent. In terms of the associations with perceived user trust, perceived flow had highest significant positive correlation coefficients,
followed by perceived information quality and perceived system quality. Next, further investigation of
the study encountered that perceived flow is significantly associated by both perceived system quality
and perceived information quality of mobile SNS, respectively. The chapter concludes with directions
for future research.

In Chapter 3, “Creating Believable and Effective AI Agents for Games and Simulations: Reviews and
Case Study,” Iskander Umarov and Maxim Mozgovoy study current approaches to believability and ef-
effectiveness of AI behavior in virtual worlds. They examine the concepts of believability and effectiveness,
and analyze several successful attempts to address these challenges. In conclusion, they provide a case
study that suggests that believable and effective behavior can be achieved through learning behavioral
patterns from observation with subsequent automatic selection of effective acting strategies.

Chapter 4, “Face and Object Recognition Using Biological Features and Few Views” by J.M.F. Ro-
drigues, R. Lam, K. Terzić, and J.M.H. du Buf, discusses facial recognition advancements. In recent
years, a large number of impressive face and object recognition algorithms have surfaced, both computa-
tional and biologically inspired. Only a few of these can detect face and object views. Empirical studies
concerning face and object recognition suggest that faces and objects may be stored in our memory by
a few canonical representations. In cortical area V1 exist double-opponent colour blobs, also simple,
complex, and end-stopped cells that provide input for a multiscale line and edge representation, keypoints
for dynamic feature routing, and saliency maps for Focus-of-Attention. All these combined allow us to
segregate faces. Events of different facial views are stored in memory and combined in order to identify
the view and recognise a face, including its expression. The authors show that with five 2D views and
their cortical representations it is possible to determine the left-right and frontal-lateral-profile views,
achieving view-invariant recognition. They also show that the same principle with eight views can be
applied to 3D object recognition when they are mainly rotated about the vertical axis. Although object
recognition is here explored as a special case of face recognition, it should be stressed that faces and
general objects are processed in different ways in the cortex.

The increasing capabilities of Internet have caused a qualitative change in the management of spatial
information while recent advances in Web 2.0 technologies have enabled the integration of data and
knowledge in intuitive thematic maps. This has wide-ranging indirect effects in supporting the ways
stakeholders make a decision based on information coming from various distributed resources, but the
real question is, What applications and technologies are in place to deal with these decisional environ-
ments? Aiming at giving an answer to this question, Michele Argiolas, Maurizio Atzori, Nicoletta Dessì,
and Barbara Pes explore in Chapter 5, “Improving Spatial Decision Making in Cloud Computing,” the
feasibility of a computational environment that supports the Web-based exploration and the spatial
analysis in real estate decisional processes. It relies on the concept of dataspace as a new scenario for
accessing, integrating, and analyzing geo-spatial information regardless of its format and location. Built
on top of a cloud environment, it is made up of specialized modules, each of which provides a well-
deﬁned service. Mash-ups integrate data from different resources on the Internet and provide the user
with a ﬂexible and easy-to-use way for geo-referencing data in the maps provided by Google Maps and
Google Earth. Through an interactive process, the user arrives at some interesting maps, glimpses the
most important facets of the decisional problem, and combines them to fashion a solution. Applicative
experiments demonstrate the effectiveness of the computational environment proposed.

of an Application Framework for Computational Chemistry (AFCC) Applied to New Drug Discovery,”
describes the performance of a compute cluster applied to solve Three Dimensional (3D) molecular
modelling problems. The primary goal of this work is to identify new potential drugs. The chapter focuses upon the following issues: computational chemistry, computational efficiency, task scheduling, and the analysis of system performance. The philosophy of design for an Application Framework for Computational Chemistry (AFCC) is described. Eighteen months after the release of the original chapter, the authors have examined a series of changes adopted which have led to improved system performance. Various experiments have been carried out to optimise the performance of a cluster computer, the results analysed, and the statistics produced are discussed in the chapter.

The purpose of Chapter 7, “Research on Letter and Word Frequency and Mathematical Modeling of Frequency Distributions in the Modern Bulgarian Language,” by Tihomir Trifonov and Tsvetanka Georgieva-Trifonova is to present current research on the modern Bulgarian language. It is one of the oldest European languages. An information system for the management of the electronic archive with texts in Bulgarian language is described. It provides the possibility for processing the collected text information. The detailed and comprehensive researches on the letter and the word frequency in the modern Bulgarian language from varied sources (fiction, scientific and popular science literature, press, legal texts, government bulletins, etc.) are performed, and the obtained results are represented. The index of coincidence of the Bulgarian language as a whole and for the individual sources is computed. The results can be utilized by different specialists – computer scientists, linguists, cryptanalysts, and others. Furthermore, with mathematical modeling, the authors found the letter and word frequency distributions and their models and they estimated their standard deviations by documents.

Various attempts are made by researchers on the study of vagueness of data through Intuitionistic Fuzzy sets and Vague sets, and also it is shown that Vague sets are Intuitionistic Fuzzy sets. However, there are algebraic and graphical differences between Vague sets and Intuitionistic Fuzzy sets. In Chapter 8 by John Robinson P. and Henry Amirtharaj E.C., “Vague Correlation Coefficient of Interval Vague Sets and its Applications to Topsis in MADMProblems,” an attempt is made to define the correlation coefficient of Interval Vague sets lying in the interval [0,1], and a new method for computing the correlation coefficient of interval Vague sets lying in the interval [-1,1] using α-cuts over the vague degrees through statistical confidence intervals is also presented by an example. The new method proposed in this work produces a correlation coefficient in the form of an interval. The proposed method produces a correlation coefficient in the form of an interval from a trapezoidal shaped fuzzy number derived from the vague degrees. This chapter also aims to develop a new method based on the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) to solve MADM problems for Interval Vague Sets (IVSs). A TOPSIS algorithm is constructed on the basis of the concepts of the relative-closeness coefficient computed from the correlation coefficient of IVSs. This novel method also identifies the positive and negative ideal solutions using the correlation coefficient of IVSs. A numerical illustration explains the proposed algorithms and comparisons are made with some existing methods.

In “Decomposition Theorem of Generalized Interval-Valued Intuitionistic Fuzzy Sets,” Chapter 9, Amal Kumar Adak, Monoranjan Bhowmik, and Madhumangal Pal establish decomposition theorems of Generalized Interval-Valued Intuitionistic Fuzzy Sets (GIVIFS) by use of cut sets of generalized interval-valued intuitionistic fuzzy sets. First, new definitions of eight kinds of cut sets generalized interval-valued intuitionistic fuzzy sets are introduced. Second, based on these new cut sets, the decomposition generalized interval-valued intuitionistic fuzzy sets are established. The authors show that each kind of cut sets corresponds to two kinds of decomposition theorems. These results provide a fundamental theory for the research of generalized interval-valued intuitionistic fuzzy sets.
Chapter 10, “A Generalized Graph Strict Strong Coloring Algorithm: Application on Graph Distribution,” by Meriem Bensouyad, Mourad Bouzenada, Nousseiba Guidoum, and Djamel-Eddine Saïdouni, examines the graph coloring problem. A graph strict strong coloring algorithm has been proposed for trees in Haddad and Kheddouci. In this chapter, the authors recall the heuristic-based algorithm for general graphs named GGSSCA (for Generalized Graph Strict Strong Coloring Algorithm) proposed in Bouzenada, Bensouyad, Guidoum, Reghioua, and Saidouni. The complexity of this algorithm is polynomial with considering the number of vertices. Later, in Guidoum, Bensouyad, and Saidouni, GGSSCA was applied to solve the graph distribution problem.

Chapter 11, “Precordial Vibrations: Seismocardiography – Techniques and Applications,” by Mikko Paukkunen and Matti Linnavuo, discusses SCG measurement. In the era of medicine, the heart and cardiovascular system has become one of the standard observation targets. Palpation and auscultation in the precordial area is performed as part of the regular physical examination to detect possible cardiovascular and pulmonary problems. However, due to the large number of people suffering from cardiovascular problems, labor-intensive methods such as auscultation might be inefficient in preventive cardiovascular condition screening. Seismocardiography (SCG) could have the potential to be a part of the solution to this problem. SCG is one of many modalities of cardiac-induced vibration measurements, and it has been shown to be of use in detecting coronary artery disease and assessing myocardial contractility. Lately, due to advances in sensor technologies, the SCG measurement is being developed by introducing three-dimensional measurements. Three-dimensional approach is considered to yield more information about the cardiovascular system than any single uniaxial approach. In conclusion, SCG seems to have the potential to offer a complementary view to cardiovascular function and a cost-effective method for screening of cardiovascular diseases.

The existence of Single-Wall C-Nanocones (SWNCs), especially nanohorns (SWNHs), and BC$_2$N/ Boron Nitride (BN) analogues in cluster form is discussed in solution in Francisco Torrens and Gloria Castellano’s Chapter 12, “Nanostructures Cluster Models in Solution: Extension to C, BC$_2$N, and BN Fullerenes, Tubes, and Cones.” Theories are developed based on models bundle and droplet describing size-distribution function. The phenomena present unified explanation in bundle in which free energy of (BC$_2$N/BN-)SWNCs involved in cluster is combined from two parts: volume one proportional to the number of molecules $n$ in cluster and surface one, to $n^{1/2}$. Bundle enables describing distribution function of (BC$_2$N/BN-)SWNC clusters by size. From geometrical differences bundle (BC$_2$N/BN-)SWNCs and droplet (C$_{60}$/B$_{15}$C$_{30}$N$_{15}$/B$_{30}$N$_{30}$) predict dissimilar behaviours. Various disclination (BC$_2$N/BN-)SWNCs are studied via energetic and structural analyses. Several (BC$_2$N/BN-)SWNC’s ends are studied that are different because of closing structure and arrangement type. Packing efficiencies and interaction-energy parameters of (BC$_2$N/BN-)SWNCs/SWNHs are intermediate between C$_{60}$/B$_{15}$C$_{30}$N$_{15}$/B$_{30}$N$_{30}$ and (BC$_2$N/BN-)Single-Wall C-Nanotube (SWNT) clusters: in-between behaviour is expected; however, properties of (BC$_2$N/BN-)SWNCs, especially (BC$_2$N/BN-)SWNHs, are calculated closer to (BC$_2$N/BN-)SWNTs. Structural asymmetry in different (BC$_2$N/BN-)SWNCs characterized by cone angle distinguishes properties of types: P2. BC$_2$N/BN, especially species isoelectronic with C-analogues may be stable.

Computer Numerical Control (CNC) is a technology that converts coded instructions and numerical data into sequential actions that describe the motion of machine axes or the behavior of an end effector. Nowadays, CNC technology has been introduced to different stages of production, such as rapid prototyping, machining and finishing processes, testing, packaging, and warehousing. The main objective of Chapter 13 “An Integrated Design for a CNC Machine” by Amro Shafik and Slah Haridy, is to introduce a methodology for design and implementation of a simple and low-cost educational CNC prototype.
The machine consists of three independent axes driven by stepper motors through an open-loop control system. Output pulses from the parallel port of Personal Computer (PC) are used to drive the stepper motors after processing by an interface card. A flexible, responsive, and real-time Visual C# program is developed to control the motion of the machine axes. The integrated design proposed in this chapter can provide engineers and students in academic institutions with a simple foundation to efficiently build a CNC machine based on the available resources. Moreover, the proposed prototype can be used for educational purposes, demonstrations, and future research.

Chapter 14, “Computer-Aided Ceramic Design: Its Viability for Building User-Centered Design” by Olalere Folasayo Enoch and Ab Aziz Bin Shuaib, investigates the knowledge regarding how user-centered design can be achieved during ceramic product development with the aid of computer-aided ceramic design. The chapter gives the general overview of ceramics, computer-aided design, and its application in ceramic product development. It also illuminates on product emotion, its influence on consumers’ behaviour, and how it can be integrated into new products. With reference to desire emotion, the chapter elaborates on the determining factors and the resulting appraisal that will elicit the desire emotion. Furthermore, it analyses the systematic approach in building user-centred design in new products. Based on this understanding, a study is described where a newly developed mug design and a multi-functional ceramic pot were tested to know emotive responses of people towards the products. The results from the study show some interesting findings by demonstrating the theories in practice and also reveal the viability of computer-aided design as a tool for building user-centered design.

The move towards a low-carbon world, driven partly by climate science and partly by the business opportunities it offers, will need the promotion of environmentally friendly alternatives, if an acceptable stabilisation level of atmospheric carbon dioxide is to be achieved. This requires the harnessing and use of natural resources that produce no air pollution or greenhouse gases and provide comfortable coexistence of humans, livestock, and plants. This chapter presents a comprehensive review of energy sources, and the development of sustainable technologies to explore these energy sources. It also includes potential renewable energy technologies, efficient energy systems, energy savings techniques, and other mitigation measures necessary to reduce climate changes. The chapter concludes with the technical status of the Ground Source Heat Pumps (GSHP) technology. The purpose of Abdeen Mustafa Omer’s Chapter 15, “Clean and Green Energy Technologies, Sustainable Development, and Environment,” however, is to examine the means of reduction of energy consumption in buildings, identify GSHPs as an environmentally friendly technology able to provide efficient utilisation of energy in the buildings sector, promote using GSHPs applications as an optimum means of heating and cooling, and to present typical applications and recent advances of the DX GSHPs.

Evolutionary Algorithms (EAs) are well-known optimization techniques to deal with nonlinear and complex optimization problems. However, most of these population-based algorithms are computationally expensive due to the slow nature of the evolutionary process. To overcome this drawback and to improve the convergence rate, Chapter 16, “New Efficient Evolutionary Algorithm Applied to Optimal Reactive Power Dispatch” by Provas Kumar Roy, employs Quasi-Opposition-Based Learning (QOBL) in conventional Biogeography-Based Optimization (BBO) technique. The proposed Quasi-Oppositional BBO (QOBBO) is comprehensively developed and successfully applied for solving the Optimal Reactive Power Dispatch (ORPD) problem by minimizing the transmission loss when both equality and inequality constraints are satisfied. The proposed QOBBO algorithm’s performance is studied with comparisons of Canonical Genetic Algorithm (CGA), five versions of Particle Swarm Optimization (PSO), Local Search-Based Self-Adaptive Differential Evolution (L-SADE), Seeker Optimization Algorithm (SOA),
and BBO on the IEEE 30-bus, IEEE 57-bus, and IEEE 118-bus power systems. The simulation results show that the proposed QOBBO approach performed better than the other listed algorithms and can be efficiently used to solve small-, medium-, and large-scale ORPD problems.

Many industrial problems in process optimization are Multi-Objective (MO), where each of the objectives represents different facets of the issue. Thus, having in hand multiple solutions prior to selecting the best solution is a seminal advantage. In Chapter 17, “Multiobjective Optimization of Bioethanol Production via Hydrolysis using Hopfield-Enhanced Differential Evolution,” T. Ganesan, I. Elamvazuthi, K.Z.K. Shaari, and P. Vasant use the weighted sum scalarization approach in conjunction with three metaheuristic algorithms: Differential Evolution (DE), Hopfield-Enhanced Differential Evolution (HEDE), and Gravitational Search Algorithm (GSA). These methods are then employed to trace the approximate Pareto frontier to the bioethanol production problem. The Hypervolume Indicator (HVI) is applied to gauge the capabilities of each algorithm in approximating the Pareto frontier. Some comparative studies are then carried out with the algorithms developed in this chapter. Analysis on the performance as well as the quality of the solutions obtained by these algorithms is shown in the chapter.

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