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The Technology of Knowledge Management and Decision Making for the 21st Century
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Artificial Intelligence (AI) has expert systems as one of the areas in its domain. AI almost defines itself as the replication, to some degree of human intelligence by the utilization of computers, sensor systems, and other technologies, in the performance of useful or interesting tasks. While application of AI to areas such as natural language translation, original composition of music or prose, vision, and other diverse tasks which are more in keeping with human facilities is problematic, restriction of AI to some of its generally regarded subset areas may provide useful solutions. In particular, delimiting artificial intelligence to the area of expert systems has proven to offer many significant capabilities and applications. As in other cases, there are no doubt many possible definitions of expert systems. One such effective definition of expert systems is that an expert system is a knowledge-based computer system which emulates the decision making ability of a human expert.

It seems the primary role of expert systems is to perform their functions, where it is appropriate to do so, under the supervision or monitoring of the human that is being supported. That is, the primary role of expert systems would appear to be supporting the human or humans who are using them. A classic example of where this relationship failed and resulted in near catastrophic economic consequences, was computerized stock trading (a flawed expert system at the time). On Monday, October 19, 1987, a malfunctioning expert system resulted in the worst stock market crash in history. Indeed, it was noted at the time that stock traders watched in helpless shock as the “bottom dropped out of the stock market” because proper monitoring measures were not put in place, to say nothing of the fact that the system itself had design flaws. Of course, these flaws have since been corrected, and research continues to produce improvements so that this catastrophe
will not be repeated. Incidentally, stock trading is an example of “forward chaining”
expert systems, i.e., a cause (various economic indicators) produces a certain effect
(stock trading).

The “flip side” of the 1987 collapse of the stock market due to computerized
trading is the Chernobyl disaster which occurred April 26, 1986. In this instance,
it has been observed that this disaster which occurred at 1:15 AM was probably,
if not indeed, due to operator fatigue. These operators were not supported by an
expert system, which very likely would have avoided this disaster. This would be an
example of a “backward chaining” expert system, i.e., effects (reactor performance
indications) resulting in correction of causes by making proper control changes.

In the case of the stock market collapse, the situation was an expert system
which was neither properly designed nor had adequate provision for human inter-
vention. In the case of the Chernobyl disaster, the system operators did not have
the support of an expert system, which very likely could have averted this major
disaster. In both cases, the wrong thing was done at times which just aggravated
the respective situations. At the bottom, it is most important to be aware of this
still relatively new and growing technology of expert systems, which can perme-
ate virtually every area of human endeavor, so that it can be appropriately and
necessarily utilized. Indeed, one more noteworthy example involves the two chess
matches that world class champion Garry Kasparov played against IBM’s expert
system known as “Big Blue.” The first match was a tie and Kasparov lost the sec-
ond match! In any event, this is a particularly appropriate time to treat the issue of
expert systems techniques and applications.

This set consists of six well-integrated volumes on the broad subject of expert
systems techniques and applications. It is appropriate to mention that each of the
six volumes can be utilized individually. The great potential pervasiveness of this
broad field of major significance certainly suggests the clear requirement for an
adequately comprehensive treatment. All of the contributors to this work are to be
highly commended for their splendid contributions that will provide a significant
and unique reference for students, research workers, practitioners, computer scien-
tists, and others on the international scene for years to come.

Cornelius T. Leondes
CONTRIBUTORS

Numbers in parentheses indicate the pages on which the authors’ contributions begin.

Yasuhiro Akiba (53) ATR Spoken Language Translation Laboratories, 2-2-2 Hikaridai, Seika-cho, Souraku-gun, Kyoto, 619-0288, Japan

Hussein Almuallim (53) Information and Computer Science Department, King Fahd University of Petroleum & Minerals, Dhahran, 31261, Saudi Arabia

Tom Andersen (411) Department of Civil Engineering, Technical University of Denmark, DK-2800 Denmark

I. Andreadis (771, 875) Department of Electrical and Computer Engineering, Democritus University of Thrace, Xanthi, 67100, Greece

Rui Araújo (1897) Electrical Engineering Department, Institute for Systems and Robotics (ISR), University of Coimbra, Polo II, Pinhal de Marrocos, Coimbra, 3030, Portugal

Meir Barzohar (741) Computer Vision Group, RAFAEL, Haifa, Israel

Bernd Berthold (1413) Daimler-Chrysler AG, Ulm, 89013, Germany

Charles A. Bouman (661) Computer and Electrical Engineering Department, Purdue University, West Lafayette, Indiana 47907

Olivind Braaten (979) Department of Medical Genetics, Ullevål University Hospital, Blindern, Oslo, 0315, Norway

Ernesto Burattini (1315) Istituto di Cibernetica, CNR, Via Toiano, 6, Arco Felice (NA), I-80072, Italy
M. Cabassud (443) Laboratoire de Genie Chimique, Ecole Nationale Superieure d’Ingenieurs de Genie Chimique, UMR CNRS 5503, 31078, Toulouse Cedex, France

G. Casamatta (443) Laboratoire de Genie Chimique, Ecole Nationale Superieure d’Ingenieurs de Genie Chimique, UMR CNRS 5503, 31078, Toulouse Cedex, France

David B. Cooper (741) Division of Engineering, Brown University, Providence, Rhode Island 02912

J. Luís Cruz (1897) Electrical Engineering Department, Institute for Systems and Robotics (ISR), University of Coimbra, Polo II, Pinhal de Marrocos, Coimbra, 3030, Portugal

Aníbal T. De Almeida (1897) Electrical Engineering Department, Institute for Systems and Robotics (ISR), University of Coimbra, Polo II, Pinhal de Marrocos, Coimbra, 3030, Portugal

Massimo De Gregorio (1315) Instituto di Cibernetica, CNR, Via Toiano, 6, Arco Felice (NA), I-80072, Italy

Anastasios N. Delopoulos (701) Electrical Engineering Department, Computer Science Division, National Technical University of Athens, Zografiou, 15773, Greece

J. L. Dirion (443) Centre Energetique—Environnement Ecole des Mines d’Albi-Carmaux, Campus Jarlard, Route de Teillet, Albi Cedex 09, 81013, France

John Durkin (1, 23) Dept. of Electrical Engineering, College of Engineering, University of Akron, Akron, Ohio, 44325-3904

Mahmut Gülesin (327) Mechanical Education Department, Gazi University Technical Education Faculty, Beşevler, Ankara 06500, Turkey

Matti Hämäläinen (1155) The Center for Research in Electronic Commerce, Graduate School of Business, The University of Texas at Austin, Austin, Texas 78712-1175

June Seok Hong (617) Department of Business Administration, Inje University, Korea

Hui-Min Huang (197) Intelligent Systems Division, National Institute of Standards and Technology, Gaithersburg, Maryland, 20899

S. Huang (1525) Intelligent Systems Laboratory, School of Applied Science, Nanyang Technological University, 639798, Singapore

Mitsuru Ikeda (171) The Institute of Scientific and Industrial Research, Osaka University, Osaka, 567-0047, Japan

E. Ikonen (1457) Department of Process and Environmental Engineering, Systems Engineering Laboratory, University of Oulu, Oulu, FIN-90014, Finland

Seiichi Inoue (909) Fukui National College of Technology, Geshi, Sabae, Fukui, 916-8507, Japan

Takashi Ishikawa (1559) Kisarazu College of Science and Technology, Department of Information and Computer Engineering, 2-11-1 Kiyomidai Higashi, Kisarazu, Chiba, 292, Japan
Maris Juberts (197) Intelligent Systems Division, National Institute of Standards and Technology, Gaithersburg, Maryland, 20899

Alain Jutard (833) Laboratoire d’Automatique Industrielle, Institut National de Sciences Appliquées, Villeurbanne Cedex, 69621, France

Shigeo Kaneda (53) Graduate School of Policy and Management, Doshisha University, Imadegawa-Karasuma-Higashiiru, Kamigyou-ku, Kyoto, 602-8580, Japan

Khalid W. Khawaja (661) Structural Dynamics Research Corporation, Milford, Ohio 45150

Ryugo Kijima (909) Faculty of Engineering, Gifu University, Yanagido, Gifu, 501-1112, Japan

Yoshinobu Kitamura (171) The Institute of Scientific and Industrial Research, Osaka University, Osaka, 567-0047, Japan

Takahiro Kobayashi (909) International Academy of Media Arts and Sciences, Ryoake, Ogaki, Gifu, 503-0014, Japan

Kazuhiko Kohara (1175) NTT Cyber Solutions Laboratories, 3-9-11 Midori-cho, Musashino-shi, Tokyo, 180-8585, Japan

Yuichi Koike (801) C&C Media Research Laboratories, NEC Corporation, 4-1-1 Miyazaki, Miyamae-ku, Kawasaki, 216-8555, Japan

Stefanos D. Kollias (701) Electrical Engineering Department, Computer Science Division, National Technical University of Athens, Zografou, 15773, Greece

U. Kortela (1457) Infotech Oulu and Department of Process Engineering, Systems Engineering Laboratory, University of Oulu, Oulu, FIN-90014, Finland

Yoshiyuki Koseki (801) C&C Media Research Laboratories, NEC Corporation, 4-1-1 Miyazaki, Miyamae-ku, Kawasaki, 216-8555, Japan

Anita Krämer (1413) Research Institute for Applied Knowledge Processing (FAW), University of Ulm, Ulm, 89019, Germany

Ryuji Kudo (1641) Interdisciplinary Course on Advanced Science and Technology, Graduate School of Engineering, University of Tokyo, 4-6-1 Komaba, Meguro-ku, Tokyo, 153-8904, Japan

K. P. Lam (553) Department of Systems Engineering and Engineering Management, The Chinese University of Hong Kong, Hong Kong, China

M. V. Le Lann (443) Laboratoire d’Analyse et d’Architecture des Systemes, Institut National des Sciences Appliquées de Toulouse, 31077 Toulouse Cedex 4, France

Jae Kyu Lee (617) Graduate School of Management, Korea Advanced Institute of Science and Technology, Seoul, 130-012, Korea

Kyoung Jun Lee (617) School of Business, Korea University, Seoul, 136-701, Korea

Jung Seung Lee (617) Graduate School of Management, Korea Advanced Institute of Science and Technology, Seoul, 130-012, Korea

Jinxin Lin (305) Softouch Intelligence, Toronto, Ontario, M4Y 1R5, Canada
Grier C. I. Lin (381) Centre for Advanced Manufacturing Research, University of South Australia, Mawson Lakes, South Australia 5095, Australia

Zhangxi Lin (1155) The Center for Research in Electronic Commerce, Graduate School of Business, University of Texas at Austin, Austin, Texas 78712-1175

Wei Liu (267) Department of Automation Engineering, Hebei Institute of Technology, 1831 Tangsham, Hebei 063009, People’s Republic of China

C. K. Looi (1831) Intelligent Systems Laboratory, Nanyang Technological University, 637989, Singapore

Tien-Fu Lu (381) Department of Mechanical Engineering, University of Adelaide, South Australia 5005, Australia

Yves Lucas (833) Laboratoire Vision & Robotique, Institut Universitaire de Technologie, Bourges Cedex, 18020, France

Anthony A. Maciejewski (661) Computer and Electrical Engineering Department, Purdue University, West Lafayette, Indiana 47907

Tay Kiang Meng (199) Systems Technology Division, Gintic Institute of Manufacturing Technology, Singapore 638075, Republic of Singapore

Elena Messina (197) Intelligent Systems Division, National Institute of Standards and Technology, Gaithersburg, Maryland, 20899

Kazuo Miyashita (1667) National Institute of Advanced Industrial Science and Technology, 1-1-4 Umezono, Tsukuba, Ibaraki, 305-8568, Japan

Riichiro Mizoguchi (171) The Institute of Scientific and Industrial Research, Osaka University, Osaka, 567-0047, Japan

K. Najim (1457) Process Control Laboratory, Ecole Nationale Superieure d’Ingenieurs de Genie Chimique, Toulouse Cedex, 31078, France

P. W. Ng (1773) Intelligent Systems Laboratory, Nanyang Technological University, 637989, Singapore

Hideki Noda (1199) Department of Electrical, Electronic, and Computer Engineering, Kyushu Institute of Technology, 1-1 Sensio-cho, Tobata-ku, Kita-Kyushu, 804-8550, Japan

Urbano Nunes (1897) Electrical Engineering Department, Institute for Systems and Robotics (ISR), University of Coimbra, Polo II, Pinhal de Marrocos, Coimbra, 3030, Portugal

Setsuo Ohsuga (1015) Department of Information and Computer Science, School of Science and Engineering, Waseda University, 3-4-1 Okubo, Shinjuku-Ku, Tokyo, 169, Japan

Takeo Ojika (909) Faculty of Engineering, Gifu University, Yanagido, Gifu, 501-1112, Japan

Simon Parsons (79) Department of Computer Science, University of Liverpool, Liverpool, L69 7ZF, United Kingdom

M. Pasquier (1773) Intelligent Systems Laboratory, Nanyang Technological University, 637989, Singapore

Ferdinand Peper (1199) Communications Research Laboratory, Kansai Advanced Research Center, 588-2 Iwaoka, Iwaoka-cho, Nishi-ku, Kobe, 651-2492, Japan
Elena Pérez Miñana (1497) Philips Research Laboratories, Cross Oak Lane, Redhill, Surrey, RH1 5HA, England

Gerhard Peter (1413) Research Institute for Applied Knowledge Processing (FAW), University of Ulm, Ulm 89019, Germany

C. Quek (1355, 1699, 1773, 1831) Intelligent Systems Laboratory, School of Applied Science, Nanyang Technological University, 639798, Singapore

Richard Quintero (197) Intelligent Systems Division, National Institute of Standards and Technology, Gaithersburg, Maryland, 20899

Tanneguy Redarce (833) Laboratoire d’Automatique Industrielle, Institut National de Sciences Appliquées, Villeurbanne Cedex, 69621, France

Christian Rupprecht (1413) Research Institute for Applied Knowledge Processing (FAW), University of Ulm, Ulm, 89019, Germany

David J. Russomanno (1071) Department of Electrical Engineering, University of Memphis, Memphis, Tennessee, 38152

Sumit Sarkar (961) School of Management, University of Texas at Dallas, Management Science and Information Systems, Richard, Texas, 75080

Harry Scott (197) Intelligent Systems Division, National Institute of Standards and Technology, Gaithersburg, Maryland, 20899

Hisashi Shimodaira (1259, 1577) Faculty of Information and Communication, Bunkyo University, 2-2-16 Katsuradai, Aoba-Ku, Yokohama-city, Kanagawa 227-0034, Japan

Mahdad N. Shirazi (1199) Communications Research Laboratory, Kansai Advanced Research Center, 2-2-2 Hikaridai Seika-cho, Kyoto 619-0289, Japan

W. C. Sim (1699) Intelligent Systems Laboratory, Nanyang Technological University, 637989, Singapore

Milan Sonka (639) Department of Electrical and Computer Engineering, University of Iowa, Iowa City, Iowa 52242

Mladen Stanojević (1107) Computer Systems Department, Mihailo Pupin Institute, Volgina 15, Belgrade, 11060, Yugoslavia

Violeta Stevanović (1107) Computer Systems Department, Mihailo Pupin Institute, Volgina 15, Belgrade, 11060, Yugoslavia

Zarko Sumić (489) Connex T, 1301 5th Avenue, Ste. 1900, Seattle, Washington, 98101

Yu-Liang Sun (1135) iz Technologies, Inc., Dallas, Texas 75234

Guglielmo Tamburrini (1315) Instituto di Cibernetica, CNR, Via Toiano, 6, Arco Felice (NA), I-80072, Italy

Midori Tanaka (801) C&C Media Research Laboratories, NEC Corporation, 4-1-1 Miyazaki, Miyamae-ku, Kawasaki, 216-8555, Japan

J. Tay (1525) Intelligent Systems Laboratory, School of Applied Science, Nanyang Technological University, 639798, Singapore

Takao Terano (1559, 1641) Graduate School of Systems Management, University of Tsukuba, 3-29-1 Otsuka, Bunkyo-ku, Tokyo, 112-0012, Japan

Daniel Tretter (661) Hewlett-Packard Co., Palo Alto, California, 94304-1126
P. Tzionas (875) Department of Automation, Technological Educational Institute of Thessaloniki, Thessaloniki, 54101, Greece

S. S. Venkata (489) Department of ECE, Iowa State University, 2001 Coover Hall, Ames, Iowa, 50011-3060

Sanja Vraneš (1107) Computer Systems Department, Mihailo Pupin Institute, Vojgina 15, Belgrade, 11060, Yugoslavia

Geoffrey I. Webb (937) School of Computing and Mathematics, Deakin University, Geelong, Victoria 3217, Australia

Andrew B. Whinston (1155) The Center for Research in Electronic Commerce, Graduate School of Business, University of Texas at Austin, Austin, Texas 78712-1175

L. H. Wong (1831) Intelligent Systems Laboratory, Nanyang Technological University, 637989, Singapore

Erh-Chun Yeh (489) Cegelec ESCA, 11120 NE 33rd Place, Bellevue, Washington 98006

Yuehwern Yih (1135) School of Industrial Engineering, Purdue University, West Lafayette, Indiana 47907-1287

S. M. Yuen (553) Department of Systems Engineering and Engineering Management, The Chinese University of Hong Kong, Hong Kong, China

Ning Zhong (1015) Department of Information Engineering, Maebashi Institute of Technology, 460-1 Kamisadori-cho, Maebashi City 371-8616, Japan

R. W. Zhou (1355) Intelligent Systems Laboratory, Nanyang Technological University, 637989, Singapore