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Dace Kūma

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LEVERAGING THE YOLO FRAMEWORK TOWARDS DETECTING OBJECTS IN STYLIZED IMAGES

Tasweer Ahmad, Mar Canet Sola, Hanna Jemmer, Maximilian Schich
Tallinn University, Estonia

Keywords: object detection, convolutional neural networks, YoloV4.

Over the recent decade, object detection in images and photographs has made great progress, mainly due to convolutional neural networks (CNN) and due to the development of large-scale annotated datasets. Still, CNNs are struggling to detect objects in stylized and effectively stylized art images, including in paintings and drawings. Applying the concept of object detection from natural real-world images to art images is known as cross-depiction. In this research, we propose a new StyleObject dataset of 5000-stylized images and try to detect objects of 10 different categories. We anticipate that this low-level task of object detection in stylized images could help in recognizing and detecting objects in paintings ideally to eventually support the task of high-level understanding of more complex art-works and other stylized image configurations. For our work, we incorporated the YoloV4 object detector, and adapted it for recognizing objects in stylized images. We further carried out an ablation study for our experiments, where the backbone architectures of YoloV4 are varied, while exercising different training settings for detecting objects in stylized images.

COMPARISON OF SOFTWARE TESTING TOPICS WITH THE ISTQB® FOUNDATION LEVEL SYLLABUS IN LATVIAN UNIVERSITIES

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Keywords: software testing, software-testing education, ISTQB.

Software testing is a critical aspect of software development process in today's world. We often encounter failures in systems, applications we use every day. It is estimated that the poor quality for 2020 resulted in a loss of more than $2.08 trillion to the US economy if we look at the US report "The Cost of Poor Quality Software in the US: A 2020 Report" [1].

At the same time, software testing is an important topic when we look at higher education and the preparation of new specialists for the labour market. Companies such as Microsoft [2] and Google [3] take testing seriously and require their engineers to know and understand software testing basics and its techniques and the surveys shows that, for example, not all of programmers have formal testing education [4].

Thus, the question arises whether the course "Software Testing Basics" or similar is also included in the Information Technology Programmes in the higher education institutions of Latvia, ensuring that future information technology students are provided with the necessary knowledge of software testing. To that aim, we analyze and review study course "Software Testing Basics" and similar courses that ensures knowledge about the software testing in Latvian higher institutions. To understand better how the courses are build and what kind of topics are included in the courses, we analyze included topics which are taken from the ISTQB® Certified Tester Foundation Level (CTFL) certification [5]. The ISTQB® CTFL certificate is one of the most demanding certificates when working as a software tester, software engineer or quality assurance specialist and several large Latvian IT companies recommend it to be settled.

Our results bring understanding and recommendations what could be improved in the future in the study courses related to software testing. One of the recommendations is to increase the size for the "Software Testing" study course, since it is not possible to cover all topics from ISTQB® Certified Tester Foundation Level in a short time, as well as to provide knowledge of tools and how to use them.

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MUSEUMS AND ART IN THE DIGITAL AGE

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Keywords: museum, digital age, art, challenges, possibilities.

The digital age is becoming our new normal. As (Bowen, Giannini, 2014) said, "From the digitization of documents to the digitalization of life itself and the birth of the digital self, digitalism demands new ways of doing, knowing, being, and thinking". The 4.0 industrial revolution is visible in social and cultural change, political movements, and social justice. Individuals share their creative works, ideas, or opinions through social media, blogs, websites, people are living in a digital world where they can communicate and access the internet 24/7. Digitalization adds a big value to the medical field, education system, traveling, communications, work field, research field, etc. The internet has now become a major part of work, leisure, social and political life for most people in advanced economic nations. It is no longer its novelty, uniqueness, or potential to transform life, but its mundane nature and pervasiveness that now gives the internet its significance." (Miller, 2011). The digital age is not only about the internet, social media, or the possibility to video call to each other, but it is also about the invention of new technologies in various fields. Of course, this digitalism has not only all nice and good things for us it also brings some issues for our population that we were not prepared for. Even if the new digital world has its cons, we as a population usually try to find more pros, so we can go forward and it is hard to ignore how digital technologies helps in the medical sector, especially for people with disabilities. Also, there is a strong impact from technologies on art and museums, digitalism changes the way art is made and presented, it changes how museums work too. L.D Rivero Moreno (2019) says that "the museum has been forced to adapt itself to the new ways of preservation, circulation, and exhibition of new media art. To that end, it will be necessary to reflect on the changes undergone by the institution inside this ongoing process". We can easily see that the digital age added new possibilities and various new technologies, those let us create products, arts, technologies not yet seen.

The analysis revealed diverting results about people's opinion towards digital age and art. Respondents were from different cultures and countries, so the analysis results got diverse answers. It was explored that even most results were matching research articles' information – digital age brought new opportunities to museums, art and artists and people with disabilities, there as well were opinions that disagreed and saw more cons in the

digitalization. Studies showed that museums developed toward integration of disabled people and 83% of survey respondents agrees and sees museums improvement. On the other hand, results explored opinion differ between people then the same percentage of interviewees said that traditional art is more important, and the same number of respondents said that digital art is more important, that leads us to think, that humanity still did not come together for new digital age. To sum up everything it is possible to see the pattern going through 4.0 industrial revolution to our everyday life changes and enormous growth and process in art world.

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EXPERT EVALUATIONS AND ANALYSIS OF RESULTS: PROBLEMS OF OBJECTIVITY AND COMPETENCE, AND THE TRUTH OF RANKING

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Keywords: mathematical model, expert assessments, decision-making, objectivity, coherence, ranking.

The problem of analyzing expert evaluation analysis in complex systems with interacting elements is referred to as the global problem of optimum decision making or even the acceptable one in the presence of inaccurate and/or missing information relevant to the studied process or object. One of the major problems in analyzing experts' data that require quantitative assessment methods is the problem of adequate mathematical tools (models and methods) selection for the expression of experts' opinions and further processing of the information obtained on the basis of operator-algebraic and/or statistical approaches. The main purpose of these diverse studies is to determine the objectivity of experts' evaluations at the decision-making process and while constructing the integral indicators. In fact, an objective analysis of the environmental, economic, socio-political and socio-psychological, educational, sports, etc. systems depends on the overall address of the problem of determining the objectivity of experts' evaluation.

One of the above-mentioned complex systems is the educational system – both in general education schools and in higher education institutions. Among the expert methods used in teaching activities there should be mentioned the following methods: a method of group experts evaluations; the method of individual expert evaluation; the method of paired comparisons and multidimensional scaling; methods based on multidimensional grouping; the method of independent characteristics synthesis; the sociometric method; the testing method; interviewing; opinion polling; the morphological expert method; the method of self-estimation; hermeneutic methods.

In general, the expertise procedure in teaching activities involves passing through the following phases:

– preparatory phase, which consists of decision-making procedures for examination, the procedure for selection and creation of technical working group; of the objectives development procedure, preparing plan and schedule of examination; of the selection process and creation of the expert committee/group;

– phase of technical working group activity, which in its turn consists of a procedure for determining the rules of both own group and expert committee/group operation; of procedures ensuring the technical side of examination, including the presence of examined students, negotiating the time of the examination, preparation of the technical and material background for examination, etc.; and of the procedure allowing to develop complementary materials;

– phase of the expert committee/group operation;

– the final phase, which is devoted to the simultaneous solution of the following interrelated objectives:

• based on scientific analysis of the overall experts evaluation it is necessary to rank students in accordance with their true ratings;

• on the same basis of experts evaluation it is required to rank the experts themselves on the their consistency and objectivity;

• while determining the final true ratings of students it is required to take into account the influence of experts consistency and objectivity to the truth of students ratings.

Currently, there are a lot of models, approaches and methods for planning expert opinion polls, as well as collecting, processing and analysis of experts' opinions. At this final phase of the expertise procedure, when from the side of DM (decision maker) it is required to make the best decisions on the above simultaneously solved three interrelated problems, there are used various mathematical models and algorithms for making the final decision by the DM. These models and algorithms may have different levels of complexity and adequacy, and could be described in terms of various areas of mathematics – probability theory and mathematical statistics, the theory of games and operations research, mathematical logic (in general, multiple-valued logic, and not only Boolean algebra), fuzzy set theory, etc. If to omit the details relevant to the existing models and methods used at the final phase of the expertise procedure, we can be conventionally regrouped into two "larger" classes: (1) probabilistic-statistical-parametric models, including a probability of various assumptions (i.e. the assumption of normality of the experts assessments distribution), which actually are not sufficiently justified, (2) operator deterministic models, which, first, are unstable (i.e. have an increased sensitivity degree of their solutions to the possible perturbations of initial data, even to arbitrarily small ones) and, secondly, are not enough algorithmized. Main generality of mathematical models of these two classes is rooted in two aspects on which basis mathematical models are constructed:

– The concept of experts' opinions consistency, when a feasible solution, including the optimal solution, made on the basis of correlated experts' opinion, i.e. there are excluded/declined from the panel of experts those

experts whose views differ from the opinions of most experts in the commission (opinions can be non-numeric; if the opinions of experts are expressed in numbers, then these numbers can be fractional). Obviously that this approach to the acceptance of a feasible (even optimal) solution, when there are not taken into account sharply contrasting expert opinions/evaluations can lead to distortion of the final expertise assessment, where a measure of distortion remains unvalued and, moreover, there also remains unexplored the potential impact of this measure on the final assessment of examination. Consequently, this approach does not allow reducing the influence of distorted expert assessments on the final solution of decision-maker (DM).

– The concept of "pursuit of experts' representativeness of experts", when the numerical assessments (as mentioned above, the numerical assessment can be fractional) are brought together without regard to the consistency of expert' opinion. It should be noted that the concept of "pursuit of experts' representativeness of experts", as a rule, usually arises during the preparatory phase of the expertise procedure when a selection and further creation of the expert committee takes place. This approach is not allowing to minimize the impact of biased (either due to the lack of qualifications of the experts or intentionally distorted) expert assessments. Namely, some members of the expert group

• due to the lack of qualification cannot objectively (in the undistorted way) evaluate the object of expertise. In this case the assessments of experts are usually independent from each other and, therefore, are inconsistent.

• may deliberately distort the evaluation, pursuing different goals, not associated with the expertise itself. In this case the evaluation of such experts tend to agree.

Therefore, there is a need to construct a mathematical model that would allow minimizing the consequences of the lack of traditional models, based on the above-mentioned two concepts. In this work, we develop and study mathematical model for the analysis of the educational numerical expert evaluations that characterize both the educational and psychological levels of students training (scholars and/or students) required in order continuing their further studies successfully. To solve the constructed mathematical model an iterative algorithm is developed. Besides, it is proved algorithm convergence as well as its convergence rate is determined. A numerical experiments illustrating how an iterative algorithm functions is implemented. The obtained results show that by means of using the developed model as well as algorithm required for finding of its solution there could be ranked both the true ratings of students based on the overall expert evaluations and the experts themselves in two ways – using the levels of "objectivity" and "coherence".

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COMPETITIVENESS OF THE SHARED ECONOMY MODEL FOR SUSTAINABLE MANAGEMENT OF LOGISTICS SYSTEMS

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Keywords: crowdsourcing, sustainable management, sharing economy, digital assets.

This paper analyses the shared economy model to sustainably manage the tangible and intangible resources of logistics systems. A critical review of literature on the current supply chain management policy and technological platform in current use that supports it was done to suggest a new conceptual framework for logistics processes' sustainable management on a shared economy platform. This was examined according to how the concepts of new technologies influence logistics and the role of sustainable management platforms of the shared economy in enabling greater improved logistics processes. The inductive methodology approach was applied using multi-criteria analysis interpretive research method. The impact of the shared business model on each stakeholder and beneficiary varies according to how resources are consumed and its adoption according to the core business models requirements of each. Current scientific literature does not identify the impact this phenomenon has on companies in different sectors, as there is a lack of detailed analysis and evidence to fill this gap, particularly as the Internet of Things (IoT) monetize digital assets autonomously through the Economy of Things, (EoT) marketplaces. From the analysis conducted, the findings provide a concept of the prototype framework required for the shared economy in the e-logistics' ecosystems rather than traditional ones, modelled using multi-criteria analysis interpretive methods as a strategic resource within the shared economy of supply chain management systems.

THE WAR IN UKRAINE AND GLOBAL FOOD SECURITY: CURRENT CHALLENGES

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Keywords: food security, crisis situations, food supply disruptions, global conflicts.

The article examines the issue of global food security. We have substantiated that due to the invasion of Russian troops into Ukraine, Russia may cause humanitarian food crises in some countries around the world. That is why Russia's war against Ukraine is also a war against the countries of the Middle East and North Africa, which are the main importers of food from Ukraine. We have substantiated that given the current situation, namely Russia's war against Ukraine, a deficit in production and exports is inevitable. The war threatens the sowing campaign. We have established that the most dependent on Ukrainian food imports are Egypt, Yemen, Indonesia, Bangladesh, Ethiopia, Lebanon, Libya, Pakistan and Iraq.

CHALLENGES AND EXPERIENCE IN ORGANIZING MATHEMATICS COMPETITIONS REMOTELY

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Keywords: math competitions, remote learning, on-line tests.

Liepaja University organizes math and physics competition for school students since year 2005. Usually it takes place in the Liepaja University, competition consist of two rounds - individual and team round. However, due to the Covid-19 pandemic and restrictions, changes to the current organizational arrangements had to be made.

In the report will be discussed the organization and results of the competition and comparison with results of previous years.

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THE IMPACT OF THE COMMERCIAL BANKS FINANCING POLICY ON ECONOMIC ACTIVITY

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Keywords: financial system sustainability, liquidity, coverage ratio, capital adequacy.

The stability of commercial banks and credit policies have a significant impact on economic growth. Commercial banks accumulate free funds, redistribute financial resources, and provide credit to businesses and individuals to promote consumption, economic development, innovation, and economic growth. The efficiency of commercial banks is affected by economic development cycles. As the economy grows, businesses potentially require more funding for investment and the innovation process. When the downturn begins, the economic sector shrinks, and then there is the problem of regulating cash flows, which poses a credit risk. As a result, banking operations are controlled like no other economic sector, focusing on the supervisory system. Many studies have shown that the economic downturn has been triggered by the irresponsible lending behaviour of commercial banks. It has led to an 'overheating' of the economy and a crisis in the financial system, followed by economic and political crises.

On the other hand, the economic crisis has severely affected the financial system in Lithuania as a whole and the activities of commercial banks in particular. The deterioration in the quality and structure of the loan portfolio posed a serious threat to the ability of commercial banks to comply with regulated liquidity, capital adequacy requirements, and systemic risk. The share of the problem loans in the loan portfolio exceeded 28%. The Basel III directives have required commercial banks to comply with newly approved, raised liquidity and capital adequacy standards.

Many foreign and domestic authors, as: Bowman (2009), Hausa (2014), Hagendroff, Nietto and Wall (2012), Pat Obi (2021) and national authors as Lileikienė (2016),(2021), Kovalčik (2015),.Likus (2011), etc.have examined the impact of credit policies pursued by commercial banks on business development. However, the research of these authors was limited to the context of Basel II requirements. Basel III requirements formed during the economic crisis, tightened the requirements of credit policy of commercial banks, raising higher capital adequacy and liquidity requirements

This study applies systematization, comparison, grouping, and graphical imaging techniques to perform dynamic analysis of commercial banks' compliance with approved Basel III requirements. Also, this study identifies

trends in the sustainability of commercial banks as a component of the financial system that directly affects potential commercial sector growth. The study results showed that the Covid-19 pandemic had a severe impact on the global economy. Lithuanian economy in 2020 suffered the least in the EU, while real GDP contracted only by 0.8%. Commercial banks have remained stable, well-capitalized, and are prepared to withstand the worst-case scenario if the economy shrinks to 6.8 percent. During the crisis, with the increase in household deposits, the liquidity of commercial banks increased, which presupposes a favourable credit policy. Mortgages have risen sharply due to low-interest rates, but business lending has declined as many businesses have ceased operations in the wake of the crisis.

The research allows us to conclude that the lending policy of commercial banks is favorable for both the provision of housing loans and the provision of business loans. The volume of housing loans has grown significantly in recent years, while the change in business loans is 3.3%, mainly at the expense of short-term loans.

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IMPROVED APPLICABILITY IN AN AUTOMATED E-MATERIAL FORMATTING TOOL PROTOTYPE 3.0

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Keywords: app prototype, e-material, formatting application, user interface.

An automated e-material formatting tool based on fundamental principles of visual science and with a user-oriented approach increased its need to be created and its overall value for e-material users over the last two years. Covid-19 pandemic showed us that most users experience discomfort in increased digital workload on a daily basis as humans' visual system is not fully adapted digital reading model yet and currently existing e-material typographic formatting recommendations are not adapted to digital screen use as well. Also, new distant work and distant education systems are becoming our new normal in most occupations, and there must be a future-oriented approach to public health.

Firstly, there have been changed approaches in developing an automated e-material formatting tool prototype 3.0 for reaching broader document types in easier and shorter formatting time by using existing Microsoft plugins.

Secondly, the tool's applicability has been put as a priority for the development of prototype 3.0. The paper includes a description of conceptual design and user interface design in the prototype. It includes key concepts such as user-friendliness, ease of navigation, tools appearance and design, functionality, and efficiency of use.

The improved version of the tool, a prototype 3.0 is planned to use for the testing by users.

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MODELLING OF E-LEARNING INFORMATION ARCHITECTURE BASED ON MENTAL LEXICON

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Keywords: mental models, information architecture, cognitive modelling, UX design.

Realizing the importance of creating technology for people, more and more companies are developing their products in accordance with the concepts of user-oriented design. There is more and more talk about user experience design, interaction design, usability, information architecture. Whether these terms are used consciously or under the influence of modern IT trends, it is a fact that many companies in the industry put end users at the centre of their developments and seek to influence their emotions and feelings. An important role in the overall process of developing user-oriented technologies is played by the information architecture related to the organization of information in the application, including the names of links, buttons, titles, etc. It is often critical to the success of software products because of its close dependence on users' mental models. In this regard, the purpose of this paper is to propose a model of e-learning information architecture based on a mental lexicon. The model should support decision-making and building behaviour in different e-learning environments based on the accumulated knowledge and the specifics of users' perceptions.

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HUMAN IN DATA

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Keywords: human in data, personal data, open data, shared data, closed data, digital environment.

Today, one of the most expensive products on the world market is personal data, whose protection is based on legal norms, which in turn focused on written documents. The digitisation of society and the rapid development of Internet technologies results in the loss of effective control over the dissemination, use and processing of personal data. Consequently, a person only faces a more frequent problem with regard to the legality of the processing of personal data, false information about himself, the use of malicious identifying personal messages, etc.

In view of this problem, this article will address the issue of human in data by dividing coded human information into three groups: open data, shared data, and closed data.

The aim of this work is to investigate human in data by identifying existing risks with the transfer of information and the processing of personal data in the digital environment. The aim of the study is to promote the development of public knowledge by helping everyone to be responsible for protecting their data and for respecting the rights of others in the digital environment.

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AUTOMATIC GRADING OPPORTUNITIES OF LABORATORY EXERCISES IN PHYSICS USING DIFFERENT TOOLS

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Keywords: automatic grading, learning environments, tests, laboratory exercises.

Learning process in study courses in physics and other engineering courses is unthinkable without laboratory works. As with tests, homework, and laboratory work, immediate evaluation is required to provide feedback. It often takes a long time to repair such work. Various calculation tasks and tests can be designed to be evaluated automatically. Moodle, Google classroom, liveworksheets, etc. are often used for automatic grading. Laboratory work can also be evaluated automatically using the mentioned tools, but in this case, unfortunately, there are no examples as in other types of tasks. This study compares different tools for the automatic evaluation of laboratory work and offers several examples of how they can be created using a test activity or similar options.

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THE CONCEPTUAL INFORMATION SYSTEM MODEL FOR TESTING IMAGE SEGMENTS DATA ANALYSIS

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Keywords: information system, data analysis, conceptual model.

Today's educational environment can no longer be looked at in isolation from various electronic technologies for the educational system to respond to the trends of the electronic age, which also corresponds to the 'electronic' everyday life of modern people.

Teaching and learning processes need to be assessed using various electronic technologies to engage today's youth in the learning process and make the learning process more accessible [1].

The visual process is the dominant process in everyone's perception and interpretation of the world. Visual perception and cognition are active and coordinated [2].

The conceptual, information system model of results processing greatly speeds up the process of collecting and obtaining results - as we all know, time today is a vital resource that everyone needs to save.

The purpose of this paper is to develop a conceptual, information model for the processing and analysis of data obtained for psychophysiological tests. The work includes theoretical analysis, the conceptualization, the use of previous experimental data. As a result of the work, a new information system conceptual model for processing and analysis of psychophysiological test data was developed.

The developed version of the new model provides an idea of the work schemes implemented, the relationship between the database and the information system.

This model will allow faster data processing and obtaining data for further analysis. The main feature of modern society is modern technology, in the shortest possible time and at the lowest possible cost. The conceptual, technical model will allow these advantages to be fully realized.

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DIFFUSION OF DIGITAL INNOVATION IN MUSEUM EDUCATION: THE EFFECT OF PANDEMIC AND CHARACTERISTICS OF IMPLEMENTERS

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Keywords: digital innovation, diffusion of innovation, museum education, schoolchildren.

This study is the first known attempt to employ Roger's diffusion of innovation (2003) theory to analyse how innovation in museum education spreads across entire museum sector over time. The study rests on a quantitative strategy. A survey was conducted in September 2021 with a sample size totalling 92% of all Latvia's accredited museums (N=111). Each question had a temporal dimension – before, during the pandemic and a few years after (in terms of expectations).

Results shows that a sharp visitor decline in 2021 has overwhelmingly increased development of digital educational programmes, resulting as top1 of all implemented digital tools in Latvian museums during pandemic, and confirms schoolchildren as the dominant target group across the sector. 32% of the respondents reported introducing online educational activities at some point in the pandemic, and 34% are planning them for the coming few years – a massive increase from only 2% in the pre-pandemic period. Other digital tools for educational purposes, such as educational games, quizzes, worksheets, etc., were implemented by 33% of the respondents during the pandemic, while 21% reported planning them for the nearest future – another substantial rise from just 3% before 2020.

Results of this study also fight several stereotypes on innovative organisation and present factors that correlate with digital innovativeness in museums. Digital innovativeness correlates with higher number of audiences under the age of 18 visits. Results also suggest that digitally innovative museums have developed a digital strategy, have location in a city, and have at least one innovation "champion" – an employee who initiates innovative practices; an individual that throws weight behind an innovation, thus overcoming indifference or resistance that the new idea may provoke in an organisation (Roger, 2003, p. 414). Although Roger's study found that larger-sized organisations have generally been found to be more innovative, in museum sector neither number of employees nor annual budget correlate with museum's digital advancement.

ON BOUNDARY CONDITION REGULATION METHODS IN NUMERICAL FLOW SIMULATION USING LATTICE BOLTZMANN METHOD

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Keywords: surface morphology, nano-channel, Lattice Boltzmann method.

Flow in nanochannels and in the immediate vicinity of a structured surface is affected by several conditions: the effective size and shape of the channel, fluid properties, usually expressed in Reynolds number, and the hydrophilicity or hydrophobicity of the liquid. In numerical solutions of kinetic equations, most commercial software products do not allow defining a flow rate near the wall other than zero. This work provides a convenient solution using Lattice Boltzmann method (LBM), where with the help of special regulators (coefficients) it is possible to change the flow boundary conditions. By varying the flow velocity at the channel wall in the range from zero (standard modelling techniques) to the maximum limit of the flow continuity condition, the solution gives a complete flow vector field in the vicinity of the surface morphology. The solution can be used for both numerical calculations of standard flows in micro- and nano-channels and specific cryo-flow calculations (liquid nitrogen flows in development of silicon semiconductors, liquid oxygen flows in medicine and rocket construction, etc.). Developed software product supplemented with phase transition energy conditions, is also applicable to cavitation studies.

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CIRCULAR CITY ADAPTATION BY CO-ACTIVITY COMPANY CASE

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Keywords: climate smart project, regenerative materials, collaboration, sustainable urban food solutions.

It is a well-known fact that food waste is one of the major contributors to GHG emissions in the world. This and the company and developer desires to make an impact was the starting point for this project. Therefore, the development of new products from the organic-waste materials i.e., coffee grounds and silver skins of coffee beans was launched in spring 2021. The raw material was obtained from the company Robert's Coffee. This recycling of coffee side-stream task was a part of a larger project with aim to promote the appreciation of food and the sustainable urban food production: 6Aika-CircularHoodFood. As the project aims to find solutions where the circular city adaption can be implemented with the given objective and raw material- more brilliant ideas and products came spawning from the developers. The main goal was to find solutions, which met the criteria of first level circulation, with the focus anchored on the end products such as food and food additives. The feedback on this successful project proved to be very positive, thus, encouraging us to continue further with next steps in the product development.