WSPS 7

7th Winter School of PhD Students in Informatics and Mathematics

7th Winter School of PhD Students in Informatics and Mathematics

SECTION OF MATHEMATICAL AND INFORMATION SCIENCES
ASSOCIATION OF HUNGARIAN PhD AND DLA STUDENTS

24th-26th January, 2020
Veszprém, Hungary

Contents

Foreword

Dear Participant,

On behalf of the Section of Mathematical and Information Sciences of the Association of Hungarian PhD and DLA Students it gives me great pleasure to welcome you to Veszprém on the occasion of the 7th Winter School of PhD Students in Informatics and Mathematics. The aim of our workshop is to expand the multidisciplinary scientific network of PhD students and improve their professional skills via an intensive course.

The scientific program includes academic and industrial lectures accompanied by an intensive and practical course in the topic of human-computer interaction and artificial intelligence, and a poster session presenting results in various fields of information technology and mathematics.

Let me take this opportunity to wish you an exciting technical meeting at the University of Pannonia and a pleasant stay in the beautiful city of Veszprém.

Veszprém, January 2020

Judit Szűcs
Section of Mathematical and Information Sciences
Association of Hungarian PhD and DLA Students

Introduction of the Scientific Section

Name of the Section
Section of Mathematical and
Information Sciences

Association of Hungarian PhD
and DLA Students

Scientific disciplines
Informatics, Mathematics

Contact
Email: mito@dosz.hu

President
Judit Szűcs

Editor
Péter Hudoba
Flóra Hajdu

Webpage
www.doszmito.hu

Address
Falk Miksa utca 1., Budapest
H-1055 Hungary

Introduction

The Section of Mathematical and Information Sciences of the Association of Hungarian PhD and DLA Students was established in June 2013. The members of the section come from different doctoral schools in information technology and mathematics across the country. The main goal of the section is to support the PhD students with information about conferences, scholarship opportunities and workshops.

Travel information

The WSPS 7 will be held at University of Pannonia.
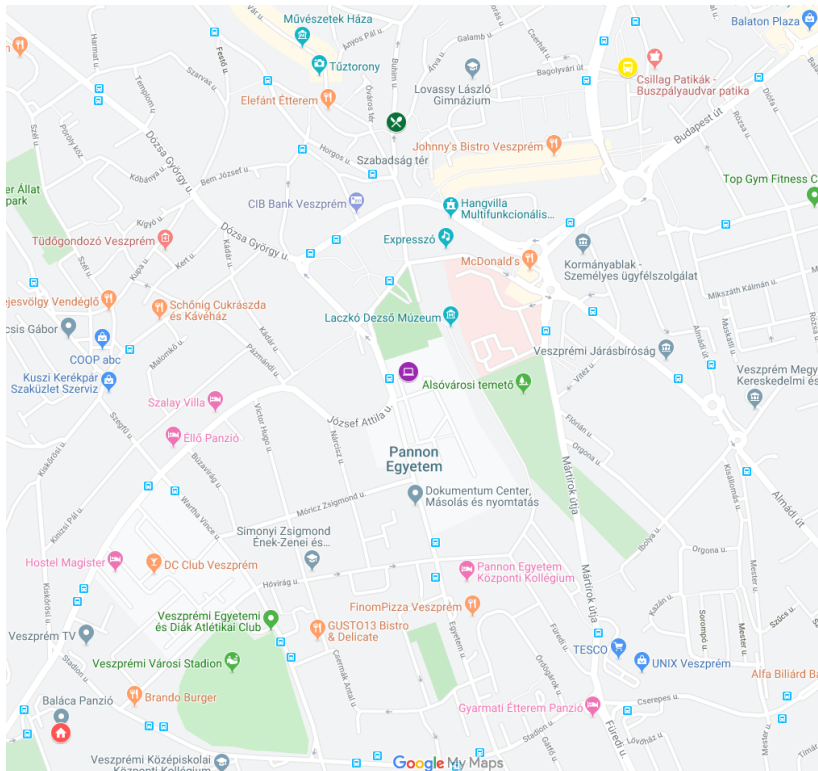
🔲 University (Egyetem u. 10.)

🏠 Accommodation (Baláca u. 21.)

❌ Óváros Vendéglő (Szabadság tér 14.)

🚌 Bus station (autóbusz-állomás)

Online map with POIs.

Traveling in Veszprém

Bus tickets within Veszprém are 330Ft / piece if you buy them on the bus, but they cost 250Ft / piece if you buy them at a machine. They can also be bought at the shop named Tom Market in front of the University for the price of 250Ft.

If buses are not for you, you can always take the taxi. In Veszprém, the taxi company is called Bakony Taxi and can be reached on the following phone number: +36 88 444 444.

Online travel planner.

Lecturers

Dr. Péter Zoltán Baranyi obtained his PhD degree in 1999 at the Budapest University of Technology and Economics, and was the youngest scientist to receive the Doctoral Degree of the Hungarian Academy of Sciences in 2006.

He invented the TP model transformation that is a higher order singular value decomposition of continuous functions. It has crucial role in nonlinear control design theories and opens new way for optimization. Professor Peter Baranyi initiated and defined the Cognitive Infocommunications scientific discipline. (www.coginfocom.hu) He established the Cognitive Infocommunications concept around 2010. It has annual IEEE Int. Conf. and a number of scientific journal special issues. It focuses on then new cognitive capabilities of the blended combination of human and informatics.

He is the inventor of MaxWhere that is the first 3D platform including 3D web, 3D browser, 3D store and 3D Cloud. He is the recipient of numerous international awards, including the Sigma Xi Young Investigator Award and the International Dennis Gabor Award. He has published over 450 scientific works, including 3 books – 6000 citations.

Dr. Ádám Balázs Csapó obtained his PhD degree at the Budapest University of Technology and Economics in 2014. He is currently working as an associate professor at the Széchenyi István University in Győr, Hungary. His research focuses on soft computing tools for developing cognitive infocommunication channels in virtual collaboration environments, with the goal of enabling users to communicate with each other and their spatial surroundings in novel and effective ways. Dr. Csapo has over 50 publications, including 1 co-authored book and 16 journal papers.

Dr. Márk Jelasity is a full professor and the head of the AI Department at the University of Szeged. He received his PhD degree in computer science from the University of Leiden in 2001. He spent several years in various institutions including the VU University, Amsterdam, University of Bologna, and Cornell. He received the DSc degree from the Hungarian Academy of Sciences in 2014. His research interests include decentralized data mining and adversarial machine learning.

Dr. Veronika Szücs started her university studies in 2007. In 2010 she got her Computer Engineering BSc degree, then in 2013 she got her MSc degree, also in Computer Engineering. She got her PhD degree in 2019. As a PhD student from the September of 2013, she helped the department by researching, teaching and working in projects. From 2016 she was an assistant lecturer, and beginning from 2019 she is a senior lecturer at the Department of Electrical Engineering and Information Systems. She works at the Virtual Environments and Applied Multimedia Research Laboratory. Her research areas include: Virtual Environments, applied multimedia, assistive technologies, information systems, web programming and mobile programming.

Lecture details

3D VR – Radical Breakthrough in Future Infocommunication
(Dr. Péter Zoltán Baranyi)

This presentation investigates the unique potential of VR environments to serve as a comprehensive tool for future infocommunication. The same way that character-based interfaces (e.g., DOS) were replaced in the late '90s by windowing systems (e.g., Windows), so should the widespread use of 2D windows soon be superseded by 3D spatial content. We pointed out that just as the irreversible transition between DOS and Windows led to a significant increase in user effectiveness, so too would this transition between windows and spaces yield even greater benefits.

Tests shows that the users were able to complete the required workflow at least 50% faster in the MaxWhere 3D VR environment than in traditional 2D platforms and 3D VR environments are capable of providing users with a much higher level of comprehension when it comes to sharing and interpreting digital workflows.

Research shows unique potential of VR environments to serve as a comprehensive tool for communication and memory management and presents how VR spaces can do more than just provide appealing visual experiences, by capturing the psychology of how new memories are formed. Outstanding result, that MaxWhere can provide 30-50% increase in effectiveness in education and in enterprise applications. 3D VR plays an important role in everyday digital life and in professional industry (Industrie 4.0).

Enhancing Human Digital Capabilities via 3D Computational Affordances: Hands-On Examples Using the MaxWhere VR Platform
(Dr. Ádám Balázs Csapó)

Results in the fields of cognitive psychology, neuroscience and human-computer interactions have shown convincingly that user interfaces shape not only what we humans can do and how easily we can do it; but also how we conceptualize new information and create maps of knowledge based on those conceptualizations. In this talk, I will describe a new vision of 3D operating systems that carry the possibility of superseding 2D interactions, thereby allowing for information to be presented and understood via 3D relationships rather than in file and directory structures. I argue that this transition from 2D to 3D can enable both faster and more memorable knowledge discovery, as well as enhanced knowledge retention. Key ideas from the talk are demonstrated using the MaxWhere VR Platform. The talk will also include a hands-on demonstration, allowing the audience to try out various 3D spaces offered by MaxWhere.

Adversarial Examples in Machine Learning
(Dr. Márk Jelasity)

Since the publication of the seminal paper by Szegedy et al, 2014, adversarial examples for machine learning models have been in the focus of interest. In a nutshell, the problem Szegedy et al discovered is that machine learning models can be fooled very easily. That is, with little effort, one can find examples very close to an original example (for example, changing only one pixel of an image, or adding invisible noise, etc) that makes the model output arbitrary labels for the given example: a panda is recognized as a school bus, or an oistrich, or, in fact, anything we can think of. This is quite alarming, since with the increasing levels of automation, it is natural to require reliability and robustness from AI solutions, yet we see that they are in fact extremely fragile. Also, this phenomenon sheds light on the fact that the mechanisms of machine learning models use to classify examples are extremely different from those ones that humans are using and, most importantly, we have very little understanding of (and thus very little control over) these mechanisms. In this talk I will review the problem and present some interesting approaches for explaining it and some promising attempts for solving it. We will also explore some of the techniques through hands-on examples in Google's colab environment.

Human Centered HCI Design
(Dr. Veronika Szücs)

Nowadays, in a growing number of areas of life, a Gamification approach is used to solve certain problems and to popularize certain activities. Virtual Reality (VR) technology provides an unique toolkit for effective rehabilitation, whether phobia treatment or motion therapy for stroke patients. The role of virtual reality-based "serious game" software solutions in post-stroke rehabilitation is also important. Several frameworks, even in the home environment, have been developed in recent years worldwide. Unfortunately, many of them did not spread, did not fulfill hopes. The main reason for the failure of these and many similar projects and the experience of previous projects is that patients and supporters and nurses find it difficult to use new IT tools, to personalize therapy, and patients lose motivation. This presentation will introduce a solution that supports motion controlled applications that are already in operation and will be developed in the future so that in the rehabilitation the movement therapy can be fully adapted to the users' needs, condition to ensure a sense of success, to maintain user motivation.

Program

7th Winter School of PhD Students in Informatics and Mathematics

Veszprém, University of Pannonia

24th-26th January, 2020

Day 1 - Friday, January 24, 2020

14:00 – 15:00 Registration
University and occupying Accommodation

15:00 – 15:30 Opening Ceremony
University - PC0

15:30 – 17:00 3D VR – Radical breakthrough in
future infocommunication
Dr. Péter Baranyi
University - PC0

17:00 – 17:20 Coffee Break
University - I/1

17:20 – 19:00 Poster Session
University - I/1

19:30 – 21:30 Gala Dinner
Óváros Vendéglő

21:30 – Networking

Day 2 - Saturday, January 25, 2020

7:00 – 9:00	Breakfast *Accommodation*
9:00 – 10:30	Adversarial Examples in Machine Learning I. **Dr. Márk Jelasity** *University - PC0*
10:30 – 10:50	Coffee Break *University - I/1*
10:50 – 12:20	Adversarial Examples in Machine Learning II. **Dr. Márk Jelasity** *University - PC0*
12:40 – 13:50	Lunch *Óváros Vendéglő*
13:50 – 15:30	Cultural Program (starts from the Óváros Vendéglő)
15:30 – 17:00	Enhancing Human Digital Capabilities via 3D Computational Affordances I. **Dr. Ádám Csapó** *University - PC0*
17:00 – 17:20	Coffee Break *University - I/1*
17:20 – 18:50	Enhancing Human Digital Capabilities via 3D Computational Affordances II. **Dr. Ádám Csapó** *University - PC0*
19:20 – 20:20	Dinner *Óváros Vendéglő*
20:30 –	Networking

Day 3 - Sunday, January 26, 2020

7:00 – 9:00   Breakfast
                 Accommodation

9:00 – 10:30   Cultural Program (starts from the Accommodation)

10:30 – 13:00   Human centered HCI design
                 Dr. Veronika Szücs
                 University - PC0

13:00 – 14:00   Lunch
                 Óváros Vendéglő

Google Calendar of the program.

Dragonfly: A C++17 OpenGL Framework

BÁLINT Csaba, BÁN Róbert

Faculty of Informatics, Eötvös Loránd University

Computer graphics developers and researchers usually have to choose between graphics APIs that are high performing or frameworks that are high level. In the former case, built-in debugging and developing tools are usually lacking. Current high level frameworks, such as Nvidia's Falcor [1], are complicated to use or suffer performance overhead and sometimes are even harder to debug.

Dragonfly combines high performance and short client code while providing built-in debug tools. The framework achieves this via C++17 templates trading compilation time for the near-zero runtime overhead. Additionally, our framework can generate GUIs for most classes allowing runtime monitoring and debugging.

The abstraction encapsulates most OpenGL operations in five classes: Shader Program, Framebuffer, Texture, Vertex Array, and Buffer. With Dragonfly, a single line of code can represent a pipeline of rendering commands. Prototype and production graphics applications may both be implemented in Dragonfly.

[1] Benty, N.,Yao K. H., Chen L., Foley T., Oakes M., Lavelle C., Wyman C., The Falcor Rendering Framework, (10/2019), `https://github.com/NVIDIAGameWorks/Falcor`

Incremental Parsing of Build Systems

CSERÉP Máté, FEKETE Anett

Eötvös Loránd University, Faculty of Informatics

The development and maintenance of large, legacy software code often results in higher time and financial cost due to increasing size and complexity of the codebase and their usually deteriorating quality, the insufficient documentation and the loss of original intentions caused by the fluctuation among developers. Code comprehension tools and similar features of integrated development environments (IDE) both aim to support the development and the maintenance of large (legacy) software. When applied to actively developed projects, it is essential to process the most recent revision of the source code in real time. Since a complete analysis of the codebase might take up significant time (even several hours), the inclusion of incremental parsing is indispensable. However the utilized build system of a software project is tightly entangled with the source code: over time not only the content of the source files can be amended, but translation units can be added or removed and the parameters of the existing build instructions might also change.

This research is intended to describe how the incremental update of the build system of a software facilitates the maintenance of the software workspace database in a code comprehension tool by completing the workflow of incremental parsing. We describe why including the build system in incremental parsing is relevant as well as the actual method of parsing build commands. We show that updating the build system is more cost-effective than disposing of the existing build command database. The research also compares the incremental parsing of build systems to that of actual source code.

As a case-study we accomplished this through CodeCompass [1], a standalone, open-source software comprehension tool developed by Ericsson

Hungary and Eötvös Loránd University which already applies the incremental parsing of source code [2]. In order to test our method, we used the open-source LLVM [3] project. LLVM is a large-scale go-to test project for CodeCompass, as it contains nearly 5000 C++ source files, and is actively developed with usually multiple dozens of commits daily affecting not only hundreds of source files, but typically the build infrastructure as well.

[1] Porkoláb, Z., Brunner, T., Krupp, D., Csordás, M.: Codecompass: An open software comprehension framework for industrial usage. *In Proceedings of the 26th Conference on Program Comprehension*, pp. 361–369. ICPC '18, ACM, New York, NY, USA (2018). https://doi.org/10.1145/3196321.3197546

[2] Fekete, A., Cserép, M., Incremental Parsing of Large Legacy C/C++ Software, *21th International Multiconference on Information Society (IS), Collaboration, Software and Services in Information Society (CSS)*, Vol. G (2018), 51–54.

[3] The LLVM Compiler Infrastructure. https://llvm.org/.

Collision Detection Using Cross Section Approximations of Meshes

FÁBIÁN Gábor[1], RÁBELY Ákos

[1] Eötvös Loránd University, Faculty of Informatics

The key concepts of dynamic simulation of rigid bodies are collision detection and collision response, which allows the moving objects to change their momentum and angular momentum [3]. In computer graphics objects are mostly defined as polyhedra bounded by triangular surface elements (named triangle mesh), therefore the collision detection process in general can be considered as performing numerous triangle-triangle intersection tests. In some cases the colliding mesh contains so many triangles, that the exhausting triangle-triangle testing can not be done in real time. Thus various approximating methods are used to reduce the computation time. The common procedures are using bounding volume hierarchies (e.g. AABB) or space partitioning data structures (e.g. octree, k-d tree) and/or using a proxy, which is an approximation of the object containing much less triangles [1]. Unfortunately the reduced mesh (which contains sufficiently small number of triangles) sometimes is not a satisfactorily good approximation of the original one, therefore the dynamic simulation does not seem realistic.

In our research we try to approximate the model in an unusual way, which can be used in collision detection of an arbitrary polyhedron and a triangulated ,,ground" defined by a heightmap. The basic idea is to compute the cross sections of the mesh with some planes in orthogonal directions. If the mesh defines a self-intersectionless closed 2-manifold, then a cross section consists of simple polygonal lines [2]. If the mesh contains many triangles, the polygons may also have many vertices, consequently the approximation of these polygons is required. The coordinate functions of parameterizations of the polygonal lines are approximated by partial sums of Fourier-series. Using this approach we

can show, that the collision detection problem is equivalent to testing intersection between two functions. The colliding point(s) can be found using a constrained minimization method, in our implementation the so-called simulated annealing algorithm was used [4]. Besides that, our method consists of multiple levels of preprocessing which helps us to reduce the computation time. This concludes that the time consuming minimization algorithm is called only if we can not exclude the collision of the mentioned cross section approximations.

[1] Ericson, C., Real-Time Collision Detection, Morgan Kaufmann, (2005)

[2] Fábián, G., Gergó, L., Fast algorithm to split and reconstruct triangular meshes, Studia Universitatis Babes-Bolyai Informatica, Vol. 59. Special Issue (1) (2014) 90-102.

[3] Millington, I., Game Physics Engine Development, Morgan Kaufmann (2007)

[4] Locatelli, M., Simulated annealing algorithms for continuous global optimization, Handbook of Global Optimization II, Kluwer Academic Publishers (2002)

Homography Estimation from Images of a Vehicle-mounted Camera for Vertical and Horizontal Planes

GÁL István Gergő[1], **BARÁTH Dániel**[2,3],
HAJDER Levente[1]

[1] **Eötvös Loránd University**

[2] **MTA SZTAKI**

[3] **Czech Technical University**

We propose two solvers for estimating the egomotion of a calibrated camera mounted to a moving vehicle from a single affine correspondence, via recovering a homography. For the first solver, the sought plane is assumed to be parallel to one of the camera axes. For the second solver, the plane is orthogonal to the ground with unknown normal, e.g., it is a building facade. Both methods are solved as a linear system with a small coefficient matrix, thus, being extremely fast, i.e., 4–5 μs. The methods are tested on synthetic data and on publicly available real-world datasets. They lead to accuracy comparable to the traditional algorithms while being faster when included in state-of-the-art robust estimators.

Improvements on Spatial Ability Tests Using Virtual Reality

GUZSVINECZ Tibor[1], SIK-LÁNYI Cecília[1], ORBÁN-MIHÁLYKÓ Éva[2], PERGE Erika[3]

[1] Department of Electrical Engineering and Information Systems, University of Pannonia, Veszprém, Hungary

[2] Department of Mathematics, University of Pannonia, Veszprém, Hungary

[3] Department of Basic Technical Studies, University of Debrecen, Debrecen, Hungary

The authors examined the effects of using virtual reality with different display parameters and display devices during spatial ability tests with the goal to find the optimal user-centric virtual environment preference which can help the spatial skills of the users. The authors measured the spatial skills of 240 and 61 students who used an LG desktop display and the Gear VR, respectively. The different display parameters such as the virtual camera type, its field of view, its rotation, the contrast ratio and whether the shadows were turned on in the scene were also assessed. After gathering the data, the authors evaluated the rates of correct answers with F, t and Welch-tests and the probabilities of correct answers were examined with the logistic regression analysis. The results show that the Gear VR proved to be superior to the desktop display, as it significantly improved on the results of female, left-handed and older students while making the Purdue Spatial Visualization Test type easier as well. The optimal user-centric preference was also found, which is a perspective camera type, a camera rotation of $-45°$ or $0°$ or $45°$, a contrast ratio of $1.5 : 1$ or $3 : 1$ and the Gear VR display device. Using these factors and device, the probabilities of correct answers on the spatial ability tests increase.

CIS - Human Computer Interaction - Cognitive Infocommunication

MATTYASOVSZKY-PHILIPP Dóra, MOLNÁR Bálint

Eötvös Loránd University, Faculty of Informatics

The rapid change of world causes new challenges in the business environment and in operational areas of enterprises. Those challenges likely increase the chance for client satisfaction and other key factors meanwhile improve companies' efficiency. Enterprises are not able to answer these challenges easily in time, e.g. predicting the potential future as one of the key elements impacting the long-term success. The required skills are rarely available in one single person or team, and they are not affordable or not efficient. Therefore, one of the possible solutions is to leverage the capability of a Cognitive Information System via Human Computer Interaction trough cognitive resonance and Cognitive Infocommunication. Cognitive Infocommunication is a channel and a tool to realize the cognitive resonance that ensure and improve the quality of Human Computer Interaction that support the sensed data extraction and the semantic understanding via cognitive resonance. The aim of the publication to describe the silicon agent and the human interaction in light of Cognitive Infocommunication, meanwhile map the value of Cognitive Infocommunication via human computer interaction. The publication related to, how the human knowledge builds into the Cognitive Information System knowledge, meanwhile highlights the importance of Cognitive Infocommunication process during knowledge transfer between silicon and carbon agent.

Use of Vehicle Sensors for Navigation

MEDGYES Krisztián[1,2]

[1] John von Neumann University - GAMF Faculty

[2] University of Pannonia, PhD School of Information Technology

Today, almost all vehicles have an OBD2 interface. Petrol-fueled vehicles placed on the market in Europe must be fitted with such a coupling from 01.01.2001, and diesel-fueled vehicles from 01.01.2004.[1] Not only is it possible to query vehicle faults through this connector, but in addition to the current speed, speed, and power consumption, you can also request information about the operation of the vehicle's security system.

The function of the vehicle's stability control electronics can also be monitored. Usually this electronics is activated by the vehicle when the built-in sensors suggest that the safety of the vehicle and its occupants is at risk. If more than one vehicle is activated on the road, ESC (Electronic Stability Control), ESP (Electronic Stability Program or ABS (Anti-lock Braking System) or ASR (Anti-Slip Regulation), or TCS (Traction Control System), then we can conclude that something has happened. This could be heavy pollution from an accident on the road, heavy rainfall from a sudden downpour or even heavy rainfall, and use of the temperature sensors to suspect snowfall or heavy ice on the area. I have suggested the use of this in my research so far, but I would like to expand its scope now.

The more vehicles that automatically indicate that they are unsafe (significantly slippery) on a particular road section, the more likely it is that other vehicles in circulation will try to avoid that section and another route. A route from which there are no or fewer warnings from other vehicles. I want to implement vehicle-to-vehicle communication

using the IEEE 802.11p WAVE[3] standard, as I discussed in my previous presentation.

[1] DIRECTIVE 98/69/EC OF THE EUROPEAN PARLIAMENT
AND OF THE COUNCIL of 13 October 1998
relating to measures to be taken against air pollution by emissions
from motor vehicles and amending, Council Directive 70/220/EEC
(OJ L 350, 28.12.1998, p. 1)

[2] Automatic JAM classification algorithm
Krisztián, Medgyes ; Tamás, Kovács
4th Winter School of PhD Students in Informatics and
Mathematics, Budapest, Magyarország : Association of Hungarian
PhD and DLA Students, (2017) p. 29

[3] IEEE 802.11p: Towards an International Standard for Wireless
Access in Vehicular Environments
Daniel Jiang, Luca Delgrossi
Mercedes-Benz Research and Development North America, Inc.
Vehicular Technology Conference, 2008. VTC Spring 2008. IEEE,
p. 2036-2040)

Modular Examination Techniques of Online Stores Development

NAGY Szandra[1], MEDGYES Krisztián[1,2]

[1] John von Neumann University - GAMF Faculty

[2] University of Pannonia, PhD School of Information Technology

Open source online stores, open source business systems are popular and widespread in the field of e-commerce. The term "open source" in this sense simply means that the source code is accessible to everyone. In fact, the "open source" label is considered to be a quality attribute as it increases security. How is it possible?

"Whenever the source code of a program can be viewed, software bugs and security flaws are published much faster. It also minimizes the risk of developers deceiving unwanted features (such as "back doors") into their software. "

To exam systems, a new webshop had to be created. The webshop needs a few categories and maximum 10 pieces of products. Mandatory elements were the customer registration, search, basket function and filtering by categories. Through the examination the following requirements had to be satisfied: customization, expansibility for future implementations, transparency of the file system, modularity, storage requirements, memory consumption, loadability, costs, cybersecurity.

Mechanical Model for the Dental Drilling Protocols

OLUOCH Lillian Achola, STACHO László, VIHAROS László

Faculty of Science and Informatics
University of Szeged

The aim of this study was to determine the optimum number of breaking points that minimizes the error in drilling graphs produced by drilling equipment during dental surgery. In our proposed method, the drilling protocols used in dental implantation surgery was performed by construction of best fit pattern of each experiment using mean-square minimization. Secondly, data smoothing was performed to establish typical patterns and construction of splines to obtain interpolation formulas. Finally, a mechanical model was established for an ideal situation for tooth drilling whereas Modified Steepest descent algorithm was used for step by step minimization. The results showed that the clusters had insignificant changes even when calculated with smoothed data. The interpolated data by the equipment with 3 spline function developed some elegant but complex formulas for the minimization algorithm. In conclusion, this study affirms that linear graphs with two breaking points gave the optimum number which minimized the error in drilling graphs produced by drilling equipment.

[1] AlHarbi,,S., Alkofide, E.A., et al, Mathematical analyses of dental arch curvature in normal occlusion, Angle Orthod.78(2008):281-287.

[2] Ayumi,S., Primer of statistics in dental research:PartI, Journal of Prosthodontic Research Vol. 58, (1)(2014), 11-16

Using the Leap Motion Hand Detector for 3D Interaction in VR

SZABÓ B. Katalin[1,2]

[1] Reactor Monitoring and Simulator Laboratory, Centre for Energy Research, Budapest, Hungary

[2] Doctoral School of Informatics, University of Debrecen, Hungary

The Leap Motion hand detector is an inexpensive input device suitable for 3D interaction. The author summarizes advantages and disadvantages of the device from the point of view of a developer of VR (virtual reality) applications. An actual application (interaction with the 3D model of the control room in the full-scope simulator of the Paks Nuclear Power Plant) is outlined. In the application the user is represented by a pair of virtual hands, the model of which has been developed specially for the project [1].

[1] Szabó, B. K.,Rigged hand model for the Blender Game Engine, Recent Innovations in Mechatronics Vol. 6 (1)(2019), 1– 7.

A Q-Convexity Based Local Shape Descriptor

SZŰCS Judit, BALÁZS Péter

Department of Image Processing and Computer Graphics
University of Szeged
{jszucs,pbalazs}@inf.u-szeged.hu

In digital image analysis, there are a lot of different shape descriptors and the measure of convexity is one of the most popular ones. Quadrant-convexity (Q-convexity) was proposed a couple of years ago, which illustrates the image with a single scalar value.

In this research we introduce a Q-convexity based local descriptor which uses predefined windows to create histograms.

Based on experiments, this approach can yield higher classification accuracy than the method based on the global descriptor.

Automatic Extrinsic Calibration of LiDAR-Camera Setup Using a Spherical Target

TÓTH Tekla[1], HAJDER Levente[1]

[1] **Eötvös Loránd University, Department of Algorithm and Applications**

Calibration of devices with different modalities is a key problem in robotic vision. This poster investigates a fully automatic extrinsic calibration of a LiDAR-camera system. Regular spatial objects, such as planes, are frequently used for this task. However, our approach applies spheres as target surfaces. We propose novel methods to (i) detect surface points of a sphere in point clouds, (ii) detect an ellipse contour in camera images and (iii) estimate the spatial location of the corresponding sphere. The algorithms are tested both quantitatively and qualitatively and it yields accurate camera and LiDAR extrinsic parameters. They are applied for calibrating the sensor system of autonomous cars equipped with digital cameras and LiDAR devices.
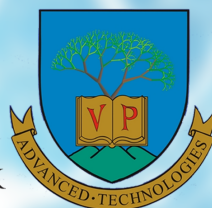
Section of Mathematical and Information Sciences
Association of Hungarian PhD and DLA Students
www.doszmito.hu