ICTERI-2019: THE 15TH INTERNATIONAL CONFERENCE ON ICT IN EDUCATION, RESEARCH, AND INDUSTRIAL APPLICATIONS

PROGRAM FOR FRIDAY, JUNE 14TH

View:

08:00-09:00 Session 14: Registration

09:00-10:30 Session 15: ICTERI Tutorial (Plenary Session)

CHAIR:
Grygoriy Zholtkevych
LOCATION: Conference Hall

09:00 *Vadim Ermolayev*

Do Not Let Them Trash Your Paper! The Alchemy for Higher Chances to be Accepted

ABSTRACT. It a short (90 min) tutorial offering the audience a coherent set of good practices on how to write a Research Paper for a conference with high chances to be accepted. The tutorial is logically organized to describe and advise on the phases outlined as follows:

• Motives (wish to) and Commitments (have to) to write

• Pre-requisites: Doing research (Scientific Method); Choosing the Venue (estimating the chances)

• Ingredients: Relevance and Readership; Structure and Logic (Methodology and Story); Background, Approach and Foreground; Problem setting, Focus, and Contribution (vs Related Work); Rigor, Evidence, and Evaluation; Illustrations; Use of Terminology; Reproducibility

• An after-taste check: the maturity of and interest to your paper; Responsibility, and Apprenticeship as an approach to learn writing; what to leave in and what out

10:30-11:00 Coffee Break

11:00-12:30 Session 16A: ICTERI Session V-A (ICT-IS: Information Systems)

CHAIR:
Vladimir Peschanenko
LOCATION: 256

11:00 *Nataliya Osipova* and *Oleksandr Kyriukhin*

Advantages of Programmable Compile Time with Metaprogramming: the Case of ASN.1 and Perl 6
PRESENTER: *Oleksandr Kyriukhin*

ABSTRACT. With the ever-growing complexity of software systems already built and, more importantly, needing to be built in future, the need for research toward

better methodologies, approaches and architectures is hard to overestimate. Ideas of novel software writing techniques are often implemented in tools in order to test out the pros and cons of the new technique, which may become generally accepted in the case of its successful application. This paper demonstrates a real world application of a recently introduced approach to the development of software libraries using advanced metaprogramming features that are present in some programming languages, notably in a recently released language called Perl 6. This research takes as a subject a well-developed problem, ASN.1 (The Abstract Syntax Notation One) implementation, with two approaches to writing a solution being common, and depicts resulting disadvantages of those approaches. Next, it describes how the use of metaprogramming in Perl 6 allows mitigating such problems, along with obstacles encountered during the development process. A number of software libraries were designed and implemented utilizing this approach, and it is used as a part of ASN.1 support for the Perl 6 language. A brief explanation of the solution's internal architecture and ideas about possible future improvements are provided.

11:30 *Ihor Skyrda*, *Valeriy Chepizhenko* and *Tetiana Davydenko*
Formation Control of Multiple Autonomous Fixed-Wing Unmanned Aerial Vehicles in Dynamic Environment
PRESENTER: *Ihor Skyrda*

ABSTRACT. This paper presents Modified Artificial Potential Field (MAPF) approach application for decentralized formation control of multiple Unmanned Aerial Vehicles (UAVs) flying through dynamic environment. MAPF is based on Formation Potential Field (FPF) and it allows preventing mid-air collisions within defined security zone around multiple UAVs. This technique combines issue resolution connected with oscillation effects produced by potential fields, UAV fixed-wing type specification with the respect to application in the dynamic environment. Based on measured ranges between Remotely Piloted Aircraft (RPA) and obstacles (buildings, restricted areas), attraction and repulsion forces are formulated and are converted to aircraft flight control commands via rudder, aileron trims and engine throttle. The simulation results are used to validate and verify a given approach of real application, provision of optimal, collision-free, and safety flight path between initial UAVs positions and destination area.

12:00 *Artur Zaporozhets*
Development of software for fuel combustion control system based on frequency regulator

ABSTRACT. A system for monitoring and controlling the process of fuel combustion in boilers based on a stepwise change in the composition of the air-fuel mixture has been considered. Algorithms for the operation of the frequency control-ler in various modes have been developed. A software module has been cre-ated for monitoring the oxygen concentration in the exhaust gases based on the LM Programmer. The interaction of the developed software and hard-ware is shown.

11:00-12:30 Session 16B: ICTERI PhD Symposium Session I-B
CHAIR:
Grygoriy Zholtkevych
LOCATION: Conference Hall

11:00 *Ján Perháč*, *Zuzana Bilanová* and *Gabriela Havrilčáková*
Simple-typed Functional Language Modelled by Category Theory
PRESENTER: *Ján Perháč*

ABSTRACT. The simply-typed Lambda calculus is considered to be the simplest functional programming language. It was introduced by the Alonzo Church and Stephen Kleen. In our work, we use a language extended by typed arithmetic expressions, Boolean values, derived types, and reference types. The goal of this paper is to unify the individual extensions of simply-typed Lambda calculus to one syntax, one many-typed signature, and one algebraic specification. Based on that, we construct its corresponding model by category theory.

11:20 *Martin Štancel* and *Michal Hulič*
An Introduction to Image Classification and Object Detection using YOLO Detector
PRESENTER: *Martin Štancel*

ABSTRACT. Artificial neural networks have been proved to be the best and the most used solution for image classification and object detection tasks. Paper analyzes them as a tool that significantly improves the mentioned, very complicated computational calculations. In the paper there is a brief history of their development as well as the selected object detector that we used for our introductory experiment that is shown later in the paper. Also, there is introduced the idea of the future research that is going to be based on the conducted experiment and which is going to involve a new methodology for an automated generation of new domain-specific datasets that are essential in the training phase of the neural networks.

11:40 *Olena Ponochovna*, *Volodymyr Piliavskyi* and *Petr Makarenko*
Assessing the Reviving Risks while using the Manufacturing Resource Planning system at agribusiness enterprises
PRESENTER: *Olena Ponochovna*

ABSTRACT. The article proposes to use the mathematical apparatus of economic analysis' axiomatic theory for studying the reviving risks. Adapting of the reviving risks' evaluation method for simple global supply chains of financial and production relations of agricultural enterprises has been conducted. The methodical apparatus for measuring the logistic risks of optimal raw materials' and final products' stocks of agro-industrial enterprises has been provided. It is proposed to implement the offered models and methods into Manufacturing Resource Planning system, for rapid prevention and minimization of risks.

12:00 *Andrii Kopp* and *Dmytro Orlovskyi*
A Method for Business Process Model Analysis and Improvement
PRESENTER: *Andrii Kopp*

ABSTRACT. Since business process modeling is considered as the foundation of Business Process Management, it is required to design understandable and modifiable process models used to analyze and improve depicted business processes. Therefore, this article proposes a method for business process model analysis and improvement. The lifecycle of Business Process Management from business process modeling to applying the Business Intelligence and process mining techniques is considered. Existing approaches to business process model analysis are reviewed. Proposed method is based on best practices in business process modeling, process model metrics, and corresponding thresholds. The usage of business process model metrics and thresholds to formalize process modeling guidelines is outlined, as well as the procedure of business process model analysis and improvement is shown. The application of Business Intelligence techniques to support the proposed method is demonstrated.

12:30-14:00 Lunch Break

14:00-15:30 Session 17A: ICTERI Session VI-A (ICT-IS: Information Systems)

CHAIR:
Vadim Ermolayev
LOCATION: 256

14:00 *Volodymyr Eremenko* and *Artur Zaporozhets*
Application of wavelet transform for determining diagnostic signs

ABSTRACT. It is proposed to apply the wavelet transform to localize in time the frequen-cy components of the information signals in this article. The wavelet trans-form allows to fulfil time-frequency analysis of signals, which is very important for studying the structure of a composite material from the mode composition of free oscillations. The proposed approach to the development of information signals using wavelet transform makes it possible to further study the nature of the occurrence of free oscillations and the propagation of acoustic waves in individual layers of composites and to study the change in the structure of composites from the changes in the three-dimensional wave-let spectrum.

14:30 *Anastasiia Bystriantseva*, *Iryna Shakhman* and *Maksym Bystriantsev*
Spatio-Temporal Representation of the Ecological State of the Surface Waters of the Lower Section of the Dnieper River using GIS Technologies
PRESENTER: *Anastasiia Bystriantseva*

ABSTRACT. Research goal of the paper is to study the ecological state of the surface waters using spatio-temporal representation of water quality using a geographic information system (GIS), which will provide interdepartmental information interaction and analytical support for environmental and socio-economic decision making. Mathematical modeling of the ecological state of surface waters according to hydrochemical ingredients was carried out in accordance with the ecological classification. The visual interpretation of multidimensional data, which was obtained using GIS technologies, makes it possible to obtain information on the extent and areas of surface waters pollution and to estimate the level of anthropogenic load on hydroecosystems.

15:00 *Andriy Krysovatyy*, *Oleksandra Vasylchyshyn*, *Oksana Desyatnyuk* and *Svitlana Galeshchuk*
News Feed in Stock Movement Prediction
PRESENTER: *Oleksandra Vasylchyshyn*

ABSTRACT. The study aims at predicting 10-day stock return movements using heterogeneous data over the timespan of 5 years. The data includes the historical stock performance at the market and the news feed with information on the particular firm's asset. Feature engineering helps reduce the number of variables used in the classification model by excluding multicollinearity. A suite of parametric and non-parametric machine learning methods has not provided satisfactory accuracy, i.e., the random forest ensemble as the best predictor renders only 66% correctly forecasted values at the out-of-sample data using all features and 51% respectively with only historical data from the stock market. It motivates us to develop the convolutional neural network architecture which has delivered significantly better results.

14:00-15:30 Session 17B: ICTERI PhD Symposium Session II-B
CHAIR:
Grygoriy Zholtkevych
LOCATION: Conference Hall

14:00 *Pavlo Kushneryk*, *Yuriy Kondratenko* and *Ievgen Sidenko*

Intelligent Dialogue System Based on Deep Learning Technology
PRESENTER: *Pavlo Kushneryk*

ABSTRACT. Recent advances in machine learning has contributed to the rebirth of the chat-bot. Lately we have seen a rise in chat-bot technology being made available on the web and on mobile devices, and recent reports states that 57 % of companies have implemented or are planning to implement a chat-bot in the near future. Chat-bots are therefore a big part of an AI powered future, however recent reviews find chat-bots to be perceived as unintelligent and non-conversational. Such findings have not slowed down the rapid im-plementation of chat-bots online, and the same mistakes seems to be repeated over and over again. This explains why we need to understand how to develop, deploy and monitoring our own dialog system based on "Deep Learning" technologies. In our case studies we have compared different neural network architectures and develop chit-chat bot which based on encoder-decoder architecture with attention mechanism. In order to achieve this goal we use Python as programming language, TensorFlow as deep learning framework and GoogleNews word embedding. The peculiarities of the "Deep Learning" technology implementation are discussed in detail. Simulation results confirm the efficiency of the proposed approach for speech recognition.

14:20 *Anastasia Timofeeva* and *Oleksii Kudin*
Automatic Image Annotation with Ensemble of Convolutional Neural Networks
PRESENTER: *Anastasia Timofeeva*

ABSTRACT. This paper discusses the models and methods of machine learning that are employed to solve the problem of automatic image annotation. Today, the systems which have the ability to extract meaning from visual data are increasingly developed and used both in academia and industry. One of the practically important directions within the scope of this problems is the development of automatic systems for understanding of visual scenes. In this paper, we propose a brief survey of the state-of-the-art machine learning approaches and methods that have been suggested for automatic image annotation. We study the mathematical foundations of the overviewed methods and analyze their strengths and limitations. Further, we develop a proof-of-concept system for the image annotation using convolutional neural networks and construct a neural network ensemble using the snapshot approach. In the image processing stage, we apply the Fast Fourier Transform method. In addition, we outline a direction for further development of image annotating systems based on both theoretical and experimental models.

14:40 *Matej Madeja* and *Jaroslav Porubän*
Innovative approaches in C introductory programming courses
PRESENTER: *Matej Madeja*

ABSTRACT. The choice of programming language in an introductory programming course (CS0) is crucial for understanding of basic programming principles. From our previous research, C programming language seems to be the most appropriate for these courses. In this paper we propose 8 problem sets (PS), the one of whom focused on Arduino boards, and we implement them to the curriculum of an CS0 course in C which is yearly attended by 500 students. We have collected PS results from four semesters of the course and we observed the impact of PS quantity on students' motivation and overall results. From our observation students mostly start to work since the last two weeks before the deadline, regardless of the solution evaluation length. A surprising result was the

fact that with a higher number of PSs in a semester the average rate of submissions and final results was lowered. At the same time, we confirm the positive impact of game programming in CS0 courses that motivate students to work from the early beginning of testing and it is 27% earlier than in the case of classical PSs.

15:00 *Zuzana Bilanová* and *Ján Perháč*
Natural Language Dialogue Formalization: From Hyperintensional Logic to Linear Logic
PRESENTER: *Zuzana Bilanová*

ABSTRACT. This paper deals with a formalization of a natural language dialogue using transparent intensional logic and predicate linear logic. In the beginning, it is necessary to choose the dialogue in a natural language. Subsequently, this dialogue is analyzed by transparent intensional logic, that allows it to capture the meaning of sentences in logical structures. At this stage, a three-step method of an analysis will be applied to the dialogue: at first, there will be a type analysis of the lexical units, which is the base for the logical constructions that capture the meaning of the sentences and then we apply a type checking to verify the correctness of the solution. In the second part of the paper, the same dialogue is analyzed by the Ludics theory, which represents the superstructure of the predicate linear logic. In a technical presentation of Ludics theory, the dialogue is placed in a logical space and time what allows to model interactions between its actors.

15:30-16:00 Coffee Break

16:00-17:30 Session 18A: ICTERI Session VII-A (ICT-R, ICT-IS: Research, Infrastructures, IS - Short Papers)

CHAIR:
Martinkus Iryna
LOCATION: 256

16:00 *Anatoliy Doroshenko*, *Oleksii Beketov*, *Mykola Bondarenko* and *Olena Yatsenko*
Automated Generation of OpenCL Programs Based on Algebra-Algorithmic Approach
PRESENTER: *Oleksii Beketov*

ABSTRACT. The paper proposes the further development of algebra-algorithmic design and synthesis tools towards the development of OpenCL programs. The method for semi-automatic parallelization of cyclic operators is proposed. The particular feature of the approach consists in using high-level algebra-algorithmic program specifications (schemes) and rewriting rules technique. The developed tools provide the construction of parallel algorithm schemes by superposition of predefined language constructs of Glushkov's system of algorithmic algebra, which are considered as reusable components. An algorithm scheme is a basis for the generation of corresponding source code in a target programming language. The approach is illustrated with an example of developing an OpenCL interpolation program used in a numerical weather forecasting. The results of the experiment consisting in executing the generated OpenCL program on a graphics processing unit are given.

16:20 *Alexander Lyaletski*, *Elena Glazunova* and *Bella Golub*
On a multi-language computer support of a human mathematical activity

ABSTRACT. The work being carried out on the development of Ukrainian and Russian versions of the ForTheL formal natural language, which is the input language of the system for automated deduction SAD

(http://nevidal.org/sad.en.html) and simulates the structure of sentences of ordinary English, is described. The implementation of these versions will allow to do a remote access to the SAD system for solving tasks of theorem proving and mathematical text verification for users who speak only one of the three languages (English, Russian or Ukrainian), which confirms a perspectivity of providing human mathematical activity with a computer support in languages that, on the one hand, are formal, but, on the other hand, are as close to the languages used by people in their daily practice as possible.

16:40 *Anatoliy Doroshenko* and *Oleksii Beketov*
Large-scale loops parallelization for GPU accelerators
PRESENTER: *Oleksii Beketov*

ABSTRACT. The technique that allows to extend GPU capabilities to deal with data volumes that outfit internal GPU's memory capacity developed. The technique involves loop tiling and data serialization and could be applied to utilize clusters consisting of several GPUs. Applicability criterion specified. Transforming scheme designed and semiautomatic proof-of-concept software tool implemented. Conducted an experiment to demonstrate the feasibility of the proposed approach.

16:00-17:30 Session 18B: ICTERI PhD Symposium Session III-B
CHAIR:
Grygoriy Zholtkevych
LOCATION: Conference Hall

16:00 *Hanna Krapivina*, *Yuriy Kondratenko* and *Galyna Kondratenko*
Multi-Criteria Decision Making Approaches for Rational Choice of Wireless Communication Technologies for IoT-Based Systems
PRESENTER: *Hanna Krapivina*

ABSTRACT. In this paper, several methods and approaches for multi-criteria selection of wireless communication technologies for Internet of Things (IoT) systems are analyzed. Their comparative analysis allows to choose the most appropriate multi-criteria method for increasing the efficiency of decision-making for different input data and various functioning conditions of IoT-based systems. The multi-criteria task of choosing a wireless communication technologies is definitely complicated and important because the decision-making process can be influenced by various types of criteria, in particular, the quality and power of the data transmission signal, the security of the technology, energy efficiency, etc. At present, there are several well-known methods of expert evaluation and selection of wireless communication technologies, in particular, analytic hierarchy process, pairwise comparison method, Delphi method, etc. Comparing analysis shows that considered methods and approaches have some limitations and peculiarities of their application, in particular, (a) the necessity of calculation of the consistency of expert judgments; (b) limitedness in the number of hierarchy levels and the dimensionality of the matrix of pairwise comparisons; (c) constant contact with experts for conducting questionnaires; (d) the need to update the structure of the model when changing the number of criteria and alternatives, etc. Authors discuss in detail the simulation results and advantages of the implementation of the super-criteria approach for multi-criteria selection of wireless communication technologies based on the methods of linear and multiplica-tive convolution with the study of the influence of criteria weighting coefficients on the decision making efficiency.

16:20 *Yuliia Pomanysochka*, *Yuriy Kondratenko* and *Ievgen Sidenko*
Noise Filtration in the Digital Images Using Fuzzy Sets and Fuzzy Logic
PRESENTER: *Yuliia Pomanysochka*

ABSTRACT. In this paper, existing methods for filtering noise in digital images are considered. The following noise filtration methods were analyzed: arithmetic averaging filter, geometric averaging filter, median filtering, adaptive median filtration, Gaussian filtration and filtration using fuzzy logic, in particular the fuzzy color preserving Gaussian noise reduction method (FCG filter). Besides, the different types of noise that may occur on a digital image are discussed. All methods were evaluated using metrics like mean squared error, peak signal-to-noise ratio and structure similarity. It has been found that all of the above methods can well filter out only a certain type of noise. Pulse noise on a digital image better removed with median and adaptive me-dian filtering. Gaussian noise better removed with averaging, Gaussian and FGG filters. In this paper, a combination of adaptive median filtering and FGG filter is proposed for separate pulse and Gaussian noise removal. This will allow further removal of combined noise.

17:30-18:00 Coffee Break

18:00-19:00 Session 19: ICTERI Poster Session II

CHAIR:
Nataliya Kushnir
LOCATION: Library Hall

18:00 *Ievgen Vagin*, *Olena Havrylenko*, *Juan Pablo Martínez Bastida* and *Andriy Chukhray*
COMPUTER INTELLIGENT TUTORING SYSTEM "SQLTOR"
PRESENTER: *Olena Havrylenko*

ABSTRACT. Intelligent tutoring systems are required in different spheres, especially in IT. The presented system "SQLTOR" provides supporting tools for teachers and an adaptive tutoring approach for SQL students as well. Tutoring course in SQLTOR consists of task sequences ordered by complexity. Clustering and or-dering are automatically performed based on student's degree of mastery of the relevant knowledge components in the learning domain. Thus, course structure allows gradually increase or decrease tasks complexity during tutoring process. Besides, student's correct solutions can be recognized and stored. SQLTOR also provides hints which depend on learner's mistakes and the task content. Hints ei-ther are automatically generated based on comparison of a student's SQL query with the referred one or are manually customized. Such functionality allows using of SQLTOR as a tool that effectively supports educational courses on SQL. SQLTOR structure, task grouping (clustering) and ordering methods, SQLTOR tutoring modes and its behavior when a student makes mistakes are also de-scribed in this paper. As a conclusion, testing results from a student group at Na-tional Aerospace University "Kharkiv Aviation Institute" are provided.

18:00 *Nataliia Dotsenko*, *Dmytro Chumachenko* and *Igor Chumachenko*
Management of critical competencies in a multi-project environment
PRESENTER: *Dmytro Chumachenko*

ABSTRACT. The issues of managing critical competencies in a multi-project environment are considered. It is proposed to use the profile of critical competencies. A process approach to the management of critical competencies in a

multi-project environ-ment is proposed, the application of which will reduce the risks of critical knowledge losses.

18:00 *Denys Zolotukhin*, *Anatoly Sachenko*, *Volodymyr Kochan* and *Myroslav Komar*

Textures Maps Complex for 3D Character Model Development 📄
PRESENTER: *Denys Zolotukhin*

ABSTRACT. 3D character texturing - the process is long and requires a high level of professional skills, it is also one of the most important stages in the development of 3D model, because the texture is the first thing that the viewer sees, and the quality of the object's shader depends on its quality. To simplify and accelerate this phase, we offer an approach using the textures maps complex. This complex includes a set of prepared, segmented and sorted textures of different types (diffuse, specular, displacement, bump, SSS). Thanks to it, the developer can combine and edit the already finished fragment of textures, which turns off the need to make a texture from the scratch. The complex enables to skip the stages of sculpting and retopology, and get various visual outcomes for same 3D model geometry. The texturing result is connected with the quality of the shader and visualization. Finally, we described the application of the proposed approach as well as experimental results.

18:00 *Daniel Haidachuk*, *Olena Havrylenko*, *Juan Pablo Martínez Bastida* and *Andriy Chukhray*

STRUCTURAL DIAGNOSIS METHOD FOR TRAINEE'S COMPUTER PROGRAMS
PRESENTER: *Olena Havrylenko*

ABSTRACT. Today one of the most urgent scientific and applied problems is ensuring effective individual professional skills learning via intelligent tutoring systems. We consider the issue that arises while teaching professional skills of algorithms and programming, specifically – how reference a program stored in ITS will be compared with the program developed by a trainee. Structural diagnosis method for computer programs developed by trainees is proposed. Its advantages are the speed increment in comparison with known methods and a better adjustment of tutoring purposes. Results are verified by means of the module testing, the tutoring system prototype implementation and the introduction to a studying process.

18:00 *Andrey Dashkevich*, *Darya Vorontsova* and *Sergii Rosokha*

Finding a Strong Key Point Correspondences in Large-Scale Images and Depth Maps
PRESENTER: *Andrey Dashkevich*

ABSTRACT. Depth map fusion is an essential task in multi-view stereo vision and structure from motion methods, but there are some issues of the process of depth maps matching of large-scale outdoor scenes, which are acquired by unmanned aerial vehicles. First, they can have low depth resolution due to long distance from a scene to a camera, in the second, as a consequence of above problem and some camera defects, they can have some noise. In our work we propose an approach of matching the depth maps based on a local shape and a color similarity correspondences. The proposed idea is to find a similar regions by calculating local keypoints in small patches of two images by ORB feature detector. Then we find corresponding regions assuming spatial proximity of movement vectors of keypoints, this is done by the search of main vector direction and length in feature

space. We test our approach with the help of video sequences acquired by a consumer multicopter.

18:00 *Yuriy Kondratenko*, *Galyna Kondratenko* and *Ievgen Sidenko*
Hesitant Fuzzy Information Processing Based on the Generalized Aggregation of Resulting Trapezoidal Linguistic Terms
PRESENTER: *Ievgen Sidenko*

ABSTRACT. This paper discuss the results of the analysis of multi-criteria decision making algorithms based on expert evaluations, which are presented in the form of hesitant linguistic terms (LTs). Authors propose to form the resulting trapezoidal linguistic terms for any pairs of hesitant triangular fuzzy numbers. To increase the efficiency of the multi-criteria decision making process with hesitant input data, the authors suggest a new approach for fuzzy aggregation of generalized trapezoidal LTs based on combination of pessimistic and optimistic views of decision-makers. Simulation results proves high efficiency of the proposed hesitant fuzzy information processing approach, in particular in solving multi-criteria problem for selection of the most efficient transport company from the set of the existing alternatives.

18:00 *Liudmyla Bilousova*, *Liudmyla Gryzun*, *Valentyna Pikalova* and *Natalia Zhytienova*
SEARCH ALGORITHMS LEARNING BASED ON COGNITIVE VISUALIZATION
PRESENTER: *Liudmyla Gryzun*

ABSTRACT. Search algorithms are considered to be the classical Informatics problems due to their great applied significance. Hence, these algorithms mastering is an integral component of the expertise of any Informatics teacher. Thus, it is important to find out efficient ways of the search algorithms learning, realization, and implementation in the process of the pre-service teachers' vocational training. The aim of the paper is to offer the technique of the algorithms mastering that is based on the leading ideas of cognitive visualization (CV) enhanced with the elements of choreography. The theoretical basis of the elaborated technique includes CV concepts in their connection with the stages of learning and cognitive activity; ideas of bodily-kinesthetic intelligence as a factor of CV functions enhancing; choreographic ideas and their links with algorithms representation. The technique (which is given in the paper on the examples of linear and binary search algorithms in arrays) is represented as a set of connected tasks for students that determine direction of their collaborative activity. This detailed learning strategy, based on bodily-kinesthetic enhancing of CV functions, can be also successfully applied to the acquisition of key algorithms arrays processing. The peculiarities of the offered technique are analyzed. Such an approach to the algorithms learning is implemented for the pre-service Informatics teachers' training. It might cause a positive impact on the level of their knowledge and cognitive eagerness, which makes a prospect of our investigations.

18:00 *Iryna Martinkus*, *Heinrich C. Mayr*, *Kostiantyn Nagornyi* and *Mykola Tkachuk*
Evaluation of the Effectiveness of Domain Modeling Methods in Terms of Model Complexity
PRESENTER: *Iryna Martinkus*

ABSTRACT. Domain Modeling Methods (DMMs) are used to improve quality in the development of complex software systems such as product families. This paper examines how the effectiveness of such methods in combination with appropriate case tools (CTs) can be evaluated with regard to (1) the complexity of a model to be created and (2) the reusability of the developed source code. Our goal is to be able to recommend, for a particular development project, a DMM/CT combination that is as suitable (effective) as possible. For this purpose, we formalize an effectiveness metric and its calculation using structured data resources and quantitative metrics. The approach is based on a three-level design paradigm that

supports the variability required for software product lines. The paper illustrates this approach by analyzing and comparing the DMMs JODA (Joint integrated Object oriented Domain Analysis) and ODM (Organizational Domain Modeling) as well as the CTs Actifsource and Eclipse Modeling Framework.

18:00 *Mykhailo Shovheniuk*, *Bohdan Kovalskiy*, *Nataliia Zanko*, *Vitalii Semeniv* and *Mariia Semeniv*
Information technology of digital images processing with saving of material resources
PRESENTER: *Mariia Semeniv*

ABSTRACT. The recent color print technology innovations use standard process of color management. The authors proposed new information technology that is built on representing original image in a new color space ICaS. We found the exact solutions of equations for synthesis of color image, which allowed to optimize the using of inks. Reducing the use of materials in the printing process has not only an economic effect, but also the rational use of natural resources. The specialized software for processing digital originals by traditional and new technologies in the common information environment was developed. The software is based on a new color separation information model developed by the authors. It is shown that the new technology works on analytical methods. We compared the traditional technology and the new one. Researched the possibility to forecast, analyze, and manage the process of color synthesis for different print conditions.

18:00 *Yuliia Prokop*, *Elena Trofimenko*, *Nikolay Severin* and *Liudmila Bukata*
An Analysis of Criteria for Choosing a First Programming Language in High Schools

ABSTRACT. The choice of the optimal programming language for teaching students of IT specialties the basics of programming at the universities has been the sub-ject of heated debate over the past decades. When choosing a programming lan-guage for the introductory course, it is important to focus on modern and signifi-cant criteria. The article analyzes the arguments put forward by teachers in favor of the use of a particular language, as well as the criteria for choosing a language proposed by earlier researchers. Some regional differences in the approaches used by programming languages, learning paradigms and significance of the cri-teria have been identified. A multifactorial ranking of selection criteria has been carried out. Considering the changes that have occurred in the IT sector in Ukraine over the past decade, based on the study of literature and many years of experience in teaching the basics of programming, a rating of the criteria for choosing the first language was formed. The rating makes it possible to select an optimal programming language, based on the significance of various criteria in-herent in one or another programming language under the prevailing conditions of the course taught.

19:00-21:00 ICTERI 2019 Conference Dinner
CHAIR:
Aleksander Spivakovsky