

# **BUSINESS INFORMATICS**

**16**

**PRACE NAUKOWE  
UNIWERSYTETU EKONOMICZNEGO  
WE WROCŁAWIU  
nr 104**

**RESEARCH PAPERS  
OF WROCŁAW UNIVERSITY  
OF ECONOMICS  
No. 104**

# **BUSINESS INFORMATICS**

# **16**

**Data Mining and Business Intelligence**

edited by  
**Jerzy Korczak**



Publishing House of Wrocław University of Economics  
Wrocław 2010

Scientific Council

*Jadwiga Sobieska-Karpińska (chairman)*

*Andrzej Bąk, Andrzej Bytniewski, Jerzy Korczak, Andrzej Małachowski,  
Adam Nowicki, Mieczysław Owoc, Kazimierz Perekhuda, Jacek Unold*

Reviewers

*Waldemar Bojar, Bernard Kubiak, Halina Kwaśnicka, Antoni Ligęza,  
Stanisław Stanek, Stanisław Wrycza*

Proof-reading

*Agnieszka Flasińska*

Typesetting

*Beata Mazur*

Cover design

*Beata Dębska*

All rights reserved. No part of this book may be reproduced in any form or in any means without the prior permission in writing of the Publisher.

© Copyright by Wrocław University of Economics  
Wrocław 2010

**ISSN 1899-3192**

**ISSN 1507-3858**

## Contents

|  |     |
|--|-----|
| Preface .....  | 7   |
| <b>Helena Dudycz:</b> Visualization methods in business intelligence systems – an overview .....   | 9   |
| <b>Dominique Renaud, Cecilia Zanni-Merk, Philippe Bouché, Nathalie Gartiser, François Rousselot:</b> A strategy for reasoning with close knowledge bases: application to knowledge bases on SMEs ..... | 25  |
| <b>Doulkifli Boukraa, Omar Boussaïd, Fadila Bentayeb, Sabine Loudcher:</b> OLAP operators for a complex object-orienteted multidimensional model .....   | 34  |
| <b>Małgorzata Nycz, Mieczysław L. Owoc, Maciej Pondel:</b> Business intelligence concepts for education quality management .....   | 47  |
| <b>Wiesław Pietruszkiewicz, Dorota Dżega:</b> An application of data mining in the management of e-learning platform .....   | 60  |
| <b>Aleksander Fafula:</b> A prototype of a platform for data-driven approach to detection of cognitive biases .....  | 71  |
| <b>Maciej Bac:</b> Self Organizing Map (SOM) network application support for short-term investment decisions .....   | 79  |
| <b>Janina A. Jakubczyc:</b> The interpretability of contextual classifier ensemble .....   | 89  |
| <b>Jerzy Korczak, Krzysztof Drełczuk:</b> Effect of wavelet compression of high frequency time series on the quality of information and prediction .....   | 99  |
| <b>Mariusz Żytniewski:</b> Perfecting the synergic effect in hybrid multi-agent systems .....  | 114 |
| <b>Arnaud Quirin, Jerzy Korczak:</b> GramGen: A genetic programming system based on context free grammar .....   | 128 |
| <b>Anna Ławrynowicz:</b> A novel intelligent method to support operations management in clusters .....   | 148 |
| <b>Mikołaj Morzy:</b> Influence in the blogosphere .....   | 166 |
| <b>Paweł Weichbroth:</b> The system framework for profiling the content of Web portals .....   | 186 |
| <b>Dionyssios S. Demetis:</b> Artificial non-intelligence and anti-money laundering .....  | 194 |

## Streszczenia

|  |     |
|--|-----|
| <b>Helena Dudycz:</b> Metody wizualizacji w systemach <i>business intelligence</i> – przegląd rozwiązań .....  | 24  |
| <b>Dominique Renaud, Cecilia Zanni-Merk, Philippe Bouché, Nathalie Gartiser, François Rousselot:</b> Strategia wnioskowania w heterogenicznych bazach wiedzy: zastosowanie w bazach wiedzy małych i średnich przedsiębiorstw ..... | 33  |
| <b>Doulkifli Boukraa, Omar Boussaïd, Fadila Bentayeb, Sabine Loudcher:</b> Operatory OLAP dla złożonych obiektowo zorientowanych wielowymiarowych modeli danych .....  | 46  |
| <b>Małgorzata Nycz, Mieczysław L. Owoc, Maciej Podel:</b> Koncepcja wykorzystania inteligencji biznesowej w obszarze zarządzania jakością kształcenia .....  | 59  |
| <b>Wiesław Pietruszkiewicz, Dorota Dżega:</b> Zastosowanie eksploracji danych w zarządzaniu platformą e-learningową .....  | 70  |
| <b>Aleksander Fafula:</b> Wykrywanie błędów poznawczych poprzez podejście zorientowane na dane – prototyp platformy .....  | 78  |
| <b>Maciej Bac:</b> Wykorzystanie sieci (SOM) do wspomagania krótkoterminowych decyzji inwestycyjnych .....   | 88  |
| <b>Janina A. Jakubczyc:</b> Możliwości interpretacyjne kontekstowego klasyfikatora złożonego .....   | 98  |
| <b>Jerzy Korczak, Krzysztof Dreliczuk:</b> Wpływ kompresji szeregów czasowych o dużej częstotliwości falką Daubeuchies 4 na jakość zawartych w nich informacji .....   | 113 |
| <b>Mariusz Żytniewski:</b> Doskonalenie efektu synergicznego w hybrydowych systemach wieloagentowych .....   | 127 |
| <b>Arnaud Quirin, Jerzy Korczak:</b> GramGen: System programowania genetycznego oparty na gramatyce bezkontekstowej .....  | 147 |
| <b>Anna Ławrynowicz:</b> Nowatorska inteligentna metoda wspomagająca zarządzanie operacyjne w klastrach .....  | 165 |
| <b>Mikołaj Morzy:</b> Relacja wpływu w blogosferze .....   | 185 |
| <b>Paweł Weichbroth:</b> Architektura systemu profilowania treści witryn internetowych .....   | 193 |
| <b>Dionyssios S. Demetis:</b> Niesztuczna inteligencja i przeciwdziałanie praniu pieniędzy .....   | 203 |

## Preface

*Data Mining* and *Business Intelligence* currently belong to the most active branches of business informatics. Today a Google search for these two highly intersecting themes, returns over 24 million pages for the first term, and over 38 million for the second. Just to remind us of their respective definitions, *Data Mining* is understood as a process of extracting novel, hidden, or useful knowledge from large databases, whilst *Business Intelligence* is a less precisely defined domain, but most authors underline the key aspects of business intelligence as: support of business decision making; advanced data analysis; data warehouses and OLAP technology.

The purpose of this particular edition is to present the research results to system analysts and developers rather than theoreticians. This volume covers a broad selection of data mining methods and business intelligence, ranging from theoretical works to business applications. It presents original research papers on architectures and interfaces of business intelligence systems, OLAP technology, the interpretability of classifiers, financial time series, Web applications, user behavior modeling, and AI methods in information systems.

This special issue is the first volume on data mining and business intelligence produced by the Publishing House of Wrocław University of Economics, Poland. The majority of papers are submitted by leading Polish research laboratories. In addition four papers have been authored by foreign researchers; two from France, one from the United Kingdom and one from Spain. I am particularly happy to publish research works submitted by young researchers and PhD students from Wrocław University of Economics.

I believe that this special issue will be of great value not only to practitioners but also to researchers in management information systems and advanced AI applications. The results presented demonstrate the high utility potential of the methods of data mining and business intelligence in decision making and business driven applications.

The editorial supervision resulting in this volume was carried out by the Publishing House of Wrocław University of Economics, and was supported by the research funds of the University. I cordially thank all people involved in its preparation, in particular the authors of the papers, the reviewers, the members of the Editorial Board.

Wrocław, January 2010

*Jerzy Korczak*