

## Charakteristika predkladaného výstupu tvorivej činnosti / Characteristics of the submitted research/ artistic/other output

*Tlačivo VTC slúži na predkladanie výstupov tvorivej činnosti podľa metodiky hodnotenia tvorivých činností (časť V. Metodiky na vyhodnocovanie štandardov) / The form is used to submit the research/artistic/other outputs according to the evaluation methodology of research/artistic/other activities (part V. The Methodology for Standards Evaluation).*

ID konania/ID of the procedure: <sup>1</sup>

Kód VTC/Code of the research/artistic/other output (RAOO):<sup>1</sup>

|                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                    |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| OCA1. Priezvisko hodnotenej osoby / Surname awarded to the assessed person <sup>2</sup>                                                                                                                           | Dirgová Luptáková                                                                                                                                                                                                                                                                                                                                  |
| OCA2. Meno hodnotenej osoby / Name awarded to the assessed person <sup>2</sup>                                                                                                                                    | Iveta                                                                                                                                                                                                                                                                                                                                              |
| OCA3. Tituly hodnotenej osoby / Degrees awarded to the assessed person <sup>2</sup>                                                                                                                               | doc. RNDr., PhD.                                                                                                                                                                                                                                                                                                                                   |
| OCA4. Hyperlink na záznam osoby v Registri zamestnancov vysokých škôl / Hyperlink to the entry of the person in the Register of university staff <sup>3</sup>                                                     | <a href="https://www.portalvs.sk/regzam/detail/18294">https://www.portalvs.sk/regzam/detail/18294</a>                                                                                                                                                                                                                                              |
| OCA5. Oblasť posudzovania / Area of assessment <sup>4</sup>                                                                                                                                                       | Aplikovaná informatika/ Applied Informatics                                                                                                                                                                                                                                                                                                        |
| OCA6. Kategória výstupu tvorivej činnosti / Category of the research/ artistic/other output<br><i>Výber zo 6 možností (pozri Vysvetlivky k položke OCA6) / Choice from 6 options (see Explanations for OCA6).</i> | vedecký výstup / scientific output                                                                                                                                                                                                                                                                                                                 |
| OCA7. Rok vydania výstupu tvorivej činnosti / Year of publication of the research/artistic/other output                                                                                                           | 2017                                                                                                                                                                                                                                                                                                                                               |
| OCA8. ID záznamu v CREPČ alebo CREUČ (ak je) / ID of the record in the Central Registry of Publication Activity (CRPA) or the Central Registry of Artistic Activity (CRAA) <sup>5</sup>                           | ID: UCM.Trnava.PC024087                                                                                                                                                                                                                                                                                                                            |
| OCA9. Hyperlink na záznam v CREPČ alebo CREUČ / Hyperlink to the record in CRPA or CRAA <sup>6</sup>                                                                                                              | <a href="http://www.crepc.sk/portal?fn=*review&amp;uid=2206287&amp;pagelid=resultform&amp;full=0">http://www.crepc.sk/portal?fn=*review&amp;uid=2206287&amp;pagelid=resultform&amp;full=0</a>                                                                                                                                                      |
| CREUČ / Characteristics of the output that is not registered in CRPA or CRAA                                                                                                                                      | OCA10. Hyperlink na záznam v inom verejne prístupnom registri, katalógu výstupov tvorivých činností / Hyperlink to the record in another publicly accessible register, catalogue of research/ artistic/other outputs <sup>7</sup>                                                                                                                  |
|                                                                                                                                                                                                                   | OCA11. Charakteristika výstupu vo formáte bibliografického záznamu CREPČ alebo CREUČ, ak výstup nie je vo verejne prístupnom registri alebo katalógu výstupov / Characteristics of the output in the format of the CRPA or the CRAA bibliographic record, if the output is not available in a publicly accessible register or catalogue of outputs |
|                                                                                                                                                                                                                   | OCA12. Typ výstupu (ak nie je výstup registrovaný v CREPČ alebo CREUČ) / Type of the output (if the output is not registered in CRPA or CRAA)<br><i>Výber zo 67 možností (pozri Vysvetlivky k položke OCA12) / Choice from 67 options (see Explanations for OCA12).</i>                                                                            |
|                                                                                                                                                                                                                   | OCA13. Hyperlink na stránku, na ktorej je výstup sprístupnený (úplný text, iná dokumentácia a podobne) / Hyperlink to the webpage where the output is available (full text, other documentation, etc.)                                                                                                                                             |

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| Charakteristika výstupu, ktorý nie je registrovaný v CREPČ alebo | OCA14. Charakteristika autorského vkladu / Characteristics of the author's contribution                                                                                                                                                                                                                                                                                                                                                                                            | Hodnotená osoba sa ako spoluautor (30 %) podieľala na všetkých fázach tvorby výstupu. / The evaluated person participated as a co-author (30%) in all phases of the creation of the output.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|                                                                  | OCA15. Anotácia výstupu s kontextovými informáciami týkajúcimi sa opisu tvorivého procesu a obsahu tvorivej činnosti a pod. / Annotation of the output with contextual information concerning the description of creative process and the content of the research/artistic/other activity, etc. <sup>8</sup><br><i>Rozsah do 200 slov v slovenskom jazyku / Range up to 200 words in Slovak</i><br><i>Rozsah do 200 slov v anglickom jazyku / Range up to 200 words in English</i> | Combined Heuristic Attack Strategy on Complex Networks / Marek Šimon ... [et al.], 2017. In: Mathematical Problems in Engineering. - ISSN 1024-123X, Vol. 2017, Article ID 6108563, [9 s.] (CC, IF 0.802, Q2) A+<br><br>Hodnotená osoba sa ako spoluautor podieľala na všetkých fázach tvorby výstupu, od samotného návrhu koncepcie riešenia, cez experimentálne testovanie, analýzu dosiahnutých výsledkov, až po proces písania článku a zapracovanie recenzných odporúčaní. / The evaluated person participated as a co-author in all phases of the creation of the output, from the very design of the solution concept, through experimental testing, analysis of the achieved results, to the process of writing the article and incorporating review recommendations.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|                                                                  | OCA16. Anotácia výstupu v anglickom jazyku / Annotation of the output in English <sup>9</sup><br><i>Rozsah do 200 slov / Range up to 200 words</i>                                                                                                                                                                                                                                                                                                                                 | Usually, the existence of a complex network is considered an advantage feature and efforts are made to increase its robustness against an attack. However, there exist also harmful and/or malicious networks, from social ones like spreading hoax, corruption, phishing, extremist ideology, and terrorist support up to computer networks spreading computer viruses or DDoS attack software or even biological networks of carriers or transport centers spreading disease among the population. New attack strategy can be therefore used against malicious networks, as well as in a worst-case scenario test for robustness of a useful network. A common measure of robustness of networks is their disintegration level after removal of a fraction of nodes. This robustness can be calculated as a ratio of the number of nodes of the greatest remaining network component against the number of nodes in the original network. Our paper presents a combination of heuristics optimized for an attack on a complex network to achieve its greatest disintegration. Nodes are deleted sequentially based on a heuristic criterion. Efficiency of classical attack approaches is compared to the proposed approach on Barabási-Albert, scale-free with tunable power-law exponent, and Erds-Rényi models of complex networks and on real-world networks. Our attack strategy results in a faster disintegration, which is counterbalanced by its slightly increased computational demands. |
|                                                                  | OCA17. Zoznam najviac 5 najvýznamnejších ohlasov na výstup / List of maximum 5 most significant citations corresponding to the output<br><i>Rozsah do 200 slov / Range up to 200 words</i>                                                                                                                                                                                                                                                                                         | 1. A Framework of Hierarchical Attacks to Network Controllability. Lou, Y. , Wang, L. , Chen, G. (2021) Communications in Nonlinear Science and Numerical Simulation<br>2. Disintegrating spatial networks based on region centrality. Wang, Z.-G. , Deng, Y. , Wang, Z. (2021) Chaos<br>3. Training set fuzzification based on histogram to increase the performance of a neural network. Volna, E. , Jarusek, R. , Kotyrba, M. (2021) Applied Mathematics and Computation<br>4. A Convolutional Neural Network Approach to Predicting Network Connectedness Robustness<br>Lou, Y., Wu, R., Li, J., Wang, L., Chen, G. 2021 IEEE Transactions on Network Science and Engineering 8(4), pp. 3209-3219<br>5. Robustness evaluation method for unmanned aerial vehicle swarms based on complex network theory WANG, X., ZHANG, Y., WANG, L., LU, D., ZENG, G. Chinese Journal of Aeronautics 33(1), pp. 352-364                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |

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|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>OCA18. Charakteristika dopadu výstupu na spoločensko-hospodársku prax / Characteristics of the output's impact on socio-economic practice<br/> <i>Rozsah do 200 slov v slovenskom jazyku / Range up to 200 words in Slovak</i><br/> <i>Rozsah do 200 slov v anglickom jazyku / Range up to 200 words in English</i></p>                                  | <p>Článok patrí do radu výskumných úloh riešených v rámci projektu VEGA a APVV, ktorý využíva metódy soft computing k zvýšeniu bezpečnosti počítačových sietí. Štúdium útokov je dôležité v tomto smere z dvoch uhlov pohľadu. Jednak je zásadné pre rozbiehanie tzv. temných sietí, tvorených kriminálnymi elementami rozširujúcimi vírusy, detskú pornografiu apod. Z opačného pohľadu je dobré vedieť, do akej miery všeobecne užitočná bežne používaná počítačová sieť môže byť náchylná na útok. Článok obsahuje návrh a otestovanie algoritmu, ktorý efektívnym spôsobom odstraňovaním vrcholov postupne rozbieha počítačovú sieť. Nech už je taký algoritmus použitý na odstránenie zločineckej siete, alebo na posúdenie bezpečnosti a návrhy vylepšenia užitočnej siete, aplikovateľnosť tohto algoritmu by mala byť zrejmá. / The article belongs to a series of research tasks solved within the VEGA and APVV project, which uses soft computing methods to increase the security of computer networks. The study of attacks is important in this regard from two points of view. On the one hand, it is fundamental for breaking the so-called dark networks formed by criminal elements spreading viruses, child pornography, etc. From the opposite point of view, it is good to know to what extent a commonly used computer network may be vulnerable to attack. The article contains the design and testing of an algorithm that must be performed to gradually break a computer network by removing vertices. Whether such an algorithm is used to remove a criminal network, or to assess the security and improvement of a useful network, the proposed applicability of this algorithm should be obvious.</p> |
| <p>OCA19. Charakteristika dopadu výstupu a súvisiacich aktivít na vzdelávací proces / Characteristics of the output and related activities' impact on the educational process<br/> <i>Rozsah do 200 slov v slovenskom jazyku / Range up to 200 words in Slovak</i><br/> <i>Rozsah do 200 slov v anglickom jazyku / Range up to 200 words in English</i></p> | <p>Problém riešený vo výstupe (výskum súvisiaci so sieťami, s výpočtovou inteligenciou aj s teóriou grafov) má nepriamy dopad na predmet výskum v informatike, na ktorého vyučovaní sa hodnotená osoba spolupodieľa. Problematika riešená vo výstupe zodpovedá náplni tohto predmetu, po metodologickej stránke ukazuje prepojenie teórie a praxe a pozitívne ovplyvní vzdelávací proces. Dopady je možné nepriamo vidieť aj v predmete aplikácie umelej a výpočtovej inteligencie, ktorý je vyučovaný v aplikovanej informatike na pracovisku, ako aj na predmete algebra a diskretná matematika pre informatikov, ktorý hodnotená osoba vyučuje. / The problem solved in the output (research related to networks, computational intelligence and graph theory) has an indirect impact on the subject of research in informatics, in the teaching of which the evaluated person participates. The problem solved in the output corresponds to the content of this subject, from the methodological point of view it shows the connection between theory and practice and will positively influence the educational process. The impacts can also be seen indirectly in the subject of application of artificial and computational intelligence, which is taught in applied informatics at the workplace, as well as in the subject of algebra and discrete mathematics for computer scientists, which the evaluated person teaches.</p>                                                                                                                                                                                                                                                                                           |

## Charakteristika predkladaného výstupu tvorivej činnosti / Characteristics of the submitted research/ artistic/other output

Tlačivo VTC slúži na predkladanie výstupov tvorivej činnosti podľa metodiky hodnotenia tvorivých činností (časť V. Metodiky na vyhodnocovanie štandardov) / The form is used to submit the research/artistic/other outputs according to the evaluation methodology of research/artistic/other activities (part V. The Methodology for Standards Evaluation).

ID konania/ID of the procedure: <sup>1</sup>

Kód VTC/Code of the research/artistic/other output (RAOO):<sup>1</sup>

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| OCA1. Priezvisko hodnotenej osoby / Surname awarded to the assessed person <sup>2</sup>                                                                                                 | Dirgová Luptáková                                                                                                                                                                                                                                                                                                                                  |
| OCA2. Meno hodnotenej osoby / Name awarded to the assessed person <sup>2</sup>                                                                                                          | Iveta                                                                                                                                                                                                                                                                                                                                              |
| OCA3. Tituly hodnotenej osoby / Degrees awarded to the assessed person <sup>2</sup>                                                                                                     | doc. RNDr., PhD.                                                                                                                                                                                                                                                                                                                                   |
| OCA4. Hyperlink na záznam osoby v Registri zamestnancov vysokých škôl / Hyperlink to the entry of the person in the Register of university staff <sup>3</sup>                           | <a href="https://www.portalvs.sk/regzam/detail/18294">https://www.portalvs.sk/regzam/detail/18294</a>                                                                                                                                                                                                                                              |
| OCA5. Oblasť posudzovania / Area of assessment <sup>4</sup>                                                                                                                             | Aplikovaná informatika/ Applied Informatics                                                                                                                                                                                                                                                                                                        |
| OCA6. Kategória výstupu tvorivej činnosti / Category of the research/ artistic/other output<br><i>Výber zo 6 možností (pozri Vysvetlivky k položke OCA6) / Choice from 6 options</i>    | vedecký výstup / scientific output                                                                                                                                                                                                                                                                                                                 |
| OCA7. Rok vydania výstupu tvorivej činnosti / Year of publication of the research/artistic/other output                                                                                 | 2019                                                                                                                                                                                                                                                                                                                                               |
| OCA8. ID záznamu v CREPČ alebo CREUČ (ak je) / ID of the record in the Central Registry of Publication Activity (CRPA) or the Central Registry of Artistic Activity (CRAA) <sup>5</sup> | ID: 118941                                                                                                                                                                                                                                                                                                                                         |
| OCA9. Hyperlink na záznam v CREPČ alebo CREUČ / Hyperlink to the record in CRPA or CRAA <sup>6</sup>                                                                                    | <a href="https://app.crepc.sk/?fn=detailBiblioFormChildWRU2C&amp;sid=40DAA8F9ABC010BB4330D26456&amp;seo=CREP%C4%8C-detail-%C4%8C%C3%A1nok">https://app.crepc.sk/?fn=detailBiblioFormChildWRU2C&amp;sid=40DAA8F9ABC010BB4330D26456&amp;seo=CREP%C4%8C-detail-%C4%8C%C3%A1nok</a>                                                                    |
| Ovplyvnený v CREPČ alebo CREUČ / Characteristics of the output that is not registered in CRPA or CRAA                                                                                   | OCA10. Hyperlink na záznam v inom verejne prístupnom registri, katalógu výstupov tvorivých činností / Hyperlink to the record in another publicly accessible register, catalogue of research/ artistic/other outputs <sup>7</sup>                                                                                                                  |
|                                                                                                                                                                                         | OCA11. Charakteristika výstupu vo formáte bibliografického záznamu CREPČ alebo CREUČ, ak výstup nie je vo verejne prístupnom registri alebo katalógu výstupov / Characteristics of the output in the format of the CRPA or the CRAA bibliographic record, if the output is not available in a publicly accessible register or catalogue of outputs |
|                                                                                                                                                                                         | OCA12. Typ výstupu (ak nie je výstup registrovaný v CREPČ alebo CREUČ) / Type of the output (if the output is not registered in CRPA or CRAA)<br><i>Výber zo 67 možností (pozri Vysvetlivky k položke OCA12) / Choice from 67 options (see Explanations for OCA12).</i>                                                                            |
|                                                                                                                                                                                         | OCA13. Hyperlink na stránku, na ktorej je výstup sprístupnený (úplný text, iná dokumentácia a podobne) / Hyperlink to the webpage where the output is available (full text, other documentation, etc.)                                                                                                                                             |
|                                                                                                                                                                                         | OCA14. Charakteristika autorského vkladu / Characteristics of the author's contribution                                                                                                                                                                                                                                                            |

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|----------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Charakteristika výstupu, ktorý nie je registrovaný | <p>OCA15. Anotácia výstupu s kontextovými informáciami týkajúcimi sa opisu tvorivého procesu a obsahu tvorivej činnosti a pod. / Annotation of the output with contextual information concerning the description of creative process and the content of the research/artistic/other activity, etc. <sup>8</sup></p> <p><i>Rozsah do 200 slov v slovenskom jazyku / Range up to 200 words in Slovak</i></p> <p><i>Rozsah do 200 slov v anglickom jazyku / Range up to 200 words in English</i></p> | <p>Multi-Hub Location Heuristic for Alert Routing [electronic] / Marek Šimon, Iveta Dirgová Luptáková, Ladislav Huraj, Jiří Pospíchal, 2019. DOI DOI 10.1109/ACCESS.2019.2907161. In: IEEE Access : practical innovations, open solutions : practical innovations, open solutions. - ISSN 2169-3536 (online), Roč. 7 (2019), s. 40369-40379 [online]. (CC, IF 4.098, Q1) A+</p> <p>Hodnotená osoba sa ako spoluautor podieľala na všetkých fázach tvorby výstupu, od samotného návrhu koncepcie riešenia, cez experimentálne testovanie, analýzu dosiahnutých výsledkov, až po proces písania článku a zapracovanie recenzných odporúčaní. / As a co-author, the evaluated person participated in all phases of the creation of the output, from the very design of the solution concept, through experimental testing, analysis of the achieved results, to the process of writing the article and incorporating review recommendations.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|                                                    | <p>OCA16. Anotácia výstupu v anglickom jazyku / Annotation of the output in English <sup>9</sup></p> <p><i>Rozsah do 200 slov / Range up to 200 words</i></p>                                                                                                                                                                                                                                                                                                                                     | <p>Trigger warning and other delay-sensitive applications for environmental, healthcare, and industrial or military surveillance and monitoring are usually based on networks. Surveillance nodes (like in the Internet of Things or wireless sensor networks) send the data to selected nodes (hubs) that forward the alert or alarm further to the next system level. The maximum length of the shortest paths from the nodes to their nearest hub should be optimized to minimize the maximum necessary number of hops required to route a warning. For k hubs, this requirement is expressed as k-source minimization of the maximum vertex eccentricity problem, i.e. minimization of d in a d-hop dominating set of a given cardinality k. In this contribution, several heuristic algorithms selecting the initial set H of hubs (i.e. the dominating set) are combined with our greedy and k-means-like approaches adapted from Euclidean to graph (i.e. geodesic) distance. The presented algorithms were tested on static geometric network models, standardly used for models of Wi-Fi networks. The best results were produced by the k-means-like algorithm with initialization provided by the centers of communities found by edge-betweenness community detection. When compared with, e.g., random selection of hub locations, our method can cut the worst case number of hops by half, and when compared with a classical k center approach, our improvement was more than 50%.</p>                                                                            |
|                                                    | <p>OCA17. Zoznam najviac 5 najvýznamnejších ohlasov na výstup / List of maximum 5 most significant citations corresponding to the output</p> <p><i>Rozsah do 200 slov / Range up to 200 words</i></p>                                                                                                                                                                                                                                                                                             | <p>1. Zhang, Qi, Li, "Marine Observation Beacon Clustering and Recycling Technology Based on Wireless Sensor Networks", Sensors, vol. 19, pp. 3726, 2019</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|                                                    | <p>OCA18. Charakteristika dopadu výstupu na spoločensko-hospodársku prax / Characteristics of the output's impact on socio-economic practice</p> <p><i>Rozsah do 200 slov v slovenskom jazyku / Range up to 200 words in Slovak</i></p> <p><i>Rozsah do 200 slov v anglickom jazyku / Range up to 200 words in English</i></p>                                                                                                                                                                    | <p>Článok patrí do radu výskumných úloh riešených v rámci projektu VEGA a APVV, ktorý využíva metódy soft computing k zvýšeniu bezpečnosti počítačových sietí. Častým problémom v sieťach je výber podmnožiny výhodne umiestnených centrálnych uzlov, ktoré sú následne schopné rýchlo získať časovo kritickú správu (napr. napadnutie počítača) od okolitých uzlov, ktorú potom pošlú ďalej. Na rozdiel od podobného problému tzv. "burning graph" maximálna grafová vzdialenosť uzlov k najbližšiemu centrálnemu uzlu by mala byť minimálna ale pre všetky centrálné uzly rovnaká. Článok popisuje návrh a testovanie algoritmu, riešiaceho tento problém, a tak urýchlím kritických bezpečnostných správ do budúcnosti prispieva k zvýšeniu bezpečnosti sietí. / The article belongs to a series of research tasks solved within the VEGA and APVV project, which uses soft computing methods to increase the security of computer networks. A common problem in networks is the selection of a subset of advantageously located central nodes, which are subsequently able to quickly receive a time-critical message (eg a computer attack) from surrounding nodes, which they then forward. Unlike a similar problem called "burning graph" the maximum graph distance of nodes to the nearest central node should be minimal but the same for all central nodes. The article describes the design and testing of an algorithm that solves this problem, thus contributing to the increase of network security by speeding up critical security messages in the future.</p> |

OCA19. Charakteristika dopadu výstupu a súvisiacich aktivít na vzdelávací proces / Characteristics of the output and related activities' impact on the educational process

*Rozsah do 200 slov v slovenskom jazyku / Range up to 200 words in Slovak*

*Rozsah do 200 slov v anglickom jazyku / Range up to 200 words in English*

Problém riešený vo výstupe (výskum súvisiaci s bezpečnosťou aj s teóriou grafov) má nepriamy dopad na predmet výskum v informatike, na ktorého vyučovaní sa hodnotená osoba spolupodieľa. Problematika riešená vo výstupe zodpovedá náplni tohto predmetu, po metodologickej stránke ukazuje prepojenie teórie a praxe a pozitívne ovplyvní vzdelávací proces. Dopady je možné nepriamo vidieť aj na predmete algebra a diskretná matematika pre informatikov, ktorý hodnotená osoba vyučuje. / The problem solved in the output (research related to both security and graph theory) has an indirect impact on the subject of research in computer science, in the teaching of which the evaluated person participates. The problem solved in the output corresponds to the content of this subject, from the methodological point of view it shows the connection between theory and practice and will positively influence the educational process. The impacts can also be seen indirectly on the subject algebra and discrete mathematics for computer scientists, which the evaluated person teaches.

## Charakteristika predkladaného výstupu tvorivej činnosti / Characteristics of the submitted research/ artistic/other output

*Tlačivo VTC slúži na predkladanie výstupov tvorivej činnosti podľa metodiky hodnotenia tvorivých činností (časť V. Metodiky na vyhodnocovanie štandardov) / The form is used to submit the research/artistic/other outputs according to the evaluation methodology of research/artistic/other activities (part V. The Methodology for Standards Evaluation).*

ID konania/ID of the procedure: <sup>1</sup>

Kód VTC/Code of the research/artistic/other output (RAOO):<sup>1</sup>

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|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| OCA1. Priezvisko hodnotenej osoby / Surname awarded to the assessed person <sup>2</sup>                                                                                                 | Dirgová Luptáková                                                                                                                                                                                                                                                                                                                                  |
| OCA2. Meno hodnotenej osoby / Name awarded to the assessed person <sup>2</sup>                                                                                                          | Iveta                                                                                                                                                                                                                                                                                                                                              |
| OCA3. Tituly hodnotenej osoby / Degrees awarded to the assessed person <sup>2</sup>                                                                                                     | doc. RNDr., PhD.                                                                                                                                                                                                                                                                                                                                   |
| OCA4. Hyperlink na záznam osoby v Registri zamestnancov vysokých škôl / Hyperlink to the entry of the person in the Register of university staff <sup>3</sup>                           | <a href="https://www.portalvs.sk/regzam/detail/18294">https://www.portalvs.sk/regzam/detail/18294</a>                                                                                                                                                                                                                                              |
| OCA5. Oblasť posudzovania / Area of assessment <sup>4</sup>                                                                                                                             | Aplikovaná informatika/ Applied informatics                                                                                                                                                                                                                                                                                                        |
| OCA6. Kategória výstupu tvorivej činnosti / Category of the research/ artistic/other output<br><i>Výber zo 6 možností (pozri Vysvetlivky k položke OCA6) / Choice from 6 options</i>    | vedecký výstup / scientific output                                                                                                                                                                                                                                                                                                                 |
| OCA7. Rok vydania výstupu tvorivej činnosti / Year of publication of the research/artistic/other output                                                                                 | 2019                                                                                                                                                                                                                                                                                                                                               |
| OCA8. ID záznamu v CREPČ alebo CREUČ (ak je) / ID of the record in the Central Registry of Publication Activity (CRPA) or the Central Registry of Artistic Activity (CRAA) <sup>5</sup> | ID: 103279                                                                                                                                                                                                                                                                                                                                         |
| OCA9. Hyperlink na záznam v CREPČ alebo CREUČ / Hyperlink to the record in CRPA or CRAA <sup>6</sup>                                                                                    | <a href="https://app.crepc.sk/?fn=detailBiblioFormChildIRI85&amp;sid=26BAE0713B0B941B88CB4F3650&amp;seo=CREP%C4%8C-detail-kapitola-/-pr%C3%Adspevok">https://app.crepc.sk/?fn=detailBiblioFormChildIRI85&amp;sid=26BAE0713B0B941B88CB4F3650&amp;seo=CREP%C4%8C-detail-kapitola-/-pr%C3%Adspevok</a>                                                |
| OEA / Characteristics of the output that is not registered in CRPA or CRAA                                                                                                              | OCA10. Hyperlink na záznam v inom verejne prístupnom registri, katalógu výstupov tvorivých činností / Hyperlink to the record in another publicly accessible register, catalogue of research/ artistic/other outputs <sup>7</sup>                                                                                                                  |
|                                                                                                                                                                                         | OCA11. Charakteristika výstupu vo formáte bibliografického záznamu CREPČ alebo CREUČ, ak výstup nie je vo verejne prístupnom registri alebo katalógu výstupov / Characteristics of the output in the format of the CRPA or the CRAA bibliographic record, if the output is not available in a publicly accessible register or catalogue of outputs |
|                                                                                                                                                                                         | OCA12. Typ výstupu (ak nie je výstup registrovaný v CREPČ alebo CREUČ) / Type of the output (if the output is not registered in CRPA or CRAA)<br><i>Výber zo 67 možností (pozri Vysvetlivky k položke OCA12) / Choice from 67 options (see Explanations for OCA12).</i>                                                                            |
|                                                                                                                                                                                         | OCA13. Hyperlink na stránku, na ktorej je výstup sprístupnený (úplný text, iná dokumentácia a podobne) / Hyperlink to the webpage where the output is available (full text, other documentation, etc.)                                                                                                                                             |

|                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
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| Charakteristika výstupu, ktorý nie je registrovaný v CREPČ alebo CR                                                                                                                                   | OCA14. Charakteristika autorského vkladu / Characteristics of the author's contribution                                                                                                                                                                                                                                                                                                                                                                                                           | Hodnotená osoba sa ako spoluautor (50 %) podieľala na všetkých fázach tvorby výstupu. / The evaluated person participated as a co-author (50%) in all phases of the creation of the output.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|                                                                                                                                                                                                       | <p>OCA15. Anotácia výstupu s kontextovými informáciami týkajúcimi sa opisu tvorivého procesu a obsahu tvorivej činnosti a pod. / Annotation of the output with contextual information concerning the description of creative process and the content of the research/artistic/other activity, etc. <sup>8</sup></p> <p><i>Rozsah do 200 slov v slovenskom jazyku / Range up to 200 words in Slovak</i></p> <p><i>Rozsah do 200 slov v anglickom jazyku / Range up to 200 words in English</i></p> | <p>Weak ties and how to find them / Iveta Dirgová Luptáková, Marek Šimon, Jiří Pospíchal, 2019. In: Recent Advances in Soft Computing. 837. Advances in Intelligent Systems and Computing. 837 : Advances in Intelligent Systems and Computing / Radek Matoušek. - 1. vyd. - Cham : Springer Nature, 2019. - ISBN 978-3-319-97887-1. - ISSN 2194-5357, s. 16-26. A-</p> <p>Hodnotená osoba sa ako spoluautor podieľala na všetkých fázach tvorby výstupu, od samotného návrhu koncepcie riešenia, cez experimentálne testovanie, analýzu dosiahnutých výsledkov, až po proces písania článku a zapracovanie recenzných odporúčaní. / As a co-author, the evaluated person participated in all phases of the creation of the output, from the very design of the solution concept, through experimental testing, analysis of the achieved results, to the process of writing the article and incorporating review recommendations.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <p>OCA16. Anotácia výstupu v anglickom jazyku / Annotation of the output in English <sup>9</sup></p> <p><i>Rozsah do 200 slov / Range up to 200 words</i></p>                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <p>This paper aims to obtain a better characterization of “weak ties”, edges between communities in a network. Community detection has been, for the last decade, one of the major topics in network science, with applications ranging from e-commerce in social networks or web page characterizations, up to control and engineering problems. There are many methods, which characterize, how well a network is split into communities or clusters, and a set of methods, based on a wide range set of principles, have been designed to find such communities. In a network, where nodes and edges are characterized only by their topological properties, communities are characterized only by being densely internally connected by edges, while edges between communities are scarce. Usually, the most convenient method how to find the in-between edges is to use the community detection methods to find the communities and from them the edges between them. However, the sole characterization of these edges, “weak ties”, is missing. When such characterization is mentioned, typically it is based on high value of edge betweenness, i.e. number of shortest paths going through the edge. While this is mostly valid for networks characterized by a high modularity value, it is very often misleading. Search for a community detection resulting in maximum modularity value is an NP complete problem, and since the selection of weak ties characterizes the communities, their selection is an NP complete problem as well. One can only hope to find a good heuristic. In our paper, we show, to what extent the high edge betweenness characterization is misleading and we design a method, which better characterizes the “weak tie” edges.</p> |
| <p>OCA17. Zoznam najviac 5 najvýznamnejších ohlasov na výstup / List of maximum 5 most significant citations corresponding to the output</p> <p><i>Rozsah do 200 slov / Range up to 200 words</i></p> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |

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|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>OCA18. Charakteristika dopadu výstupu na spoločensko-hospodársku prax /<br/>Characteristics of the output's impact on socio-economic practice<br/><i>Rozsah do 200 slov v slovenskom jazyku / Range up to 200 words in Slovak</i><br/><i>Rozsah do 200 slov v anglickom jazyku / Range up to 200 words in English</i></p>                              | <p>Článok patrí do radu výskumných úloh riešených v rámci projektu VEGA, ktorý využíva metódy soft computing pre bezpečnosť sietí. Pri sieťach sú podstatné tzv. slabé väzby, ktorých rozpojením sa sieť ľahko rozpadne na nesúvislé časti, a ktoré by teda bolo vhodné posilniť alternatívnym spojom. Prístup riešený v článku je schopný vyhľadávať takéto väzby, čo je priamo využiteľné pri zvýšení robustnosti sietí voči útokom. Isto netreba pripomínať, aký negatívny dopad môže mať znefunkčnenie počítačovej siete v nemocniciach či iných kritických infraštruktúrach, a predkladaný prístup môže pomôcť zabrániť útočníkom zhodenie siete. / The article belongs to a series of research tasks solved within the VEGA project, which uses soft computing methods for network security. In the case of networks, the so-called weak ties, the disconnection of which will easily disintegrate the network into disjointed parts, and which would therefore be appropriate to strengthen with an alternative connection. The approach discussed in the article is able to search for such links, which is directly usable in increasing the robustness of networks against attacks. There is no need to mention the negative impact that disabling the computer network in hospitals or other critical infrastructures can have, and the presented approach can help prevent attackers from bringing down the network.</p> |
| <p>OCA19. Charakteristika dopadu výstupu a súvisiacich aktivít na vzdelávací proces / Characteristics of the output and related activities' impact on the educational process<br/><i>Rozsah do 200 slov v slovenskom jazyku / Range up to 200 words in Slovak</i><br/><i>Rozsah do 200 slov v anglickom jazyku / Range up to 200 words in English</i></p> | <p>Problém riešený vo výstupe (výskum súvisiaci s bezpečnosťou aj s teóriou grafov) má nepriamy dopad na predmet výskum v informatike, na ktorého vyučovaní sa hodnotená osoba spolupodieľa. Problematika riešená vo výstupe zodpovedá náplni tohto predmetu, po metodologickej stránke ukazuje prepojenie teórie a praxe a pozitívne ovplyvní vzdelávací proces. Dopady je možné nepriamo vidieť aj na predmete algebra a diskretná matematika pre informatikov, ktorý hodnotená osoba vyučuje. / The problem solved in the output (research related to both security and graph theory) has an indirect impact on the subject of research in computer science, in the teaching of which the evaluated person participates. The problem solved in the output corresponds to the content of this subject, from the methodological point of view it shows the connection between theory and practice and will positively influence the educational process. The impacts can also be seen indirectly on the subject algebra and discrete mathematics for computer scientists, which the evaluated person teaches.</p>                                                                                                                                                                                                                                                                                                                   |

## Charakteristika predkladaného výstupu tvorivej činnosti / Characteristics of the submitted research/ artistic/other output

Tlačivo VTC slúži na predkladanie výstupov tvorivej činnosti podľa metodiky hodnotenia tvorivých činností (časť V. Metodiky na vyhodnocovanie štandardov) / The form is used to submit the research/artistic/other outputs according to the evaluation methodology of research/artistic/other activities (part V. The Methodology for Standards Evaluation).

ID konania/ID of the procedure: <sup>1</sup>

Kód VTC/Code of the research/artistic/other output (RAOO):<sup>1</sup>

|                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| OCA1. Priezvisko hodnotenej osoby / Surname awarded to the assessed person <sup>2</sup>                                                                                                                                                                                                                                                            | Dirgová Luptáková                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| OCA2. Meno hodnotenej osoby / Name awarded to the assessed person <sup>2</sup>                                                                                                                                                                                                                                                                     | Iveta                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| OCA3. Tituly hodnotenej osoby / Degrees awarded to the assessed person <sup>2</sup>                                                                                                                                                                                                                                                                | doc. RNDr., PhD.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| OCA4. Hyperlink na záznam osoby v Registri zamestnancov vysokých škôl / Hyperlink to the entry of the person in the Register of university staff <sup>3</sup>                                                                                                                                                                                      | <a href="https://www.portalvs.sk/regzam/detail/18294">https://www.portalvs.sk/regzam/detail/18294</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| OCA5. Oblasť posudzovania / Area of assessment <sup>4</sup>                                                                                                                                                                                                                                                                                        | Aplikovaná informatika/ Applied informatics                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| OCA6. Kategória výstupu tvorivej činnosti / Category of the research/ artistic/other output<br><i>Výber zo 6 možností (pozri Vysvetlivky k položke OCA6) / Choice from 6 options (see Explanations for OCA6).</i>                                                                                                                                  | vedecký výstup / scientific output                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| OCA7. Rok vydania výstupu tvorivej činnosti / Year of publication of the research/artistic/other output                                                                                                                                                                                                                                            | 2017                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| OCA8. ID záznamu v CREPČ alebo CREUČ (ak je) / ID of the record in the Central Registry of Publication Activity (CRPA) or the Central Registry of Artistic Activity (CRAA) <sup>5</sup>                                                                                                                                                            | ID: UCM.Trnava.PC024108                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| OCA9. Hyperlink na záznam v CREPČ alebo CREUČ / Hyperlink to the record in CRPA or CRAA <sup>6</sup>                                                                                                                                                                                                                                               | <a href="http://www.crepc.sk/portal?fn=*review&amp;uid=2206305&amp;pageId=resultform&amp;full=0">http://www.crepc.sk/portal?fn=*review&amp;uid=2206305&amp;pageId=resultform&amp;full=0</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| OCA10. Hyperlink na záznam v inom verejne prístupnom registri, katalógu výstupov tvorivých činností / Hyperlink to the record in another publicly accessible register, catalogue of research/ artistic/other outputs <sup>7</sup>                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| OCA11. Charakteristika výstupu vo formáte bibliografického záznamu CREPČ alebo CREUČ, ak výstup nie je vo verejne prístupnom registri alebo katalógu výstupov / Characteristics of the output in the format of the CRPA or the CRAA bibliographic record, if the output is not available in a publicly accessible register or catalogue of outputs |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| OCA12. Typ výstupu (ak nie je výstup registrovaný v CREPČ alebo CREUČ) / Type of the output (if the output is not registered in CRPA or CRAA)<br><i>Výber zo 67 možností (pozri Vysvetlivky k položke OCA12) / Choice from 67 options (see Explanations for OCA12).</i>                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| OCA13. Hyperlink na stránku, na ktorej je výstup sprístupnený (úplný text, iná dokumentácia a podobne) / Hyperlink to the webpage where the output is available (full text, other documentation, etc.)                                                                                                                                             | <a href="https://www.scopus.com/record/display.uri?eid=2-s2.0-85019770884&amp;origin=resultslist&amp;sort=plf-f&amp;src=s&amp;st1=Dirgova+Lupta%20c3%a1kov%20c3%a1&amp;st2=Iveta&amp;nlo=1&amp;nlr=20&amp;nls=cou-nt-f&amp;sid=85b60674c8a1fbcc750c60c6614b109f&amp;sot=anl&amp;sdt=aut&amp;sl=45&amp;s=AU-ID%28%22Dirgov%20c3%a1+Lupt%20c3%a1kov%20c3%a1%2c+Iveta%22+57192181484%29&amp;relpos=9&amp;citeCnt=1&amp;searchTerm=&amp;featureToggles=FEATURE_NEW_DOC_DETAILS_EXPORT:1">https://www.scopus.com/record/display.uri?eid=2-s2.0-85019770884&amp;origin=resultslist&amp;sort=plf-f&amp;src=s&amp;st1=Dirgova+Lupta%20c3%a1kov%20c3%a1&amp;st2=Iveta&amp;nlo=1&amp;nlr=20&amp;nls=cou-nt-f&amp;sid=85b60674c8a1fbcc750c60c6614b109f&amp;sot=anl&amp;sdt=aut&amp;sl=45&amp;s=AU-ID%28%22Dirgov%20c3%a1+Lupt%20c3%a1kov%20c3%a1%2c+Iveta%22+57192181484%29&amp;relpos=9&amp;citeCnt=1&amp;searchTerm=&amp;featureToggles=FEATURE_NEW_DOC_DETAILS_EXPORT:1</a> |

|                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|-----------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Charakteristika výstupu, ktorý nie je registrovaný v CREPČ alet | OCA14. Charakteristika autorského vkladu / Characteristics of the author's contribution                                                                                                                                                                                                                                                                                                                                                                                            | Hodnotená osoba sa ako hlavný autor (95 %) podieľala na všetkých fázach tvorby výstupu. / The evaluated person participated as the main author (95%) in all phases of the creation of the output.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|                                                                 | OCA15. Anotácia výstupu s kontextovými informáciami týkajúcimi sa opisu tvorivého procesu a obsahu tvorivej činnosti a pod. / Annotation of the output with contextual information concerning the description of creative process and the content of the research/artistic/other activity, etc. <sup>8</sup><br><i>Rozsah do 200 slov v slovenskom jazyku / Range up to 200 words in Slovak</i><br><i>Rozsah do 200 slov v anglickom jazyku / Range up to 200 words in English</i> | Maximum traveling salesman problem by adapted neural gas / Iveta Dirgová Luptáková, Jiří Pospíchal, 2017. - Príspevok indexovaný v databáze Scopus.<br>In: Advances in Intelligent Systems and Computing : 22nd International Conference on Soft Computing: Evolutionary Computation, Genetic Programming, Swarm Intelligence, Fuzzy Logic, Neural Networks, Chaos, Bayesian Methods, Intelligent Image Processing, Bio-Inspired Robotics, MENDEL 2016. - Cham : Springer, 2017. - ISBN 978-331958087-6. - ISSN 21945357, Vol. 576 (2017), pp. 168-175. A-<br>Hodnotená osoba sa ako hlavný autor podieľala na všetkých fázach tvorby výstupu, od samotného návrhu koncepcie riešenia, cez experimentálne testovanie, analýzu dosiahnutých výsledkov, až po proces písania článku a zapracovanie recenzných odporúčaní. / As the main author, the evaluated person participated in all phases of the creation of the output, from the very design of the solution concept, through experimental testing, analysis of the achieved results, to the process of writing the article and incorporating review recommendations.                                                                                                                                     |
|                                                                 | OCA16. Anotácia výstupu v anglickom jazyku / Annotation of the output in English <sup>9</sup><br><i>Rozsah do 200 slov / Range up to 200 words</i>                                                                                                                                                                                                                                                                                                                                 | This paper considers the problem of solving the Maximum Traveling Salesman Problem (otherwise known as "taxicab ripoff problem") in a plane, using an adapted Neural Gas algorithm with some features of Kohonen's Self-Organizing Map. Maximum Traveling Salesman Problem is similar to classical Traveling Salesmen Problem (TSP), but instead of a search for a Hamiltonian tour visiting all vertices and returning to the initial vertex, which has a minimum sum of lengths of visited edges, we are looking for a maximum sum of lengths. This problem is less popular than classical TSP, nevertheless, in recent years also received a great amount of attention, leading to many heuristics and theoretical results. In this paper, we propose a new heuristic, which is certainly not as efficient as the already existing methods. We are not trying to enter the fierce competition to find the most effective algorithm, but we are trying to experimentally examine a possibility to use a special type of neural network to solve such a problem. Experiments show, that elements of neural gas approach together with SOM are applicable to this kind of problem and provide reasonable results. © Springer International Publishing AG 2017. |
|                                                                 | OCA17. Zoznam najviac 5 najvýznamnejších ohlasov na výstup / List of maximum 5 most significant citations corresponding to the output<br><i>Rozsah do 200 slov / Range up to 200 words</i>                                                                                                                                                                                                                                                                                         | 1. Adapted parallel quine-McCluskey algorithm using GPGPU. Siladi, V. , Povinsky, M. , Trajtel, L.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|                                                                 | OCA18. Charakteristika dopadu výstupu na spoločensko-hospodársku prax / Characteristics of the output's impact on socio-economic practice<br><i>Rozsah do 200 slov v slovenskom jazyku / Range up to 200 words in Slovak</i><br><i>Rozsah do 200 slov v anglickom jazyku / Range up to 200 words in English</i>                                                                                                                                                                    | Článok patrí do radu výskumných úloh riešených v rámci projektu VEGA, ktorý využíva metódy soft computing pre aplikácie informatiky. Základným problémom v bioinformatike je pochopenie sekvencie dedičnej informácie DNA ako aj štúdium RNA interakcií. Kombinatorický problém riešený v článku je priamo využiteľný v oboch týchto oblastiach, a tak v budúcnosti môže nájsť cestu do novovytváraných laboratórií pri nemocniciach venovaných biochemickým a genetickým analýzám. / The article belongs to a series of research tasks solved within the VEGA project, which uses soft computing methods for computer science applications. A fundamental problem in bioinformatics is the understanding of the sequence of the hereditary information of DNA as well as the study of RNA interactions. The combinatorial problem solved in the article is directly usable in both of these areas, and thus in the future it may find its way into newly created laboratories at hospitals dedicated to biochemical and genetic analyses.                                                                                                                                                                                                                     |

OCA19. Charakteristika dopadu výstupu a súvisiacich aktivít na vzdelávací proces / Characteristics of the output and related activities' impact on the educational process

*Rozsah do 200 slov v slovenskom jazyku / Range up to 200 words in Slovak*

*Rozsah do 200 slov v anglickom jazyku / Range up to 200 words in English*

Problém riešený vo výstupe (výskum súvisiaci s bioinformatickými aplikáciami aj s teóriou grafov) má nepriamy dopad na predmet výskum v informatike, na ktorého vyučovaní sa hodnotená osoba spolupodieľa. Problematika riešená vo výstupe zodpovedá náplni tohto predmetu, po metodologickej stránke ukazuje prepojenie teórie a praxe a pozitívne ovplyvní vzdelávací proces. Dopady je možné nepriamo vidieť aj na predmete algebra a diskretná matematika pre informatikov, ktorý hodnotená osoba vyučuje. / The problem solved in the output (research related to bioinformatics applications and graph theory) has an indirect impact on the subject research in informatics, in the teaching of which the evaluated person participates. The problem solved in the output corresponds to the content of this subject, from the methodological point of view it shows the connection between theory and practice and will positively influence the educational process. The impacts can also be seen indirectly on the subject algebra and discrete mathematics for computer scientists, which the evaluated person teaches.

## Charakteristika predkladaného výstupu tvorivej činnosti / Characteristics of the submitted research/ artistic/other output

*Tlačivo VTC slúži na predkladanie výstupov tvorivej činnosti podľa metodiky hodnotenia tvorivých činností (časť V. Metodiky na vyhodnocovanie štandardov) / The form is used to submit the research/artistic/other outputs according to the evaluation methodology of research/artistic/other activities (part V. The Methodology for Standards Evaluation).*

ID konania/ID of the procedure: <sup>1</sup>

Kód VTC/Code of the research/artistic/other output (RAOO):<sup>1</sup>

|                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                    |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| OCA1. Priezvisko hodnotenej osoby / Surname awarded to the assessed person <sup>2</sup>                                                                                                 | Dirgová Luptáková                                                                                                                                                                                                                                                                                                                                  |
| OCA2. Meno hodnotenej osoby / Name awarded to the assessed person <sup>2</sup>                                                                                                          | Iveta                                                                                                                                                                                                                                                                                                                                              |
| OCA3. Tituly hodnotenej osoby / Degrees awarded to the assessed person <sup>2</sup>                                                                                                     | doc. RNDr., PhD.                                                                                                                                                                                                                                                                                                                                   |
| OCA4. Hyperlink na záznam osoby v Registri zamestnancov vysokých škôl / Hyperlink to the entry of the person in the Register of university staff <sup>3</sup>                           | <a href="https://www.portalvs.sk/regzam/detail/18294">https://www.portalvs.sk/regzam/detail/18294</a>                                                                                                                                                                                                                                              |
| OCA5. Oblasť posudzovania / Area of assessment <sup>4</sup>                                                                                                                             | Aplikovaná informatika/ Applied informatics                                                                                                                                                                                                                                                                                                        |
| OCA6. Kategória výstupu tvorivej činnosti / Category of the research/ artistic/other output<br><i>Výber zo 6 možností (pozri Vysvetlivky k položke OCA6) / Choice from 6 options</i>    | vedecký výstup / scientific output                                                                                                                                                                                                                                                                                                                 |
| OCA7. Rok vydania výstupu tvorivej činnosti / Year of publication of the research/artistic/other output                                                                                 | 2017                                                                                                                                                                                                                                                                                                                                               |
| OCA8. ID záznamu v CREPČ alebo CREUČ (ak je) / ID of the record in the Central Registry of Publication Activity (CRPA) or the Central Registry of Artistic Activity (CRAA) <sup>5</sup> | <a href="http://www.crepc.sk/portal?fn=*review&amp;uid=2206307&amp;pagelid=resultform&amp;full=0">http://www.crepc.sk/portal?fn=*review&amp;uid=2206307&amp;pagelid=resultform&amp;full=0</a>                                                                                                                                                      |
| OCA9. Hyperlink na záznam v CREPČ alebo CREUČ / Hyperlink to the record in CRPA or CRAA <sup>6</sup>                                                                                    |                                                                                                                                                                                                                                                                                                                                                    |
| : output that is not registered in CRPA or CRAA                                                                                                                                         | OCA10. Hyperlink na záznam v inom verejne prístupnom registri, katalógu výstupov tvorivých činností / Hyperlink to the record in another publicly accessible register, catalogue of research/ artistic/other outputs <sup>7</sup>                                                                                                                  |
|                                                                                                                                                                                         | OCA11. Charakteristika výstupu vo formáte bibliografického záznamu CREPČ alebo CREUČ, ak výstup nie je vo verejne prístupnom registri alebo katalógu výstupov / Characteristics of the output in the format of the CRPA or the CRAA bibliographic record, if the output is not available in a publicly accessible register or catalogue of outputs |
|                                                                                                                                                                                         | OCA12. Typ výstupu (ak nie je výstup registrovaný v CREPČ alebo CREUČ) / Type of the output (if the output is not registered in CRPA or CRAA)<br><i>Výber zo 67 možností (pozri Vysvetlivky k položke OCA12) / Choice from 67 options (see Explanations for OCA12).</i>                                                                            |
|                                                                                                                                                                                         | OCA13. Hyperlink na stránku, na ktorej je výstup sprístupnený (úplný text, iná dokumentácia a podobne) / Hyperlink to the webpage where the output is available (full text, other documentation, etc.)                                                                                                                                             |

|                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|-------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Charakteristika výstupu, ktorý nie je registrovaný v CREPČ alebo CREUČ / Characteristics of the | OCA14. Charakteristika autorského vkladu / Characteristics of the author's contribution                                                                                                                                                                                                                                                                                                                                                                                            | Hodnotená osoba sa ako hlavný autor (50 %) podieľala na všetkých fázach tvorby výstupu. / The evaluated person participated as the main author (50%) in all phases of the creation of the output.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|                                                                                                 | OCA15. Anotácia výstupu s kontextovými informáciami týkajúcimi sa opisu tvorivého procesu a obsahu tvorivej činnosti a pod. / Annotation of the output with contextual information concerning the description of creative process and the content of the research/artistic/other activity, etc. <sup>8</sup><br><i>Rozsah do 200 slov v slovenskom jazyku / Range up to 200 words in Slovak</i><br><i>Rozsah do 200 slov v anglickom jazyku / Range up to 200 words in English</i> | Detekcia sieťovej komunity nájde komunity/klastre husto prepojených uzlov s niekoľkými okrajmi mimo klastra. Aplikuje sa v rôznych oblastiach, od elektronického obchodovania na sociálnych sieťach alebo webových grafoch až po analýzy biochemických sietí alebo úloh riadenia a automatizácie. Rizikové aplikácie s vysokými následkami siahajú od obnovy energetických systémov pri štarte z černa, výroby priehradových konštrukcií, riadenia neurónových motorov, distribúcie vody až po segmentáciu obrazu na nájdenie trhlin v mostoch. Pre takéto dôležité technické aplikácie je potrebné poznať hranice používaných metód, nakoľko sa môžu odchyľovať od optima. Robustnosť komunitných detekčných metód už bola porovnaná pomocou množstva testovacích sietí, a to ako v reálnom svete, tak aj v umelých. Tieto testovacie siete však boli implicitne priemernými prípadmi. Tu vyvíjame siete, ktoré produkujú maximálnu chybu modularity pre vybrané metódy komunitnej detekcie. Tieto testovacie siete v najhoršom prípade boli vyvinuté pre detekciu modularity Edge betweenness, Fast greedy, Infomap, Louvain a Walktrap. Takéto porovnanie poskytuje tvrdší test odolnosti ako predchádzajúce prístupy. Trochu prekvapivo po Blondelovej Louvainovej metóde sa o ďalší najlepší výsledok postaral rýchly chamtivec, zatiaľ čo inak favorizovaná Infomap dopadla dosť zle. / Network community detection finds communities/clusters of densely connected nodes with few edges outside the cluster. It is applied in various fields, from e-commerce in social networks or web graphs to biochemical network analyses or control and automation tasks. Risky, high-consequence applications range from scratch power system recovery, truss fabrication, neural motor control, water distribution, to image segmentation to find cracks in bridges. For such important technical applications, it is necessary to know the limits of the methods used, as they may deviate from the optimum. The robustness of community detection methods has already been compared using a number of test networks, both real-world and artificial. However, these test nets were implicitly average cases. Here, we develop networks that produce maximum modularity error for selected community detection methods. These worst-case test nets were developed for Edge betweenness, Fast greedy, Infomap, Louvain and Walktrap modularity detection. Such a comparison provides a tougher robustness test than previous approaches. Somewhat surprisingly, after Blondel's Louvain method, the next best result was fast greedy, while the otherwise favored Infomap fared quite poorly. |
|                                                                                                 | OCA16. Anotácia výstupu v anglickom jazyku / Annotation of the output in English <sup>9</sup><br><i>Rozsah do 200 slov / Range up to 200 words</i>                                                                                                                                                                                                                                                                                                                                 | Network community detection finds communities/clusters of densely connected nodes with few edges outside the cluster. It is applied in a variety of domains, from e-commerce in social networks or web graphs, up to analysis of biochemical networks or control and automation tasks. Hi-consequence risk applications range from black-start recovery of power systems, truss structure manufacturing, neural motor control, water distribution, to image segmentation for finding cracks in bridges. For such important technical applications, it is necessary to know the limits of the used methods, how much they can deviate from optimum. The robustness of the community detection methods was already compared using a number of test networks, both real world and artificial. However, these test networks were implicitly average cases. Here, we evolve networks, which produce a maximum error of modularity measure for selected methods of community detection. This worst-case test networks were evolved for Edge betweenness, Fast greedy, Infomap, Louvain, and Walktrap modularity detection. Such a comparison provides a tougher test of robustness than previous approaches. A bit surprisingly, after the Blondel's Louvain method, the next best result was provided by fast greedy, while otherwise favored Infomap fared rather poorly.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|                                                                                                 | OCA17. Zoznam najviac 5 najvýznamnejších ohlasov na výstup / List of maximum 5 most significant citations corresponding to the output<br><i>Rozsah do 200 slov / Range up to 200 words</i>                                                                                                                                                                                                                                                                                         | 1. Horák, T., & Huraj, L. (2019, April). Smart Thermostat as a Part of IoT Attack. In Computer Science On-line Conference (pp. 156-163). Springer, Cham                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |

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|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>OCA18. Charakteristika dopadu výstupu na spoločensko-hospodársku prax / Characteristics of the output's impact on socio-economic practice<br/> <i>Rozsah do 200 slov v slovenskom jazyku / Range up to 200 words in Slovak</i><br/> <i>Rozsah do 200 slov v anglickom jazyku / Range up to 200 words in English</i></p>                                  | <p>Článok patrí do radu výskumných úloh riešených v rámci Srbsko-Slovenského projektu APVV, ktorý využíva metódy soft computing k aplikáciám. Metódy detekcie komunit sú využívané v širokej škále aplikácií, napr. pri štarte elektrickej prenosovej siete po jej kolapse, pri výrobe vazníkov, riadení motoru neurónovou sieťou, distribúcií vody, až po segmentáciu obrazu využívanú pri hľadaní prasklín v mostoch. V takýchto kritických aplikáciách je potrebné poynať, ako veľmi sú jednotlivé metódy detekcie komunit spoľahlivé, a na to odpovedá tento článok. / The article belongs to a series of research tasks solved within the Serbian-Slovak APVV project, which uses soft computing methods for applications. Community detection methods are used in a wide range of applications, e.g. at the start of the electrical transmission network after its collapse, in the production of trusses, motor control with a neural network, water distribution, up to image segmentation used in the search for cracks in bridges. In such critical applications, it is necessary to consider how reliable each community detection method is, and this article answers this question.</p>                                                                                                                                                                                                                                    |
| <p>OCA19. Charakteristika dopadu výstupu a súvisiacich aktivít na vzdelávací proces / Characteristics of the output and related activities' impact on the educational process<br/> <i>Rozsah do 200 slov v slovenskom jazyku / Range up to 200 words in Slovak</i><br/> <i>Rozsah do 200 slov v anglickom jazyku / Range up to 200 words in English</i></p> | <p>Problém riešený vo výstupe (výskum súvisiaci s pokročilými metódami výpočtovej inteligencie aplikovanými v sieťach) má nepriamy dopad na predmet výskum v informatike, na ktorého vyučovaní sa hodnotená osoba spolupodieľa. Problematika riešená vo výstupe zodpovedá náplni tohto predmetu, po metodologickej stránke ukazuje prepojenie teórie a praxe a pozitívne ovplyvní vzdelávací proces. Dopady je možné nepriamo vidieť aj v predmete aplikácie umelej a výpočtovej inteligencie, ktorý je vyučovaný v aplikovanej informatike na pracovisku. Použité prístupy tiež súvisia s témami Bc. alebo Mgr. prác vedených hodnotenou osobou. / The problem solved in the output (research related to advanced methods of computational intelligence applied in networks) has an indirect impact on the subject of research in computer science, in the teaching of which the evaluated person participates. The problem solved in the output corresponds to the content of this subject, from the methodological point of view it shows the connection between theory and practice and will positively influence the educational process. The impacts can also be seen indirectly in the subject of application of artificial and computational intelligence, which is taught in applied informatics at the workplace. The approaches used are also related to the Bc topics. or Mgr. works conducted by the evaluated person.</p> |