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|  | <b>FORM FOR PROPOSING A<br/>TOPIC IN THE SECOND<br/>CYCLE OF STUDIES</b> | Oznaka             | SAO-FENS.4.24.0-ENG |
|   |  | Datum usvajanja    | 05.03.2019          |
|   |  | Datum/Br. revizije | -                   |
|   |  | Stranica           | 1/1                 |

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| Department                  | Information Technologies                                    |
| Master thesis title:        | Routing Algorithm for Vehicular Networks in SDN Environment |
| Mentor/professor - contact: | Nejdet Dogru – nejdet.dogru@ibu.edu.ba                      |

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| Thesis background: | <p>A routing algorithm is a set of step-by-step operations used to direct Internet traffic efficiently. When a packet of data leaves its source, there are many different paths it can take to its destination. The routing algorithm is used to determine mathematically the best path to take. Different routing algorithms use different methods to determine the best path. For example, a distance vector algorithm calculates a graph of all available routes by having each point (called a node) determine the "cost" of travelling to each immediate neighbor. This information is collected for every node to create a distance table; which is used to determine the best path to from any one node to another. SDN can help nodes find better and faster routes.</p> |
| Thesis objective:  | <p>This study aims to introduce Software Defined Networks' advantages to ad-hoc networks in order to make better routing decision. Proposed system will keep track of vehicles and predict their near future movements constantly and use this information to compute the best route for requested communication between two nodes. Various machine learning algorithm will be used to predict the next behavior and genetic algorithm will be used to compute the best route.</p>   |

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| Literature: | <p>E.-K. Lee, M. Gerla, G. Pau, U. Lee, and J.-H. Lim. (2016) "Internet of Vehicles: From intelligent grid to autonomous cars and vehicular fogs." <i>Int. J. Distrib. Sens. Netw.</i>, vol. 12, no. 9, p. 1550147716665500.</p> <p>P. Rizwan, K. Suresh, and M. R. Babu. (2016) "Real-time smart traffic management system for smart cities by using Internet of Things and big data." presented at the Emerging Technological Trends (ICETT), International Conference on, pp. 1–7.</p> <p>D. Srinivasan, X. Jin, and R. L. Cheu. (2004) "Evaluation of adaptive neural network models for freeway incident detection." <i>IEEE Trans. Intell. Transp. Syst.</i>, vol. 5, no. 1, pp. 1–11.</p> <p>N. Dogru and A. Subasi. (2018) "Traffic accident detection using random forest classifier." presented at the Learning and Technology Conference (L&amp;T), 2018 15th, pp. 40–45.</p> <p>M. Ng and S. T. Waller. (2010) "A static network level model for the information propagation in vehicular ad hoc networks." <i>Transp. Res. Part C Emerg. Technol.</i>, vol. 18, no. 3, pp. 393–407.</p> |
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| Department: Information Technologies   |
| Master thesis title: Detecting Security Attacks in Data Centers in SDN Environment |
| Mentor/professor - contact: Nejdete Dogru – nejdete.dogru@ibu.edu.ba               |

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| Thesis background: | <p>Cloud computing is a technology that delivers IT resources and applications as a service, over the Internet, with pay-as-you-go pricing. It consists of a number of individual computing nodes with corresponding networking and storage subsystems. This service - based thinking has changed the way in which technology departments deliver computing technology and applications, i.e. more efficiently. Since security is the essential part of every system, it is important to keep the integrity of the data being kept in the cloud and to ensure safe access to cloud resources. However, advancements in technology have created new and amplified existing security issues and risks in the cloud. Denial of Service (DoS) attack is a type of an attack where attacker prevents a legitimate user from accessing some information and services. The most common DoS attack is when attacker “floods” a network, sending too many requests to a specific web server at once. This action prevents legitimate users accessing a website, as the server can process only a certain number of requests at the time. In a distributed denial-of-service (DDoS) attack, attacker uses more computers, which are geographically distributed, to launch the attack.</p> |
| Thesis objective:  | <p>Software Defined Networks have been used widely in data centers to optimize the network traffic and minimize the exchange of network packets. It also collects information from the network to be able to make better decision. This study aims to monitor networks in SDN environment and detect security attacks by using machine learning algorithm on collected data. Study will be implemented using data center simulation tools and attacks will be artificially created.</p>   |

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| Literature: | <p>Alkasassbeh, M., Hassanat, A., Al-Naymat, G., &amp; Almseidin, M. (2016). Detecting Distributed Denial of Service Attacks Using Data Mining Techniques. (IJACSA) International Journal of Advanced Computer Science and Applications, 436-445.</p> <p>Barati, M., Abdullah, A., Udzir, N. I., Mahmud, R., &amp; Mustapha, N. (2014). Distributed Denial of Service Detection Using Hybrid Machine Learning Technique . International Symposium on Biometrics and Security Technologies (ISBAST) , (pp. 268-273).</p> <p>Dhanabal, L., &amp; Shantharajah, S. (2015). A Study on NSL-KDD Dataset for Intrusion Detection System Based on Classification Algorithms. International Journal of Advanced Research in Computer and Communication Engineering, 446-452.</p> <p>Gao, Y., Feng, Y., Kawamoto, J., &amp; Sakurai, K. (2016). A Machine Learning Based Approach for Detecting DRDoS Attacks and Its Performance Evaluation. 11th Asia Joint Conference on Information Security, (pp. 81-86).</p> <p>He, Z., Zhang, T., &amp; Lee, R. (2017). Machine Learning Based DDoS Attack Detection From Source Side in Cloud. 4th International Conference on Cyber Security and Cloud Computing, (pp. 114-120).</p> <p>Khalimonenko, A., Kupreev, O., &amp; Ibragimov, T. (2017). DDoS attacks in Q2 2017. Moscow: Kaspersky Lab.</p> <p>Kovacs, E. (2013, August 28). Cloud Hosting Company DigitalOcean Hit by DDOS Attack. (Softpedia News)</p> <p>Kumar, R., Lal, S., &amp; Sharma, A. (2016). Detecting Denial of Service Attacks in the Cloud. IEEE 14th Intl Conf on Dependable, Autonomic and Secure Computing.</p> <p>Masetic, Z., Hajdarevic, K., &amp; Dogru, N. (2017). Cloud computing threats classification model based on the detection feasibility of machine learning algorithms. 40th International Convention on Information and Communication Technology, Electronics and Microelectronics (MIPRO), (pp. 1314-1318).</p> |
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|  | <p>McDowell, M. (2013, February 6). Understanding denial-of-service attacks. (National Cyber Alert System, Cyber Security TIP ST04-015) Retrieved September 2017</p> <p>Sofi, I., Mahajan, A., &amp; Mansotra, V. (2017). Machine Learning Techniques used for the Detection and Analysis of Modern Types of DDoS Attacks. International Research Journal of Engineering and Technology (IRJET), 1085-1092.</p> |
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| Department: Information : Information Technology                      |
| Master thesis title: Driver Behavior Analysis from Vehicular Networks |
| Mentor/professor - contact: Nejdet Dogru                              |

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| Thesis background: | In the past decade transportation systems have been augmented with information and communication technology to provide innovative services to the participants in the traffic. This synergy has resulted in safer and more optimized transportation network. Among the applications of intelligent transportation systems automatic accident detection and accident prediction have gained much attention among the researchers mostly owed to the parallel development of computation technology and machine learning algorithms.  |
| Thesis objective:  | Microscopic traffic variables measured by equipped vehicles sharing information with road side infrastructure (vehicle to infrastructure communication) together with intelligent decision making mechanisms can be used to analyze behaviour of drivers. As a part of the thesis simulation of a highway traffic will be implemented in order to come up with datasets representing different traffic and driver scenarios. Based on these datasets, different classification algorithms will be trained and tested.   |
| Literature:        | <p>Hall, M., Frank, E., Holmes, G., Pfahringer, B., Reutemann, P., &amp; Witten, I. H. (2009). The WEKA data mining software: an update. ACM SIGKDD explorations newsletter, 11(1), 10-18.</p> <p>Han, J., Pei, J., &amp; Kamber, M. (2011). Data mining: concepts and techniques. Elsevier.</p> <p>Hellinga, B., &amp; Knapp, G. (2000). Automatic vehicle identification technology-based freeway incident detection. Transportation Research Record: Journal of the Transportation Research Board, (1727), 142-153.</p> <p>Helbing, D. (1998). From microscopic to macroscopic traffic models. A perspective look at nonlinear media, 122-139.</p> |

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|  | <p>Hernandez, S., Tok, A., &amp; Ritchie, S. G. (2013). Density Estimation using Inductive Loop Signature based Vehicle Re-identification and Classification(No. UCI-ITS-WP-13-4).</p> <p>Hoogendoorn, S. P., &amp; Bovy, P. H. (2001). State-of-the-art of vehicular traffic flow modelling. Proceedings of the Institution of Mechanical Engineers, Part I: Journal of Systems and Control Engineering, 215(4), 283-303.</p> <p>Hounsell, N. B., Shrestha, B. P., Piao, J., &amp; McDonald, M. (2009). Review of urban traffic management and the impacts of new vehicle technologies. IET intelligent transport systems, 3(4), 419-428.</p> <p>Huang, H., Song, B., Xu, P., Zeng, Q., Lee, J., &amp; Abdel-Aty, M. (2016). Macro and micro models for zonal crash prediction with application in hot zones identification. Journal of Transport Geography, 54, 248-256.</p> |
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