5-7 July 2017

Zilina - Slovakia

Program of

The International Conference on

Information and Digital Technologies 2017

IEEE
Czechoslovakia Section

ESRA

CERES

Dear participants

It is a great pleasure to welcome you to International Conference on Information and Digital Technologies (IDT 2017). The Conference is organized and hosted by the Faculty of Management Science and Informatics of the University of Žilina. The IDT history goes back to the Conference on Digital Technologies (DT) that was founded at the Faculty of Electrical Engineering of our University. The DT allows growing of new conference with widened scope that is started in year 2015 as IDT. IDT 2017 provides a forum for presentation and discussion of scientific contributions covering the theories and methods in the field of information and digital technologies, and their applications to a wide range of industrial, civil and social sectors and problem areas. IDT 2017 is also an opportunity for researchers, practitioners, academics and engineers to meet, exchange ideas, and gain insights from each other. IDT 2017 offers a multidisciplinary platform to address the technological, societal and financial aspects of information systems.

The conference program is divided into some workshops that cover numerous aspects of information and digital technologies:

- Workshop on Biomedical Technologies;
- Workshop on Reliability Technologies;
- Workshop on New Frontier Information Digital Technology;
- Workshop on Dynamical Systems and Real World Applications;
- Workshop on CERES: Modern Experience on Young Researchers Organization.

We would like to thank colleagues who organized these workshops.

Initially, more than 130 papers were submitted for the conference. The final number of 73 papers to accepted is the result of a rigid reviewing procedure performed by reviewers from all over the world. The workshop chairs mainly organized the review process and the process was made by a large number of reviewers, which are gratefully acknowledged for their contributions to the improvement of quality of the accepted papers. At least two anonymous reviewers reviewed each paper in order to ensure fair and high-quality reviews.

In addition to regular sessions, IDT 2017 offers distinguished keynote lectures. We thank the IDT 2017 Invited Speakers for offering their unique perspectives on information technologies at the Conference.

In addition, we are hosting the Workshop on CERES. Participants of this workshop are PhD students and young researchers dominantly. This workshop was formed under project TEMPUS CERES (Centers of Excellence for young RESearchers, reg.no. 544137-TEMPUS-1-2013-1-SK-TEMPUS-JPHES) and hold the second time in the framework of the Conference.

We gratefully acknowledge the Faculty of Management Science and Informatics of the University of Žilina, European Reliability and Safety Association (ESRA) and The Czechoslovakia section of IEEE for the sponsoring, organizational and technical support.

We also thank all the contributed paper authors for their submissions and presentations.

Organization team of IDT 2017

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Time Schedule

Wednesday, July 5, 2017				
08.00-9.45	Registration			
09.45-10.30	Opening of the Conference (room C-9)			
10.30-11.30	The First Plenary Section (room C-9)			
11.30-12.00	Coffee/tea			
12.00-13.20	**Section R1** room C-1	**Section I1** room C-6	**Section A1** room C-9	**Section CERES1** room RA003
13.20-14.30	Lunch			
14.30-21.00	Excursion to Trenčín Castle and dinner			

Thursday, July 6, 2017				
09.30-11.30	**Section B1** room C-1	**Section R2** room C-6	**Section A2** room C-9	**Section CERES2** room RA003
11.30-12.00	Coffee/tea			
12.00-13.00	The Second Plenary Section (room C-9)			
13.00-14.00	Lunch			
14.00-15.40	**Section B2** room C-1	**Section C** room C-6	**Section I2** room C-9	CERES Discussion[*]
16.00-21.00	Tour of the Strečno Castle and dinner			

Friday, July 7, 2017				
09.00-10.40	**Section N1** room C-1	**Section D** room C-6	**Section I3** room C-9	**Section CERES3** room RA003
10.40-11.00	Coffee/tea			
11.00-13.00	The Third Plenary Section (room C-9)			
13.00-14.00	Lunch			
14.00-16.00	**Section N2** room C-1		**Section I4** room C-9	**Section CERES4** room RA003
16.00-16.15	Closing ceremony (room C-9)			
16.15-16.30	Coffee/tea			
16:30-17:30	CERES -TEMPUS management session[*]			

[*]According with full programs of the CERES-TEMPUS meeting

Detailed Schedule

Venue: Faculty of Information Sciences and Management, University of Žilina

Wednesday, July 5

Opening of the Conference

09:45-10:30 (room C-9)

The Conference Opening   Prof. Elena Zaitseva

Welcome words of

- *the Conference Chair*   Prof. Max Viergever
- *the Vice-Rector for International Relations & Marketing*   Dr. Jozef Ristvej
- *the Dean of the Faculty*   Dr. Emil Kršák
- *the Chair of Czechoslovakia Section IEEE:*   Dr. Matej Pacha
- *the Chair of the Workshop on RT*   Prof. Radim Bris
- *the Chair of the Workshop on New Frontier IDT:*   Dr. Martin Lukac
- *the Chair of the Workshop on Dynamical systems & applications*   Prof. Darya Filatova

The First Plenary Section

10:30-11:30 (room C-9)

Moderators: **Prof. Radim Bris, Czech Republic**

Assistant: **Dr. Marek Kvet, Slovakia**

Prof. **Frank Coolen** (Durham University, United Kingdom)

The Survival Signature for System Reliability

Section R1: Reliability Technologies I

12:00-13:20 (room C-1)

Chair: **Prof. Frank Coolen, United Kingdom**

Assistant: **Ing. Jan Rabcan, Slovakia**

Igor Bolvashenkov
> *Comparison of the Battery Energy Storage and Fuel Cell Energy Source for the Safety-Critical Drives Considering Reliability and Fault Tolerance*

Tien T. Thach, Radim Bris and Frank Coolen
> *Mixture Failure Rate: A study based on cross-entropy and MCMC method*

Radim Bris
> *Stochastic Ageing and Maintenance Models for Unavailability Quantification of Complex Multi-Component Systems*

Uladzimir Palukha and Yuriy Kharin
> *Statistical Hypotheses Testing for Random and Pseudorandom Generators Based on Statistical Estimators of Entropy*

Section I1. Information Technologies I

12:00-13:20 (room C-6)

Chair: **Dr. Iwona Dolińska, Poland**

Assistant: **Ing. Patrik Rusnak, Slovakia**

Iwona Dolińska, Mariusz Jakubowski and Antoni Masiukiewicz
Throughput Efficiency in 802.11*n Networks*

Mostafa Haghi, Kerstin Thurow and Norbert Stoll
A Multi-layer Multi-sensor Wearable Device for Physical and Chemical Environmental Parameters Monitoring (CO & NO_2)

Michal Susta, Pavel Zahradnik, Radek Klof, Petr Zalesky and Boris Simak
Digital Broadband Camera based on a Line Scanning Sensor

Iwona Dolińska, Mariusz Jakubowski and Antoni Masiukiewicz
Interference Comparison in Wi-Fi 2.4 *and 5 GHz Bands*

Section A1. Dynamical systems and real world applications I

14:00-15:40 (room C-9)

Chair: **Prof. Darya Filatova, Poland**

Assistant: **Dr. Marek Kvet, Slovakia**

Ľudmila Jánošíková and Patrik Vasilovský
Grouping Genetic Algorithm for the Capacitated p-median Problem

Charles El-Nouty
On the (mixed) integrated fractional Brownian motion

Darya Filatova and Dorota Bochnacka
Necessary Optimality Conditions for Enterprises Production Programs

Pavel Akimov and Marina Mozgaleva
Discrete-Continual Method of Analysis of the Coupled System "Plate – Soil Foundation" in Context of Micro-seismic and Gravitational Processes in Foundation

Section B1: Biomedical Technologies I

09:30-11:30 (room C-1)

Chair: **Prof. Vitaly Levashenko, Slovakia**

Assistant: Ing. Jan Rabcan, Slovakia

Veronika Kubíčková and Lubomír Martínek
   Using Logistic Regression for Assessing the Probability of Serious Postoperative Complications after Colorectal Operations in Geriatric Patients

Adéla Vrtková
   Predicting clinical status of patients after an acute ischemic stroke using random forests

Mariana Ondrušová and Ivan Cimrák
   Dynamical properties of red blood cell model in shear flow

Elena Zaitseva, Vitaly Levashenko, Miroslav Kvassay and Paul Barach
   Healthcare system reliability analysis based on uncertain data

Hynek Bachratý, Kristína Kovalčíková, Katarína Bachratá and Martin Slavík
   Methods of exploring the Red Blood Cells rotation during the simulations in devices with periodic topology

Alexander Nedzved, Olga Nedzved, Alexey Glinsky, Gregory Karapetian, Igor Gurevich and Vera Yashina
   Detection of dynamical properties of flow in an eye vessels by video sequences analysis

Section R2: Reliability Technologies II

09:30-11:30 (room C-6)

Chair: **Prof. Radim Briš, Czech Republic**

Assistant: Ing. Patrik Rusnak, Slovakia

Miroslav Kvassay, Jan Rabcan and Patrik Rusnak
   Multiple-Valued Logic in Analysis of Critical States of Multi-State System

Igor Bolvashenkov
   Methodology for Quantitative Assessment of Fault Tolerance of the Multi-State Safety-Critical Systems with Functional Redundancy

Vyacheslav Kharchenko, Andriy Kovalenko, Kostyantyn Leontiiev, Eugene Babeshko
   Cyber security assurance approaches for FPGA-based safety platform configuration tool

Vyacheslav Kharchenko, Andriy Kovalenko, Artem Panarin, Eugene Babeshko and Vladimir Sklyar
Modeling of Industrial FPGA-based Controllers with ForSyDe

Tyurin Sergey, Prokhorov Andrey and Vikhorev Ruslan
FPGA LUTs for a Logic Systems

Waldemar Nowakowski, Piotr Bojarczak and Zbigniew Łukasik
Performance analysis of data security algorithms used in the railway traffic control systems

Section A2. Dynamical systems and real world applications II

09:30-11:30 (room C-9)

Chair: Prof. Charles El-Nouty, France

Assistant: Dr. Michal Varga, Slovakia

Darya Filatova
The Euler schemes for numerical modeling of stochastic differential equations

Valery Smagin, Gennady Koshkin and Konstantin Kim
Control for Discrete Delayed Systems with Unknown Inputs and Model Parameters Using Nonparametric Algorithms

Miroslav Pasler, Jitka Komarkova and Ivana Cermakova
Statistical Analysis of Utilization of Landsat Data in Observation of Small Inland Water Bodies

Vladimir Sidorov and Katarzyna Nowak
Substantiation of the use of viscoelastic material model in numerical analysis the creep of concrete structures

Pavel Akimov and Oleg Negrozov
Semianalytical Solution of Multipoint Boundary Problems of Structural Analysis with the Use of Combined Application of Finite Element Method and Discrete-Continual Finite Element Method

Vasily Vasilyev and Alexander Dobrovidov
Semi-supervised Bayesian Classification by vector features with continuous and discrete components

The Second Plenary Section

12:00-13:00 (room C-9)

Moderators: **Prof. Elena Zaitseva, Slovakia**

Assistant: **Dr. Michal Varga, Slovakia**

Prof. **Max A. Viergever** (University Medical Center Utrecht, The Netherlands)

Challenges in Medical Image Analysis

Section B2: Biomedical Technologies II

14:00-15:40 (room C-1)

Chair: **Dr. Alexei Belotserkovsky, Belarus**

Assistant: **Ing. Jan Rabcan, Slovakia**

Martin Slavík, Katarína Bachratá, Hynek Bachratý and Kristína Kovalčíková
The Sensitivity of the Statistical Characteristics to the Selected Parameters of the Simulation Model in the Red Blood Cell Flow Simulations

Jaroslav Majernik and Lenka Szerdiová
Preparation of Medical Students for Cadaveric Anatomy using Multimedia Education Tools

Ahed Abugabah
Evaluation of Healthcare Enterprise Information Systems: A Structural Equation Model

Renata Wachowiak-Smolikova, Mark P. Wachowiak and Michel Johnson
Exploratory ECG Analysis of Driving Events Using Wavelet Band Metrics

Jan Rabcan
EEG signals classification by ordered fuzzy decision tree

Section C: Climate-Weather Change Influence on Critical Infrastructure Safety

14:00-15:40 (room C-6)

Chair: **Prof. Krzysztof Kołowrocki, Poland**

Assistant: **Ing. Patrik Rusnak, Slovakia**

Krzysztof Kołowrocki and Joanna Soszyńska-Budny
How to Model Operation Threats and Climate-Weather Hazards Influence on Critical Infrastructure Safety an Overall Approach

Krzysztof Kołowrocki, Ewa Kuligowska, Joanna Soszyńska-Budny, Mateusz Torbicki
An Approach to Safety Prediction of Critical Infrastructure Impacted by Climate-Weather Change Process

Krzysztof Kołowrocki, Ewa Kuligowska, Joanna Soszyńska-Budny, Mateusz Torbicki
Simplified Impact Model of Critical Infrastructure Safety Related to Climate-Weather Change Process

Krzysztof Kołowrocki, Ewa Kuligowska, Joanna Soszyńska-Budny, Mateusz Torbicki
Safety and Risk Prediction of Port Oil Piping Transportation System Impacted by Climate-Weather Change Process

Krzysztof Kołowrocki, Ewa Kuligowska, Joanna Soszyńska-Budny, Mateusz Torbicki
Safety and Risk Prediction of Baltic Oil Terminal Critical Infrastructure Impacted by Climate-Weather Change Process

Section I2. Information Technologies II

14:00-15:40 (room C-9)

Chair: **Dr. Andrii Oliinyk, Ukraine**

Assistant: **Dr. Michal Varga, Slovakia**

Marek Pecho, Norbert Adamko and Michal Varga
Modelling of pedestrian queuing behaviour independent of movement model utilising BDI reasoning in ABAsim architecture

Dmytro Yarymbash, Mikhaylo Kotsur, Sergey Subbotin and Andrii Oliinyk
A New Simulation Approach of the Electromagnetic Fields in Electrical Machines

O. Zhadanos, I. Derevyanko, Y. Proydak, O. Panchenko, A. Salnikov, O. Yakovitsky and M. Gasik
Development the Automated Information System of Ladle-Furnace Process to Predict the Content of Alloying Elements in Bearing Steel

Jan Bohacik, Antonin Fuchs and Miro Benedikovic
Detecting compromised accounts on the Pokec online social network

Dmitrii Dobriborsci and Aleksandr Kapitonov
Application of the Stewart Platform for studying in control theory

Section N1: New Frontier Information Digital Technology I

9:00-10:40 (room C-1)

Chair: **Dr. Martin Lukac, Kazakhstan**

Assistant: Dr. Miroslav Kvassay, Slovakia

Yoshichika Fujioka, Michitaka Kameyama and Martin Lukac
> *A Dynamically Reconfigurable VLSI Processor with Hierarchical Structure based on a Micropacket Transfer Scheme*

Claudio Moraga
> *On the Reed-Muller Spectrum of Symmetric Boolean Functions*

Martin Lukac, Pawel Kerntopf and Michitaka Kameyama.
> *An Analytic Sifting Approach to Optimization of LNN Reversible Circuits*

Olivier Mason, Jean Baratgin and Frank Jamet
> *NAO robot as experimenter: social cues emitter and neutralizer to bring new results in experimental psychology*

Pardis Pourghomi, Ahmed Abu Halimeh, Fadi Safieddine and Wassim Masri
> *Right-click Authenticate Adoption: The Impact of Authenticating Social Media Postings on Information Quality*

Section D: Digital Technologies

9:30-10:40 (room C-6)

Chair: **Dr. Stanislaw Czapp, Poland**
Assistant: Ing. Patrik Rusnak, Slovakia

Juraj Bienik, Miroslav Uhrina and Peter Kortis
> *Influence of CRF Value for Compression Efficiency*

Stanislaw Czapp and Jacek Horiszn
> *The Effect of Current Delay Angle on Tripping of Residual Current Devices*

Dariusz Tarnapowicz and Sergey German – Galkin
> *Researches of transition and quasi-steady state processes in a shunt active power filter*

Sofia Alexandrova, Andrey Baev, Michail Goncharenko, Nikolay Nikolaev, Olga Slita
> *Practical Implementation of High Power and Efficiency Dc-dc Full-Bridge PWM Boost Converter*

Agata Szultka, Robert Malkowski, Stanislaw Czapp and Seweryn Szultka
> *Impact of R/X Ratio of Distribution Network on Selection and Control of Energy Storage Units*

Iryna Piestova, Sergey Stankevich and Jozef Kostolny
> *Multispectral imagery superresolution with logical reallocation of spectra*

Section I3: Information Technology III

9:30-10:40 (room C-9)

Chair: **Dr. Krzysztof Pancerz, Poland**

Assistant: **Dr. Michal Kvet, Slovakia**

Jitka Komarkova, Pavel Sedlák, Jakub Habrman and Ivana Cermakova
Usability Evaluation of Web-Based GIS by means of a Model

Michal Kvet and Karol Matiasko
Temporal Data Group Management

Martin Ibl and Žaneta Boruchová
Complexity Analysis of Business Processes

Renata Bilkova
Adoption model of m-government services

Stanislava Šimonová and Nikola Foltanova
Implementation of Quality Principles for IT service Requirements Analyse

The Third Plenary Section

11:00-13:00 (room C-9)

Moderators: **Prof. Bernd Steinbach, Germany**

Assistant: **Dr. Michal Kvet, Slovakia**

Prof. **Marek Perkowski** (Portland State University, USA)

> ### *Towards Uniform Approaches to Create Quantum Grover Oracles for Practical Problems*

Prof. **Claudio Moraga** (Technical University of Dortmund, Germany)

> ### *Selected Aspects of Multiple-valued Bent Functions*

Section N2: New Frontier Information Digital Technology II

14:00-16:00 (room C-1)
Chair: **Prof. Michitaka Kameyama, Japan**

Assistant: Dr. Miroslav Kvassay, Slovakia

Martin Lukac, Aigerim Bazarbayeva and Michitaka Kameyama
Context Based Visual Content Verification

Eric Msp Veith and Bernd Steinbach
Agent-Based Power Equilibrium in a Smart Grid with XBOOLE

Linh Tran, Bruce Yen and Marek Perkowski
Comparison of Various Error-Detecting And Error-Correcting Encodings of Reversible Automata Built From Irreversible State Tables Using EPOE Circuits with EXOR Lattices

Dmitry Yudin and Alexander Knysh
Vehicle recognition and its trajectory registration on the image sequence using deep convolutional neural network

Krzysztof Pancerz and Piotr Grochowalski
From Unstructured Data Included in Real-Estate Listings to Information Systems over Ontological Graphs

Dmitrii Dobriborsci and Aleksandr Kapitonov
The basics of the identification, localization and navigation for mobile robots

Section I4: Information Technology IV

14:00-16:00 (room C-9)

Chair: **Dr. Krzysztof Pancerz, Poland**

Assistant: Dr. Michal Kvet, Slovakia

Jan Rabcan, Monika Vaclavkova and Rudolf Blasko
Selection of Appropriate Candidates for a Type Position Using C4.5 Decision tree

Uladzimir Parkhimenka, Mikhail Tatur and Anna Zhvakina
Heuristic approach to online purchase prediction based on internet store visitors classification using data mining

Nicolae Iacobici-Luca, Flaviu Mihai Frigura-Iliasa, Doru Vatau, Petru Andea
Command and Control Interface for a Navigation Lock and a Hydro Power Dam

Marek Kvet and Michal Kvet
Temporal database management

Pavel Lukashevich, Boris Zalessky and Alexei Belotserkovsky
Building Detection on Aerial and Space Images

Alexander Vorontsov and Sergey Petunin
Development of unidirectional data diode system in the secure environment

Welcome to the metropolis of Northwest Slovakia

Žilina is a natural centre of north-western Slovakia and with a population of 83 297 inhabitants (as per May 2017) it ranks among the largest cities in Slovakia. Žilina is situated around 200 km from Bratislava, the capital of Slovakia.

Žilina is located in the valley of the Váh river, in the Žilina Basin, at the confluence of the Váh river with its tributaries Kysuca and Rajčanka. The Žilina Basin is surrounded by the mountain ranges of Malá Fatra (Lesser Fatra), Strážovské vrchy (Strážov Hills), Súľovské vrchy (Súľov Hills), Javorníky and Kysucká vrchovina (Kysuce Highlands).

Žilina is a centre of significant political, cultural, sport and public health care institutions. The city of Žilina is the seat of the Žilina Region. Together with the Region, it keeps a stable position of the second or third place in gross domestic product per inhabitant. Its economic potential can be proven by the fact that Žilina has the biggest number of traders per thousand inhabitants. As for the number of join stock companies and limited companies, Žilina keeps third position in Slovakia. The Slovak Commercial and Industrial Chamber in Žilina is the second biggest in Slovakia.

Nowadays, the city of Žilina represents a dynamic development accelerated by KIA Motors Slovakia investments. However, the City is not only a centre of car production, but together with the Upper Váh River Region (Horné Považie), it is an interesting tourist destination.

Interesting events held in the city of Žilina and its surroundings during the year (Carnival Slovakia, Central European Festival of Concert Art, Old Town Festival, Folklore Festival in Terchová, Medieval Day, Rajec Marathon etc.) make the development of the City tourism more dynamic.

The city of Žilina is a centre of theatres, museums, galleries, parks and sports facilities. Its historical centre is crossed by one of the longest and the most beautiful pedestrian zones in Slovakia.

Trenčin Castle

The castle was built over a settlement site that had existed from the Bronze Age through times of Celts and Germanic tribes to the Slavic settlement. In the times of the origins of the Ugrian state a royal castle had developed out of the older Great Moravia hill-fort-roost.

The oldest stone construction of the castle is the pre-Romanesque rotunda, which dates back to Great Moravia period. At the end of 11th century a stone tower was erected (donjon,bergfrid). One story and a ghotic brick coat were added after 1270. By its conic convergence toward the peak, it represents a singular feature of the castle architecture. It is a midpoint of the castle acropolis and the most dominant part of the city skyline. Within a short distance, individual castle palaces were built. The palaces were connected to the extension function of the castle - first as a defense function then as an administrative and residential function. It is thought that Matúš palace is the oldest palace, built at the beginning of the 14th century, from which, however only one wall has been preserved. Today, the wall is a part of the Barbora palace. The castle was the seat of Matúš Čak of Trencin (around 1260-1321), who made it his residential castle and the center of his extensive domain called "Matúš's land" or Terra Mathei. Matúš Čák of Trencin, at that time, the most powerful Ugrian magnate, ruled over the whole Slovakia and a sizeable part of the Zadunajsko region. His grave has never been found and has become a popular quest with various romantics, adventurers, treasure seekers and serious historians. According to a story Matúš Čák of Trenčín was buried in a shell, silver and gold coffin along with vast treasures. After his death, Trenčín castle became the property of the Ugrian crown and king Karl. The Gothic Ludovit palace is a reminiscence of the Anju time. Its construction can be credited to the son of Karl Ludovit, also called the Saint or the Great.

The Gothic style with early renaissance elements is represented by the Barbora palace. It is thought to have been built by the emperor Zigmund of Luxembourg for his second wife Barbora Cellska at the time when the Trencin estate belonged to the Barbora's dowry properties. The third and last palace at the castle is the Palace of Zápolský's, built during the reign of a powerful Zápolský family. The castle was built in the Late Gothic style with elements of the Early Renaisance by Štefan Zápolský and his wife Hedviga, countess Tesinska. Their son and later the Ugrian king Jan Zápolský lost the castle to Johan Katzianer, whose armies surrounded the castle in May 1528. After the cannonade, which caused the explosion of the castle's gunpowder storage and after it was obvious that Zápolský couldn't help the castle, on June 15th the crew exchanged the castle for their personal security and a departure with honors.

The Zápolskýs solved the problem of the only weak spot of the castle, the saddleback of the Brezina woods knotting to the castle rock from the south side. All attacks against the castle fortification were and could have been led only from there. The New south fortification cut the saddleback by two ditches and three wall strips with crenelles and pitch noses. At that time the aging gothic system was strengthened by two artillery bastions of a new renaissance rondel

type, the Jeremias bastion and the Mlynská tower, located in the central ax of the defense. From the architectonic point of view it is a unique fortification system, singular in central Europe. Less than unique construction for this time is the building of barracks to serve for the castle's crew. It is located next to the Second castle gate. The reign of Štefan Zápolský gave birth to one of the oldest and most beautiful Slovak legends, the legend of the well of love.

The Trenčín castle, experienced not only war and terror, but also hosted kings and queens from almost all over Europe. Its advantageous location within a short distance to the borders of the three kingdoms predestined it to be the place of diplomatic meetings. On August 24, 1335 the polish king Kazimir, the Ugrian king Karol Robert along with his son Ludovit and the Czech king Jan of Luxembourg accompanied by his son Karl, met at the castle to conduct peace talks. The Czech king gave up his title of Polish king in exchange for the Piast duchy located in the Sliesko region. In 1362 peace talks between Ludovit the Great and the roman emperor Karol IVrd took place at the castle. Both rulers resolved their disputes about Aquilea. Peace was reached two years later. Both rulers, as customary at that time, exchanged splendid gifts at this occasion. King

Ludovit was given a gold-coated gothic monstrance, which is until today a part of the treasure of the Parish church in Trenčín. He gave the emperor a crystal kettle, currently held at St. Vit cathedral temple in Prague. Emperor Zigmund of Luxembourg and later the king Matej Korvin also used the Trenčín castle in a similar manner.

Strečno Castle

The Strečno Castle is a reconstructed ruin of a medieval castle of an irregular plan located in northern Slovakia, 12 km east of Žilina. The castle stands on a 103-metre-high (338 ft) calcite cliff above the international road E50 and village Strečno. Along with the Old castle (Starhrad) constitutes a significant landscape landmark of the Upper Váh region. A strategic location of the cliff massif rising 103 meters high above the river Váh and above a strategic road located in a narrow strait of the Strečno col was an important prerequisite for building a fortified guardian building.

The first recorded mention of the stone castle is from 1316. Later, in charter of Trenčín district administrator from 1358 is an explicit mention about castle and about a toll station collecting a toll for passage over the river Váh under the castle. In this period, the castle was owned by Matthew III Csák. The oldest part of the castle called small castle, object of the polygonal shaped floor plan of the area of 400 m2 approximately, that consisted of a prism watch tower, a water cistern, a courtyard and a small residential building located in the north eastern corner of the fortification. The access path led from the south through the bridge over a ditch through the main gate. At the end of the first half of the 14th century, the forecastle was completed, providing better control of the main entrance. Later, at the beginning of the 15th century, the northern palace, the chapel and 88 meters deep well on the main courtyard were built during the Barbara of Cilli´s ownership. The new entrance was located in new-built the recruit tower with on the south. Also the northern tower was built in this period. After these conversions, the castle became one of the best fortified castles of the middle Váh region. After a period of expansion of the castle, a decline occurs in the early 16th century as a result of frequent changes of the owners.

At the end of the 17th century, the castle occupied the largest area. These modifications were connected with the preparation of The Wesselényi´s plot against The House of Habsburg in the years 1663-1664. After the suppression of the plot, the castle was taken by the army of Imre Thököly. After he reconquered the castle, emperor Leopold I ordered a demolition in the 1698. The fortifications and the roofs were pulled down. Also the well was filled up. This decision resulted in the failure of the castle. The castle began to be a ruin for more than 350 years. Today the castle belongs to the national cultural heritage of the Slovak republic.

Invited Lectures

Selected Aspects of Multiple-valued Bent Functions

Claudio Moraga

Technical University of Dortmund, Germany

Bent functions were introduced by O. Rothaus in 1976, as the most non-linear Boolean functions, and captured very soon greatest interest from the Cryptography Community. Extensions of Bent functions to non-binary domains were done independently by P.V. Kumar et al. in 1985 and M. Luis and C. Moraga in 1989. Although in the non-binary domain bent functions continued to be most non-linear, their possible cryptographic properties did not have a priority. Cryptography was already strongly anchored in the binary domain. However non-binary or (p-valued) bent functions presented new highly challenging mathematical problems; among others: their generation in different mathematical structures, their characterization, formal representation, and the computation of the cardinality of their several known classes.

In the spectral domain, multiple-valued bent functions are characterized by a Vilenkin-Chrestenson circular spectrum, such that all coefficients have the same absolute value pn/2. The best known classes of p-valued bent functions are the Gamma class, generated based on the tensor sum of bent functions and with the use of spectral invariant operations the p-valued version of the Maiorana- McFarland (binary) class, and an extension of this class. In the p-valued domain there are bent functions for both even and odd number of arguments (meanwhile in the binary case, n is restricted to be even.) A matrix-based version of the Maiorana-McFarland generation method for p-valued bent functions was introduced in allowing a general spectral proof of bentness for all functions of the class. Furthermore, work with the Maiorana-McFarland class allowed to determine a lower bound on the number of p-valued bent functions for every n. For example there are 708,588 ternary bent functions of four arguments. Although this number seems to be large, it should be recalled that there are 381.= 4.43•10x38 ternary functions of four arguments.

In the Lecture, the Gamma and Maiorana-McFarlansd classes will be explained, it will be shown that they are disjoint, and examples of generation and characterization of p-valued bent functions will be given.

The Survival Signature for System Reliability

Frank Coolen

Durham University, United Kingdom

Quantification of reliability of systems is of obvious importance in many application areas. The key mathematical concept for such reliability quantification is the system structure function, which describes whether or not the system functions given the state of all of its components. For many basic inferences on system reliability, however, one only needs a summary of the structure function. One such a summary is Samaniego's system signature, which has led to many journal publications in recent years, but its practical value is limited as it can only be applied to systems whose components all have exchangeable failure times, so-called `identical components'. To overcome this disadvantage, we presented the survival signature in 2012: this summary of the structure function is closely related to Samaniego's signature for systems with identical components, but straightforwardly generalized to systems with multiple types of components. We present an introductory overview of the survival signature and discuss recent advances, including its use with imprecise probabilities, consideration of resilience of systems through the possibility of swapping components, and computational aspects including its use for very efficient simulation of system failure times.


Challenges in Medical Image Analysis

Max A. Viergever

University Medical Center Utrecht, The Netherlands

In order to disambiguate the title of this presentation, the talk is not aimed at providing a visionary display of possible breakthroughs in the field of medical image analysis. Much the opposite, it concerns a well-established - although still relatively new - approach to evaluating medical image analysis algorithms, sometimes also referred to as "grand challenges", in which algorithms that try and solve a specific problem in medical image analysis are compared, usually in a competitive fashion. The presentation will describe what challenges are, why they are organized, how they have been and may be set up, and give examples of challenges covering several topics in medical image analysis.
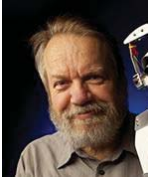
Towards uniform approaches to create quantum Grover oracles for practical problems

Marek Perkowski

Portland State University, United States of America

It is well-known that the "Unsorted Database" quantum algorithm by Grover gives quadratic speedup to several important combinatorial and enumerative problems, such as: SAT, Graph Coloring, Maximum Cliques, Travelling Salesman and others. Recently, quantum programming languages such as Quipper start to be used to design, verify and simulate practical quantum algorithms for important problems in Quantum Machine Learning. So far, however, no methodologies have been created to program Grover Oracles for particular classes of problems. In contrast, such methodologies have been created for classical Constraint Satisfaction Problems. The goal of this invited talk is to show results of some initial research towards creating systematic methodologies to program quantum computers that solve search problems in Artificial Intelligence, Logic Design and Machine Learning. Our methods are based on unified oracle blocks for such representations as set partition algebra, cube calculus and optimal mappings. For instance, several important problems in CAD and Machine Learning can be solved using only two basic operations on set partitions; $\pi1 \leq \pi2$ and $\pi1 \times \pi2$.

Map of Žilina
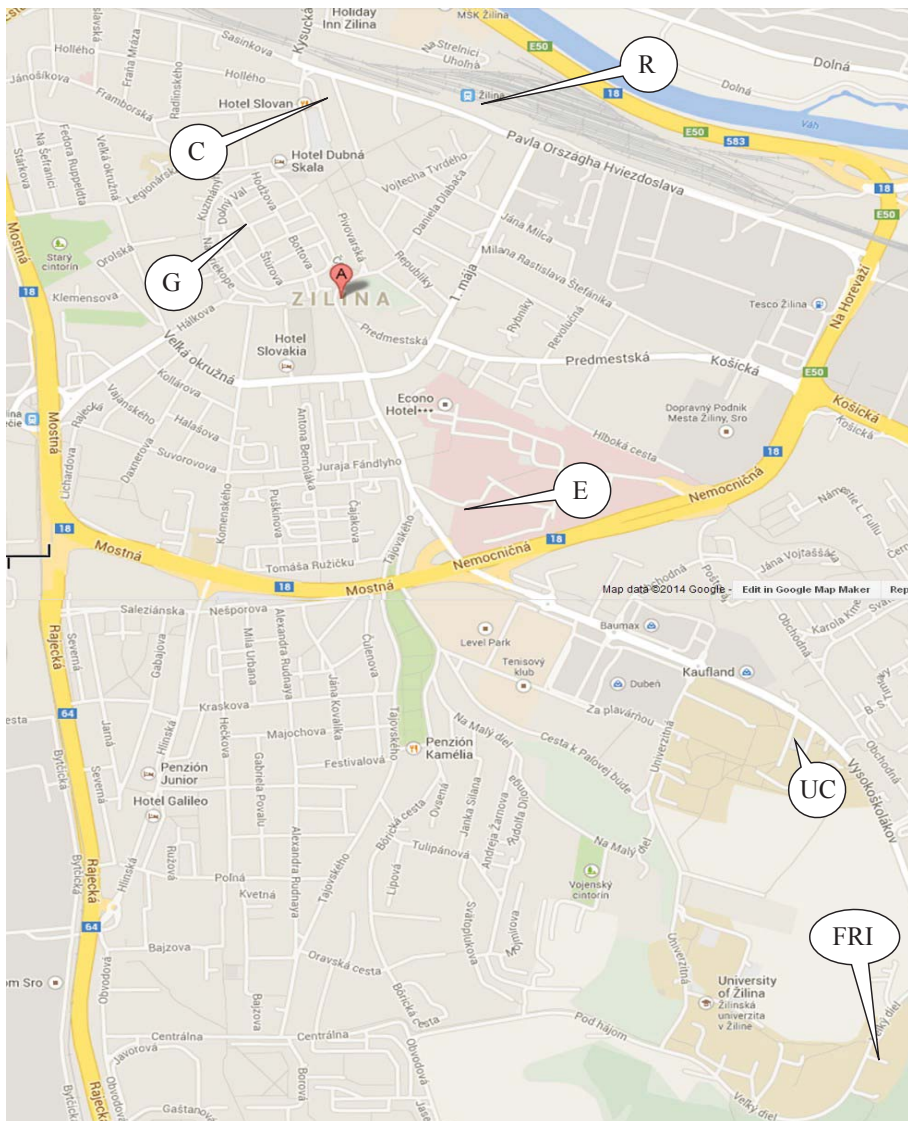
C – Hotel Center Park   A – Historical centrum of the city

G – Grand Hotel;

E – Garni Hotel Econo   R – Railway station (near auto station)

UC – University Campus

FRI – Faculty of Information Sciences and Management;

Distances between (A and R) near 10 minutes by foot.

Distance between UC and FRI near 10-15 minutes by foot.

Distance between E and FRI near 20-25 minutes by foot