

SLOVAK UNIVERSITY OF TECHNOLOGY IN BRATISLAVA
FACULTY OF CHEMICAL AND FOOD TECHNOLOGY

**INSTITUTE OF INFORMATION ENGINEERING, AUTOMATION
AND MATHEMATICS**

DEPARTMENT OF MATHEMATICS

ANNUAL REPORT

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DEPARTMENT OF MATHEMATICS

Head of Department:

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I. STAFF

Full Professors:

Vladimír Kvasnička, DSc; Ing., Jiří Pospíchal, DSc;

Associate Professors:

Vladimír Baláž, PhD; Anna Kolesárová, PhD; Michal Šabo, PhD; Štefan Varga, PhD; Imrich Fabrici, PhD

Assistant Professors :

Jozef Antoni, PhD; Július Bánki, PhD; Štefan Boor, MSc; Ivan Garaj, PhD; Eva Hainzlová, MSc; Ľubomíra Horanská, PhD; Milan Jasem, PhD; Štefan Babinec, Ing. ; Ján Mazák, MSc

PhD Students:

Štefan Babinec, Ing., Peter Grančič, Ing., Dagmar Zelisková, Ing.

II. TEACHING AND RESEARCH LABORATORIES

A. Teaching laboratories:

Laboratory equipped by personal computers for the Basics of Computer Science

B. Research laboratories:

III. TEACHING

A. Undergraduate Study:

1. semester (Bc)	Calculus I	2/3/0	Šabo, Horanská, Jasem, Fabrici, Boor Kolesárová, Baláž, Bánki, Garaj, Mazák
	Calculus I (external study)	2/2/0	Kolesárová, Jasem
	Informatics	1/0/2	Antoni, Boor
	Informatics (external study)	1/0/2	Bánki
	Informatics and algorithms	2/0/1	Babinec, Kvasnička, Bánki
	Informatics and algorithms (external study)	2/0/1	Babinec
2. semester (Bc)	Calculus II	4/4/0	Kolesárová, Horanská, Jasem, Šabo, Fabrici, Baláž, Bánki, Garaj, Hainzlová
	Calculus II (external study)	2/2/0	Kolesárová, Jasem
	Programming I	1/0/2	Pospíchal, Antoni, Babinec, Boor
	Programming I (external study)	1/0/2	Pospíchal, Babinec
3. semester (Bc)	Applied Statistics	1/0/1	Varga, Garaj
	Applied Statistics (external study)	1/0/1	Varga
	Calculus III	1/0/1	Baláž
	Calculus III (external study)	1/0/1	Baláž, Horanská
	Programming II	1/0/2	Pospíchal, Antoni, Babinec
	Programming II (external study)	1/0/2	Pospíchal, Babinec
4. semester (Bc)	Applied Statistics	1/0/1	Varga
5. semester (Bc)	Calculus III	2/0/2	Garaj, Varga
	Calculus III (external study)	1/0/1	Garaj
2. semester (MSc)	Numerical mathematics in chemistry	0/0/3	Šabo
3. semester (MSc)	Statistics	2/0/1	Varga
	Laboratory of specialization II	0/0/6	Boor
	Financial mathematics	2/0/0	Horanská
4. semester (MSc)	Diploma thesis	0/0/27	Varga, Kolesárová, Horanská, Šabo

IV. CURRENT RESEARCH PROJECTS

Conjunctive aggregation operators VEGA GRANT No. 1/3012/06 (Anna Kolesárová)

Aggregation is an important process in any sphere of life where it is necessary to obtain from a given input information a single output value representing the input data. In many areas, e.g., in knowledge-based systems, multi-criteria decision making, applications in fuzzy set theory, etc., various types of numerical aggregation operators are needed. We are interested in conjunctive types of aggregation operators, especially triangular norms, which are associative conjunctive operators, important, e.g., in fuzzy logics; copulas and quasi-copulas, which are types of conjunctive 1-Lipschitz aggregation operators, not necessarily associative, playing an important role in probability theory and statistics. We focus our attention on the construction of such operators or their best possible bounds from partial information on subdomains and on the problem of dominance of triangular norms. The aim of the project is also to propose methods for identification of copulas from observed data and application of the obtained results for investigation of the dependence structure of more dimensional random variables.

Project duration: from 01/01/2006 to 31/12/2008

Many valued logics in expert systems VEGA GRANT No. 1/ 2005/05 (Michal Šabo)

Many valued logics allow to use vague and uncertain human knowledge expressed in natural language in decision processing. Preference modelling, fuzzy modelling, multicriteria decision making, utilisation of neural network, prediction of time series, fuzzy regression models are important parts of many valued inference processes. These projects face many problems for solution of which can be used the classical knowledge from mathematical analysis, discrete mathematics, graph theory, theoretical computer science. Such problems are, e.g., problems of convenience of fuzzy connectives, existence of preference structures, domination of operators, similarities of objects. Applications of the results of this project can be expected in many-valued inference modelling, fuzzy analysis, topology, chemical technology, energetics, management etc. Some theoretical results can enrich the classical set theory and mathematical analysis.

Project duration: from 01/2005 to 12/2007

Predictions in Neural Networks and Regression models Project Kniha SK (Štefan Varga)

Predictions in neural networks and regression models is a partial theme that we have solved in the project Kniha SK (co-ordinator Svetozár Katusčák, ODCP). The aim of the project is the study of modern methods of predictions of discrete and continuous random variables and random vectors. In the field of regression analysis our interest is oriented to the logistic regression models, where the output variable is qualitative and to the nonparametric regression, where the regression model for the output variable is unknown. The problem in the both studied parts of regression analysis is to predict the output variables. Another problem is to compare these predictions with the predictions acquired using the neural networks.

Project duration: from 01/01/2006 to 31/12/2007

V. CURRENT EDUCATION PROJECTS

VI. COOPERATION

A. Cooperation in Slovakia

Institution	Type of cooperation	Responsible person	Duration
SjF STU Bratislava	E-learning in mathematics	Mgr. M. Kováčová, PhD.	2007-2008
SAV Bratislava	Scientific cooperation in Number Theory	Doc. O. Strauch, Doc.S. Jakubec	2007-2009
FMFI UK Bratislava	Scientific cooperation in Theory of Real function	Prof. P. Kostyrko	2007-2009
SvF STU	Scientific cooperation - Theory of aggregation functions and multi-criteria decision making	Prof. RNDr. R. Mesiar, DrSc.	2006-

B. International Cooperation

Institution	Type of cooperation	Responsible person	Duration
J. Kepler University, Linz	Scientific cooperation - Theory of aggregation functions	Prof. E.P. Klement	2007
Universita di Lecce, Italy	Scientific cooperation in Statistics	Prof. C. Sempi	2007
J. Kepler University, Linz	Scientific cooperation - Theory of copulas	Prof. E.P. Klement, Dr. F. Durante	2007
University of Gent, Belgium	Scientific cooperation - Theory of aggregation functions	Prof. B. De Baets	2007
University of Alcalá, Spain	Scientific cooperation - Theory of aggregation functions	Prof. T. Calvo	2007
FFP UO, Opava	Organization of a seminar on Artificial Life and Cognition	Prof. RNDr. J. Kelemen, DrSc.	1.5.2000-
University J. Monnet, St. Etienne	Scientific cooperation	Prof. G. Grekos	2007-2008
University de Provence, CMI, Marseille	Scientific cooperation in Uniform Distribution Theory	Prof. P. Liardet	2006-2007
Prírodoved. Fak. OU Ostrava	ERASMUS	Doc. L. Mišík, CSc	2006-2007
Pedagog. Fak. OU Ostrava	ERASMUS	Doc. J. Kostra, CSc	2006-2007
Univ. Luminy, Marseille de Provence IMP	Scientific cooperation	Prof. H. Favvre	2007-2008

C. Membership in Domestic Organizations and Societies

Name	Organisation or Society	Position	Valid date
Kvasnička Vladimír	Slovak Academic Society	member	1997
Kvasnička Vladimír	Slovak Artificial Intelligence Society	chairmann	29.8.2000-
Kvasnička Vladimír	Slovak Computer Science Society	member	1.1.1996-
Kvasnička Vladimír	Slovak Society for Mathematicians and Physicists	member	1980-1992
Kvasnička Vladimír	Scientific Commity of FCHPT STU	member	1.9.2002-
Kvasnička Vladimír	Scientific Commity of FIIT STU	member	1.10.2003-
Kvasnička Vladimír	Joint Commission for PhD study in Applied Informatics	member	1.1.1998-
Kvasnička Vladimír	Joint Commission for PhD study in Artificial Intelligence	member	1.1.2000-
Šabo Michal	Joint Commission for PhD study in Applied Mathematics	member	1.1.1998-
Kvasnička Vladimír	Commission for defence of DrSc. dissertations in Chemical Physics	member	1.1.1998-
Garaj Ivan	Technical commission TK71 Applications of statistical methods in quality control	member	1.1.2003
Garaj Ivan	Committee of Slovak Statistical and Demographic Society	member	1.1.2000
Kolesárová Anna	Slovak Society for Mathematicians and Physicists	member	1974-
Kolesárová Anna	Editorial Board of Tatra Mountains Math. Publ.	member	1998
Šabo Michal	Slovak Society for Mathematicians and Physicists	member	1968-
Pospíchal Jiří	Slovak Computer Science Society	member	1.1.1996-
Pospíchal Jiří	Slovak Artificial Science Society	member	29.8.2000-
Antoni Jozef	Slovak Society for Mathematicians and Physicists	member	1968-
Baláž Vladimír	Slovak Society for Mathematicians and Physicists	member	1978-
Baláž Vladimír	Slovak Mathematical Society	Member	1996-
Jasem Milan	Slovak Society for Mathematicians and Physicists	member	1978-
Varga Štefan	Slovak Society for Mathematicians and Physicists	member	1968-
Horanská Ľubomíra	Slovak Society for Mathematicians and Physicists	member	1993-

D. Membership in International Organisations and Societies

Name	Organisation or Society	Position	Valid date
Kvasnička Vladimír	MATCH Communications in Mathematical Chemistry	member of advisory board	1.1.1998 -
Kvasnička Vladimír	Neural Network World	member of advisory board	1.1.2001 -
Kvasnička Vladimír	Croatica Chimica Acta	member of advisory board	1.1.2002 -
Kolesárová Anna	European Society for Fuzzy Logic and Technology (EUSFLAT)	member	1998-
Šabo Michal	European Society for Fuzzy Logic and Technology (EUSFLAT)	member	1998-
Šabo Michal	SEFI - Mathematical Working Group	member	1994-
Sarkoci Peter	European Society for Fuzzy Logic and Technology (EUSFLAT)	member	2005-
Baláž Vladimír	Editorial Board of Uniform Distribution Theory	manager editor	2005-
Pospíchal Jiří	EURO Working group on fuzzy sets (EUROFUSE) (http://allserv.rug.ac.be/~bdebaets/members.html#SlovakRepublic)	member	1999-

E. Visitors from abroad

F. Visits of Staff Members and Postgraduate Students in Foreign Institutions

Name	Organisation / Institution / Conference	State	Date / Duration
Varga Štefan	Prírodoved. Fak. OU Ostrava , ERASMUS	Czech Republik	July 2007, 14 days
Kolesárová Anna	J.Kepler University, Linz, 28th Linz Seminar	Austria	February 5-10, 2008
Kolesárová Anna	Internat. Conference EUSFLAT'2007, Ostrava	Czech Republik	September 10-15, 2008
Kolesárová Anna	Internat. Summer School AGOP'2007, Ghent	Belgium	July 8-15, 2008
Šabo Michal	Internat. Conference EUSFLAT'2007, Ostrava	Czech Republik	September 10-15, 2008
Baláž Vladimír	Prírodoved. Fak. OU Ostrava , ERASMUS	Czech Republik	July 2007, 14 days
Baláž Vladimír	Internat. Workshop Sequences, Ostrava	Czech Republik	September 2-9, 2007
Babinec Štefan	INEB - Instituto de Engenharia Biomédica	Portugal	September 9-14, 2007
Jasem Milan	University of Klagenfurt, Internat. Workshop on General Algebra	Austria	February 1-4, 2007

VII. THESES AND DISSERTATIONS

A. Graduate Theses (Bc Degree) for state examinations after three years of study

B. Graduate Theses (MS Degree) for state examinations after five years of study

Name	Title of Thesis	Supervisor
Hladíková M.	Predictions in regression models and neural networks	Varga Š.
Horváthová I.	Predictions in fuzzy regression models	Varga Š.
Jančík M.	Intelligent technologies in education	Kolesárová A.
Kovalčík B.	Application of many valued logic in fuzzy control	Šabo M.

Kráľ M.	Evaluation of financial derivatives by Black-Scholes method	Horanská Ľ.
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C. Dissertations (PhD)

Name	Title of Thesis	Supervisor
Babinec Štefan	Using ECHO state neural networks for time series prediction	Pospíchal J. Prof., DSc.

VIII. PUBLICATIONS

Article in journal

- [1] BABINEC, Š.: Use of autoregressive predictor in Echo state neural networks. Computing and Informatics. - ISSN 1335-9150. - Vol. 26, No. 6 (2007), p. 649-661. (in English)
- [2] BABINEC, Š., POSPÍCHAL, J.: Improving the prediction accuracy of Echo state neural networks by anti-Oja's learning. Lecture Notes in Computer Science. s Vol. 4668 (2007) p. 19-28. (in English)
- [3] BABINEC, Š., POSPÍCHAL, J.: Optimization of Echo State Neural Networks for Electrical Load Forecasting. In: Neural network world. - ISSN 1210-0552. - Vol. 17, Iss. 2 (2007), p. 133-152. (in English)
- [4] DURANTE, F., KOLESÁROVÁ, A., MESIAR, R., SEMPI, C.: Copulas with given diagonal sections: novel constructions and applications. In: International Journal of Uncertainty, Fuzziness and Knowledge-Based Systems. - ISSN 0218-4885. - Vol. 15, No. 4 (2007), p. 397-410. (in English)
- [5] DURANTE, F., KOLESÁROVÁ, A., MESIAR, R., SEMPI, C.: Copulas with given values on a horizontal and a vertical section. In: Kybernetika. - ISSN 0023-5954. - Vol. 43, No. 2 (2007), p. 209-220. (in English)
- [6] GARAJ, I.: Aproximácia kvantilov necentrálneho t-rozdelenia. In: Forum Statisticum Slovacum. - ISSN 1336-7420. - Vol. 3, No. 2 (2007), p. 54-59. (in Slovak)
- [7] JANIGA, I., GARAJ, I.: Štatistický tolerančný interval - nástroj riadenia kvality. In: Forum Statisticum Slovacum. - ISSN 1336-7420. - Vol. 3, No. 4 (2007), p. 46-57. (in Slovak)
- [8] JASEM, M.: Isometries and direct decompositions of pseudo MV-algebras. In: Mathematica Slovaca. - ISSN 0139-9918. - 57-1 (2007), p. 107-118. (in English)
- [9] JASEM, M.: On ideals of lattice ordered monoids. In: Mathematica bohémica. - ISSN 0862-7959. - 132-4 (2007), p. 369-387. (in English)
- [10] KLEMENT, E.P., KOLESÁROVÁ, A., MESIAR, R., SEMPI, C.: Copulas constructed from horizontal sections : Multivariate analysis. In: Communications in Statistics - Theory and Methods. - ISSN 0361-0926. - Vol. 36, No. 16 (2007), p. 2901-2911. (in English)
- [11] KLEMENT, E.P., KOLESÁROVÁ, A.: Intervals of 1-Lipschitz aggregation operators, quasi-copulas and copulas with given affine section. In: Monatshefte für Mathematik. - ISSN 0026-9255. - Vol. 152, No. 2 (2007), p. 151-167. (in English)
- [12] KOLESÁROVÁ, A., MAYOR, G., MESIAR, R.: Weighted ordinal means. In: Information Sciences. - ISSN 0020-0255. - Vol. 177, Iss. 18 (2007), p. 3822-3830. (in English)
- [13] VARGA, Š., HORVÁTHOVÁ, I.: Fuzzy regression models with asymmetric fuzzy numbers. In: Forum Statisticum Slovacum. - ISSN 1336-7420. - Vol. 3, No. 2 (2007), p. 234-239. (in English)

- [14] VARGA, Š., HLADÍKOVÁ, M.: Neural networks versus nonparametric regression. In: Forum Statisticum Slovacum. - ISSN 1336-7420. - Vol. 3, No. 2 (2007), p. 229-233. (in English)
- [15] VARGA, Š.: Robus estimations in classical regression models versus robus estimations in fuzzy regression models. In: Kybernetika. - ISSN 0023-5954. - Vol. 43, No. 4 (2007), p. 503-508. (in English)

Article in conference proceedings

- [1] BABINEC, Š.: Použitie autoregresívneho subprediktora v Echo State neurónových sieťach. In: Cognition and Artificial Life VII. - Opava: Slezská univerzita. - ISBN 978-80-7248-412-6. - p. 29-36. (in Slovak)
- [2] JANIGA, I., GARAJ, I.: Application of statistical tolerance interval in quality control. In: REQUEST '06 : Sborník z konference. - Praha, 30.1. - 1.2. 2007. - Praha : Centrum pro jakost a spolehlivost výroby, ČVUT, 2007. - ISBN 978-80-01-03709-6. - p. 136-152. (in Slovak)
- [3] JANIGA, I., MOCÁK, J., GARAJ, I.: The link between the IUPAC detection limit and minimum detectable concentration. In: Measurement 2007 : Proceedings. 6th International Conference on Measurement. Smolenice, Slovak Republic, 20.-24.5.2007. - Bratislava : Institute of Measurement Science Slovak Academy of Sciences, 2007. - ISBN 978-80-969672-0-9. - p. 94-97. (in English)
- [4] KOLESÁROVÁ, A.: Best possible bounds for 1-Lipschitz aggregation functions determined from a partial information, and consequences for quasi-copulas and copulas. In: AGOP 2007 : Proceedings of the Fourth International Summer School on Aggregation Operators. - Ghent : Academia Press, 2007. - ISBN 978-90-382-1140-4. - p. 23-31. (in English)
- [5] KOLESÁROVÁ, A., MAYOR, G., MESIAR, R.: Ordinal means. In: New Dimensions in Fuzzy Logic and Related technologies. Volume I : Proceedings of the 5th EUSFLAT Conference. - Ostrava : Ostravská univerzita, 2007. - ISBN 978-80-7368-386-3. - p. 75-81. (in English)
- [6] MORDELOVÁ, J., KOLESÁROVÁ, A.: Some results on discrete copulas. In: AGOP 2007 : Proceedings of the Fourth International Summer School on Aggregation Operators. - Ghent : Academia Press, 2007. - ISBN 978-90-382-1140-4. - p. 145-150. (in English)
- [6] ŠABO, M.: Domination and Information Boundedness Principle for Aggregation. In: New Dimensions in Fuzzy Logic and Related technologies. Volume I : Proceedings of the 5th EUSFLAT Conference. - Ostrava : Ostravská univerzita, 2007. - ISBN 978-80-7368-386-3. - p. 41-45. (in English)
- [7] ŠABO, M.: Notes on Reverses of Binary Operations. In: Aplimat 2007. Book of abstracts : 6 th International conference. - Bratislava /Slovak Republik/, February 6-9, 2007. - ISBN 978-80-969562-9-6. - p. 433-439. (in English)

Chapter or pages in book

- [1] BALÁŽ, V.: Remarks on uniform density u. In: Proceedings IAM 2007 workshop on informatics, automation and mathematics. - ISBN 978-80-227-2751-8. - p. 43-48. (in English)
- [2] GARAJ, I.: The approximation to a percentage point of the non-central t-distribution. In: Proceedings IAM 2007 workshop on informatics, automation and mathematics. - ISBN 978-80-227-2751-8. - p. 5-11. (in English)
- [3] HORANSKÁ, L.: Note on the generalized vector field problem. In: Proceedings IAM 2007 workshop on

informatics, automation and mathematics. - ISBN 978-80-227-2751-8. - p. 49-52. (in English)

[4] KOLESÁROVÁ, A.: Fuzzy utility functions. In: Proceedings IAM 2007 workshop on informatics, automation and mathematics. - ISBN 978-80-227-2751-8. - p. 21-27. (in English)

[5] MESIAR, R., KOLESÁROVÁ, A., KOMORNÍKOVÁ, M., CALVO, T.: A review of aggregation functions. In: Fuzzy Sets and Their Extensions: Representation, Aggregation and Models. - p. 121-144. (in English)

[6] ŠABO, M.: Information boundedness principles in fuzzy control processes. In: Proceedings IAM 2007 workshop on informatics, automation and mathematics. - ISBN 978-80-227-2751-8. - p. 16-20. (in English)

[7] VARGA, Š.: Regression models - Estimations. In: Proceedings IAM 2007 workshop on informatics, automation and mathematics. - ISBN 978-80-227-2751-8. - p. 11-15. (in English)

[8] ZELISKOVÁ, D., MATÚŠ, R.: The dependence structure of random variables modeled by copulas. In: Proceedings IAM 2007 workshop on informatics, automation and mathematics. - ISBN 978-80-227-2751-8. - p. 28-34. (in English)