2021 International Conference on Innovative Computing (ICIC)

Vehicle Tracking System and Speed Estimation Utilizing Optimal Technique

Waheed Javed (IEEE Member)
University of Management & Technology Lahore, Pakistan
waheedjaved146@gmail.com

Muhammad Danish
University of Management & Technology Lahore, Pakistan
danishsohail42@gmail.com

Hassan Tahir
University of Management & Technology Lahore, Pakistan
hassan.tahir@umt.edu.pk

Hina Bashir
University of Management & Technology Lahore, Pakistan
f2019279007@umt.edu.pk

2021 International Conference on Innovative Computing (ICIC) | 978-1-6654-0091-6/21/$31.00 ©2021 IEEE | DOI: 10.1109/ICIC53490.2021.9692933

Abstract—- One of the most active study fields in the computer vision community is using video in traffic monitoring. The system Traffic Monitor in which uses a hybrid technique for autonomous vehicle monitoring and classification on highways utilizing a basic stationary calibrated camera. This paper discusses the vehicle global positioning framework system, which allows us to estimate the vehicle's speed. Optical stream is the technology used for speed testing. The optical stream is used to distinguish between the article's undeniable development in the edges and the scenes. Optical stream is the relationship between the clear developments of the objects in the scene's housings. It covers the pace of the video's more brilliant concealing pixels. Convolution Neural Network (CNN) is one of the various solutions for the readiness model because such unending systems are employed. Housings are removed from the video that is utilized to test the model's readiness. The final results are acceptable and can aid in the development of a continuous system that can track and monitor the speed of vehicles as they go throughout town.

Keywords - Convolution Neural Network, Optimal Stream, Vehicle, Tracking etc.

I. Introduction

To ensure the safe and efficient operation of organization street traffic, traffic management companies use a variety of monitoring and control devices. Offices use apparatuses that detect unsettling affects and continuously deliver successful control methods to accomplish their functional objectives [1]. Regardless, this necessitates exact and ideal information on traffic conditions across the entire organization, which is now unattainable due to the lack of tactile instrumentation in most (if not all) urban areas. Fixed sensors are expensive and will be deployed infrequently, resulting in limited spatial inclusion. Information from portable sensors is expected to be more widely accessible than information from point sensors, but it remains quite limited in practice; its scarcity is transient. To overcome such information scarcity (both physically and temporally), we needed technologies that could fill in the gaps in commuter jam perceptions. TSE (traffic state assessment) apparatuses are what they're called [2]. TSE is a basic precursor to a variety of current traffic signal systems that use either traditional cars or a mix of connected and autonomous vehicles [1, 3, 4]. Such systems incorporate, yet are not restricted to, slope metering, edge control, traffic light control, and vehicle directing [5]. TSE strategies that are now in use are listed and evaluated below, along with their pros and drawbacks.

Video observation, individual distinguishing proof, picture retrieval, and advanced driving assistance frameworks are only few of the areas where walker recognition can be used. The ability to track persons on foot in real time is crucial for the reception of such frameworks. A walker recognition calculation aims to construct leaping boxes that gradually depict the areas of individuals walking in a picture. In any event, due to the tradeoff between precision and speed [6], this is difficult to achieve. While a low-goal input will, in most cases, result in speedy article recognition but poor presentation, a high-goal input will result in superior item discovery at the expense of handling speed. Different factors, such as a swarming area, nonperson blocking objects, or different appearances of walkers (different poses or outfit styles), make this issue more challenging[7].

The total system of passersby detection can be broken down into three parts: area proposition age, highlight extraction, and pedestrian check [8]. Sliding window based approaches for proposition age, histograms of inclination direction (HOG) or scale-invariant element change[9] as provisions, and backing vector machine[10] or Adaptive Boosting as person on foot check strategies are common in exemplary tactics. Convolutional neural organizations have been used to recognize walkers as of late. To develop walker propositions, [11]employ the [12] approach. In addition, teach an[13] how to execute a person-on-foot check [14] use a Region Proposal Network (RPN) [15] to figure out passerby candidates and a fallback plan to characterize the up-and-comers, we used Boosted Forest [16] to perform test re-weighting use Fast R-CNN [17, 18] to train several organizations to recognize walkers on various scales and then combine the findings from all organizations to create the final outputs.

To control the transportation framework, the brilliant urban communities' methods can be utilized, With the expansion of vehicles in metropolitan areas and on major city roadways, speed enforcement has become a significant concern. Mishaps may happen because of the unreasonable speed of vehicles out and about and can cause significant danger for human existence[19, 20].

To overcome this danger manual speed checking isn't sufficient as it requires HR.[21] Even a manual speed checking camera isn't up to the imprint as it requires human inclusion. Video reconnaissance gives a colossal measure of information to execute progressed traffic administers, that expands the well-being in occupied roads. Growing industrial examples of self-administering vehicles also necessitate the development of a mechanism for precise speed monitoring. Following the real thing from the live video is one of the most difficult aspects of speed checking[22, 23].

There are countless different items present in the video outlines. With negligible inclusion of the individual, this should be possible by the Optical stream. Optical stream is a measurement of how far more clear pixels have progressed to approved pixels.[24] For video, video perception is used. The tanning of the model with a Convolution Neural Network is a fruitful and sensible approach[25-27].

The HSV (Hue Saturation Value) model is used to track the progress of the more awe-inspiring pixels in distinct camera markings. Using the optical stream approach, the speed of concealing pixels may be seen[28].

The remainders of this paper are organized as follows: Section II provides a brief overview of the related studies. In Section III, we look at the vehicle global positioning framework utilizing the optical stream method, paying close attention to the structure. The HSV model, in particular. In Section IV, we wrap up the results and call it a day.

II. LITERATURE REVIEW

End-to-end optical stream assessment with CNN [29]was proposed by Dosovitskiy. The yield of the stream field is two or three photos when utilizing the "net stream" approach. A 3D DNN [30, 31]is included, which is also utilized in the optical stream technique. Using CNNs and matching picture patches as an optional technique for learning-based optical stream evaluation [32] is an option. Figure important organization for smoothed out CNN from beginning to end [33].

Learn picture fix descriptors using Siamese association structures gives great accuracy, but careful model organization is necessary [34, 35] at any rate, models based on small fixes can provide high precision. Per-pixel gauges can yield fuzzy or erratic results. An assortment approach [36] can be used to post-process a fixed optical stream for the current situation.

The optical stream concept is employed to evaluate speed in our approach. This is a compelling method for determining the thing's speed. This calculation notices the adjustments that occur in the pixels of the picture. The procedure of optical flow is noticing and figuring the progressions power of pixels of the picture[37, 38]. It computes the speed of the article. Being basic and computationally and not costly this methodology can be considered as outstanding amongst other answers for speed assessment[39].

Convolutional Neural Networks (CNN) have been found to produce excellent activity recognition results [40, 41]. The study several long-term frame level combination techniques. make use of the CNN highlight to perform repeating neural organizing.[42, 43] The worldwide data is ignored since these approaches only use outline-based CNN highlights. [44] present a two-stream CNN method for activity recognition.

It has a different arrangement for optical stream than an exemplary CNN that accepts pictures as information. In addition, combine the guidelines and CNN highlights. Although these procedures, which accept hand-created worldly component as a separate stream, show promise execution on activity recognition, they do not use a start to finish profound arrange and require separate optical stream calculation and boundary improvement[45].

3D CNN is a logical solution to this problem. [46] present a human identifier and head tracker based on a 3D CNN to segment human subjects in recordings. [47] Use 3D CNN to solve the problem of large-scale activity recognition. The factorization of 3D CNN that takes advantage of multiple convolutional section disintegration methods. Nonetheless, we appear to be the first to use 3D CNN for activity detection.[48]

Activity identification, in contrast to activity acknowledgment, is a very tough topic[49-51], which has been a working investigation space, [52] provide an approach for locating events in crowded recordings. To differentiate actions in films, [53]promote the Spatio-worldly Deformable Parts Model [54]. To limit the activity limits,[55, 56] use super voxel and special inquiry. In recent years, experts have used the power of deep learning to recognize activities.

In [57]the creators separate casing level activity propositions using specific pursue and connect them using Viterbi computation. While in [58], Edge Box obtains outline level action recommendations and connects them with a subsequent computation. [59]He proposes two-stream R-CNNs for activity detection, in which outline level activity proposition is generated using a spatial Region Proposal Network (RPN) and a movement RPN. In any case, these deep learning-based techniques recognize activities by connecting outline level activity propositions and address the spatial and fleeting provisions of a video independently via two-transfer CNN preparation [60].

As a result, the company doesn't spend much time looking into worldly consistency in records. In contrast, we use 3D CNN to determine activity tube proposition directly from input recordings, focusing on decreased and more viable spatio-transient provisions [61].

III. VEHICLE TRACKING SYSTEM (SPEED ESTIMATION) UTILIZING OPTICAL STREAM TECHNIQUE

A great deal of information can be utilized by getting video from a decent camera. The photos isolated from the video are 2D pictures and they are in gathering concerning time [62]. The assessment of speed and uprooting of highlights present in a picture as for past edge in time grouping of the 2D picture is finished by Optical Flow. In view of this supposition, it is viewed as that optical flow catches continuous movement instead of compression and twisting of the items presents in a picture[63].

A. Optical Flow Algorithm

The dissemination of evident speeds and the development of more brilliant examples with in a picture is known as optical flow [64]. The optical stream provides information on the vehicle's spatial improvement as well as the rate at which the changes are occurring. The optical stream system [65] completes the calculation of paces between two successive edges taken at time t. The camera mounted on the vehicle's highest point collects the video footage. The HSV model [66]determines the pixel's path and force.

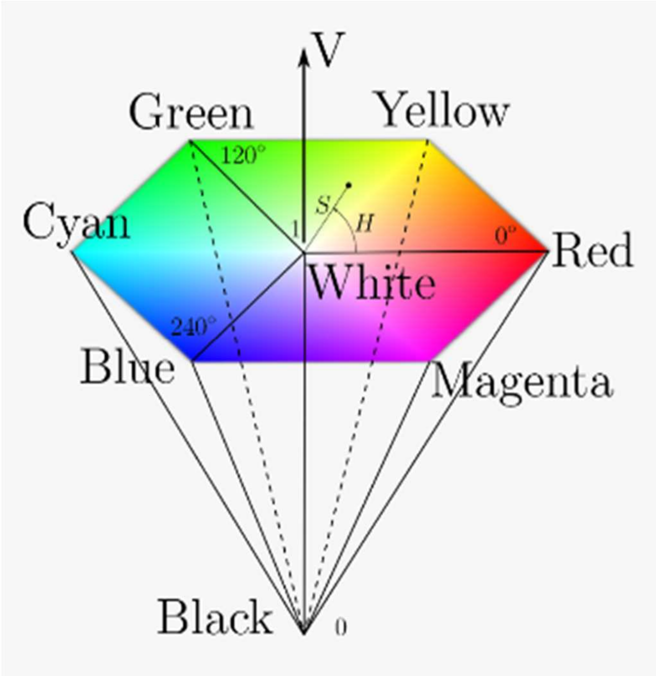

Fig.1 Color Distribution by HSV

The fig.1 shows that the heading of each tone in the image is not the same as other. This is the Model of HSV model in which we can found the force and size of shading present in pixels coming in the image. So, all the pixels that are in the front right of the camera, those will have the yellow tone, likewise front left pixels will have the green tone, and pixels that are on the right side of the camera will have the red tone, pixels that are on left half of the camera will have shading cyan, besides the pixels, close to camera than all the others will have the red and blue contingent on their bearing in a picture. Every pixel that is astonishingly close to the camera will have a dull tone because we don't have to analyze the pixels that are closest to the camera.

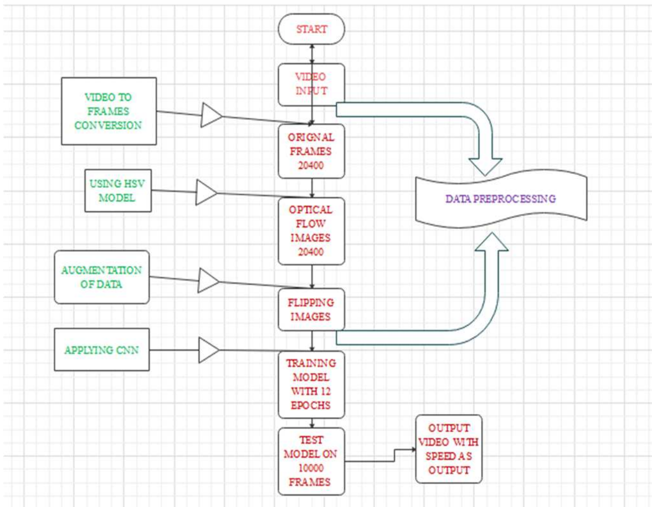

Fig.2 Technique and Data Flow Chart Model

B. Dataset

The extensiveness of the video that is utilized in our examination work is nineteen minutes since quite a while ago, caught from the camera of the vehicle introduced in front. This video catches various scenes like, spans, mountains, people on foot, travelers, thick traffic, vehicles that are left on roadside, streetlamps, traffic lights etc.20000 outlines are caught and are put in arrangement with their list and furthermore concerning their time. The dataset comprises of 20000 edges.[32]

C. Methodology and preprocessing of Dataset

As examined over the dataset utilized is 20,000 listed edges that are sequenced concerning time. The increase is done on all the casings [33]. Because of this growth, the dataset increments. Likewise, All the casings are flipped and are put away with the arrangements same as they are recorded. The absolute size of the dataset increments and becomes 40000 casings. Resizing of the picture is completed. We don't need sky in a picture and furthermore street that is likewise close to the camera [34]. As RGB, the edges become ((66, 220, 3) in size. The most common housing size was ((480 (y), 640 (x), 3) RGB. After that, optical stream estimation is utilized to convert each of the edges into an optical stream. This portion can be seen in fig.3 and fig.4

Fig.3 Unique Image

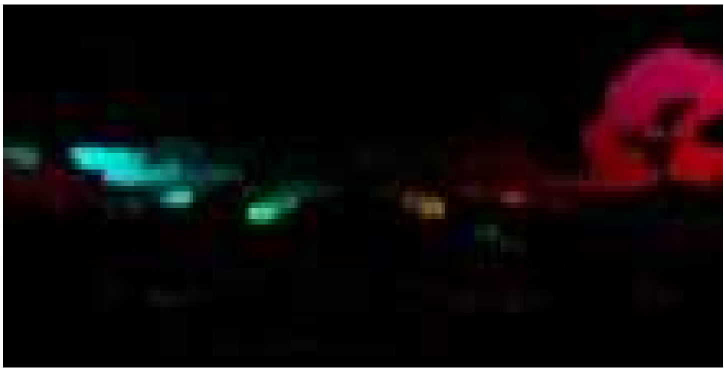

Fig.4 Resized Image

In the Fig.3 the highest point of casing 130px are trimmed as every one of these pixels comprises of sky and furthermore base 270px are edited as every one of these pixels comprises of foot of the vehicle. Applying these preprocessing, size of casings is decreased and accordingly the genuine substance of the image is it brings about the decrease of computational expense [36]. Six layers completely associated Convolutional

Neural Network is applied. For the preparation of the model 30000 edges were utilized and the model is tried on 10000 pictures. The model is prepared for 13 ages.

D. Results:

Optical flow results show that this strategy includes less computational cost and can give better outcomes in speed checking and the human association is insignificant.

The aftereffects of the calculation are appeared in the fig.5 with a precision distinction of 5 percent [67]. The preparation chart is given underneath

Fig.5 Speed Display

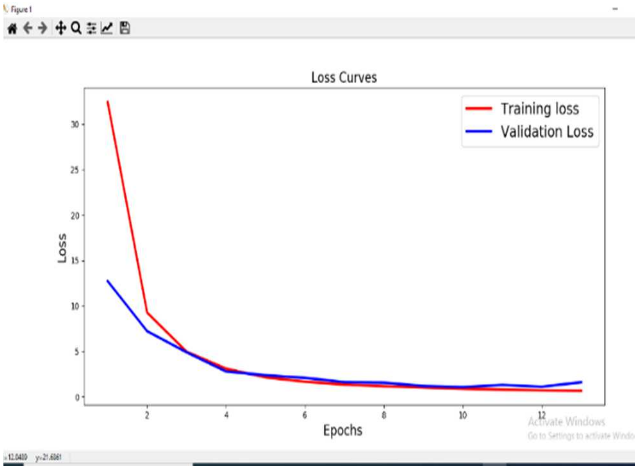

Fig.6 Training misfortune versus Validation Loss

This chart shows that as the more ages diminishes the preparation misfortune and furthermore diminishes approval misfortune. With the optical flow technique, the absolute contrast between genuine speed and the speed assessed is just 5%. Optical flow technique shows that the complete distinction between the genuine and the deliberate speed is as less as 5%.

IV. Conclusion

At first, optical flow vectors work as contribution to a horde of more significant level undertakings requiring scene comprehension of video arrangements while these assignments may additionally go about as building squares to yet more perplexing frameworks, for example, outward appearance investigation, independent vehicle route, and substantially more. Novel applications for optical flow yet to be found are restricted simply by the creativity of its planners.

References

[1] M. J. I. P. V. Papageorgiou, "Overview of road traffic control strategies," vol. 37, no. 19, pp. 29-40, 2004.

[2] T. Seo, A. M. Bayen, T. Kusakabe, and Y. J. A. r. i. c. Asakura, "Traffic state estimation on highway: A comprehensive survey," vol. 43, pp. 128-151, 2017.

[3] L. Li, V. Okoth, and S. E. J. a. p. a. Jabari, "Backpressure control with estimated queue lengths for urban network traffic," 2020.

[4] K. Yang, S. I. Guler, and M. J. T. R. P. C. E. T. Menendez, "Isolated intersection control for various levels of vehicle technology: Conventional, connected, and automated vehicles," vol. 72, pp. 109-129, 2016.

[5] C. F. J. T. R. P. B. M. Daganzo, "A variational formulation of kinematic waves: basic theory and complex boundary conditions," vol. 39, no. 2, pp. 187-196, 2005.

[6] H. Khan, M. Hussain, and M. K. J. D. i. B. Malik, "ECG Images dataset of Cardiac and COVID-19 Patients," vol. 34, p. 106762, 2021.

[7] Dakic and M. J. T. R. P. C. E. T. Menendez, "On the use of Lagrangian observations from public transport and probe vehicles to estimate car space-mean speeds in bi-modal urban networks," vol. 91, pp. 317-334, 2018.

[8] D. P. Kingma and J. J. a. p. a. Ba, "Adam: A method for stochastic optimization," 2014.

[9] A. Aw and M. J. S. j. o. a. m. Rascle, "Resurrection of" second order" models of traffic flow," vol. 60, no. 3, pp. 916-938, 2000.

[10] J. Huang and S. Agarwal, "Physics informed deep learning for traffic state estimation," in 2020 IEEE 23rd International Conference on Intelligent Transportation Systems (ITSC), 2020, pp. 1-6: IEEE.

[11] M. Abadi et al., "Tensorflow: A system for large-scale machine learning," in 12th {USENIX} symposium on operating systems design and implementation ({OSDI} 16), 2016, pp. 265-283.

[12] S. E. Jabari, F. Zheng, H. Liu, and M. Filipovska, "Stochastic Lagrangian modeling of traffic dynamics," in Proc. 97th Annu. Meeting Transp. Res. Board, 2018, pp. 1-14.

[13] M. J. Lighthill, G. B. J. P. o. t. R. S. o. L. S. A. M. Whitham, and P. Sciences, "On kinematic waves II. A theory of traffic flow on long crowded roads," vol. 229, no. 1178, pp. 317-345, 1955.

[14] R. Krajewski, J. Bock, L. Kloeker, and L. Eckstein, "The highd dataset: A drone dataset of naturalistic vehicle trajectories on german highways for validation of highly automated driving systems," in 2018 21st International Conference on Intelligent Transportation Systems (ITSC), 2018, pp. 2118-2125: IEEE.

[15] F. J. T. R. P. B. M. Daganzo, "Requiem for second-order fluid approximations of traffic flow," vol. 29, no. 4, pp. 277-286, 1995.

[16] B. Habtie, A. Abraham, and D. Midekso, "Artificial neural network based real-time urban road traffic state estimation framework," in Computational Intelligence in Wireless Sensor Networks: Springer, 2017, pp. 73-97.

[17] Nadeem, M. W., Goh, H. G., Ponnusamy, V., Andonovic, I., Khan, M. A., & Hussain, M. (2021, October). A fusion-based machine learning approach for the prediction of the onset of diabetes. In Healthcare (Vol. 9, No. 10, p. 1393). Multidisciplinary Digital Publishing Institute.

[18] Awan, M. J., Farooq, U., Babar, H. M. A., Yasin, A., Nobanee, H., Hussain, M., ... & Zain, A. M. (2021). Real-time DDoS attack detection system using big data approach. Sustainability, 13(19), 10743.

[19] T. M. Ghazal, M. Anam, M. K. Hasan, M. Hussain, M. S. Farooq et al., "Hep-pred: hepatitis c staging prediction using fine gaussian svm," Computers, Materials & Continua, vol. 69, no.1, pp. 191–203, 2021.

[20] Khan, A. H., Hussain, M., & Malik, M. K. (2021). Arrhythmia Classification Techniques Using Deep Neural Network. Complexity, 2021.

[21] Khan, A. H., Hussain, M., & Malik, M. K. (2021). Cardiac disorder classification by electrocardiogram sensing using deep neural network. Complexity, 2021.

[22] M. W. Nadeem, H. G. Goh, M. A. Khan, M. Hussain, M. F. Mushtaq et al., "Fusion-based machine learning architecture for heart disease prediction," Computers, Materials & Continua, vol. 67, no.2, pp. 2481–2496, 2021.

[23] Khan, A. H., Hussain, M., & Malik, M. K. (2021). ECG Images dataset of Cardiac and COVID-19 Patients. Data in Brief, 106762.

[24] M. Anam, V. A. Ponnusamy, M. Hussain, M. W. Nadeem, M. Javed et al., "Osteoporosis prediction for trabecular bone using machine learning: a review," Computers, Materials & Continua, vol. 67, no.1, pp. 89–105, 2021.

[25] M. M. Ahmed, S. A. Shehri, J. U. Arshed, M. U. Hassan, M. Hussain et al., "A weighted spatially constrained finite mixture model for image segmentation," Computers, Materials & Continua, vol. 67, no.1, pp. 171–185, 2021.

[26] Nadeem, M. W., Goh, H. G., Ali, A., Hussain, M., & Khan, M. A. (2020). Bone Age Assessment Empowered with Deep Learning: A Survey, Open Research Challenges and Future Directions. Diagnostics, 10(10), 781.

[27] Khalid, H., Hussain, M., Al Ghamdi, M. A., Khalid, T., Khalid, K., Khan, M. A., ... & Ahmed, A. (2020). A Comparative Systematic Literature Review on Knee Bone Reports from MRI, X-rays and CT Scans Using Deep Learning and Machine Learning Methodologies. Diagnostics, 10(8), 518.

[28] Malik, H., Farooq, M. S., Khelifi, A., Abid, A., Qureshi, J. N., & Hussain, M. (2020). A Comparison of Transfer Learning Performance Versus Health Experts in Disease Diagnosis From Medical Imaging. IEEE Access, 8, 139367-139386.

[29] Rehman, A. U., Hussain, M., Idress, M., Munawar, A., Attique, M., Anwar, F., & Ahmad, M. (2020). E-cultivation using the IoT with Adafruit cloud.

[30] Nadeem, M. W., Ghamdi, M. A. A., Hussain, M., Khan, M. A., Khan, K. M., Almotiri, S. H., & Butt, S. A. (2020). Brain tumor analysis empowered with deep learning: A review, taxonomy, and future challenges. Brain sciences, 10(2), 118.

[31] Manzoor, A., Hussain, M., & Mehrban, S. (2020). Performance Analysis and Route Optimization: Redistribution between EIGRP, OSPF & BGP Routing Protocols. Computer Standards & Interfaces, 68, 103391.

[32] Mehrban, S., Nadeem, M. W., Hussain, M., Ahmed, M. M., Hakeem, O., Saqib, S., ... & Khan, M. A. (2020). Towards secure FinTech: A survey, taxonomy, and open research challenges. IEEE Access, 8, 23391-23406.

[33] Abid, A., Manzoor, M. F., Farooq, M. S., Farooq, U., & Hussain, M. (2020). Challenges and Issues of Resource Allocation Techniques in Cloud Computing. KSII Transactions on Internet and Information Systems (TIIS), 14(7), 2815-2839.

[34] Faheem, M. R., Anees, T., & Hussain, M. (2019). The Web of Things: Findability Taxonomy and Challenges. IEEE Access, 7, 185028-185041.

[35] Hussain, M., Zaidan, A. A., Zidan, B. B., Iqbal, S., Ahmed, M. M., Albahri, O. S., & Albahri, A. S. (2018). Conceptual framework for the security of mobile health applications on android platform. Telematics and Informatics, 35(5), 1335-1354.

[36] Hussain, M., Al-Haiqi, A., Zaidan, A. A., Zaidan, B. B., Kiah, M., Iqbal, S., ... & Abdulnabi, M. (2018). A security framework for mHealth apps on Android platform. Computers & Security, 75, 191-217.

[37] Kalid, N., Zaidan, A. A., Zaidan, B. B., Salman, O. H., Hashim, M., & Muzammil, H. (2018). Based real time remote health monitoring systems: A review on patients prioritization and related" big data" using body sensors information and communication technology. Journal of medical systems, 42(2), 30.

[38] Abdulnabi, M., Al-Haiqi, A., Kiah, M. L. M., Zaidan, A. A., Zaidan, B. B., & Hussain, M. (2017). A distributed framework for health information exchange using smartphone technologies. Journal of biomedical informatics, 69, 230-250.

[39] Iqbal, S., Kiah, M. L. M., Dhaghighi, B., Hussain, M., Khan, S., Khan, M. K., & Choo, K. K. R. (2016). On cloud security attacks: A taxonomy and intrusion detection and prevention as a service. Journal of Network and Computer Applications, 74, 98-120.

[40] Hussain, M., Al-Haiqi, A., Zaidan, A. A., Zaidan, B. B., Kiah, M. M., Anuar, N. B., & Abdulnabi, M. (2016). The rise of keyloggers on smartphones: A survey and insight into motion-based tap inference attacks. Pervasive and Mobile Computing, 25, 1-25.

[41] Hussain, M., Al-Haiqi, A., Zaidan, A. A., Zaidan, B. B., Kiah, M. L. M., Anuar, N. B., & Abdulnabi, M. (2015). The landscape of research on smartphone medical apps: Coherent taxonomy, motivations, open challenges and recommendations. Computer methods and programs in biomedicine, 122(3), 393-408.

[42] Zaidan, A. A., Zaidan, B. B., Hussain, M., Haiqi, A., Kiah, M. M., & Abdulnabi, M. (2015). Multi-criteria analysis for OS-EMR software selection problem: A comparative study. Decision Support Systems, 78, 15-27.

[43] Zaidan, B. B., Haiqi, A., Zaidan, A. A., Abdulnabi, M., Kiah, M. M., & Muzamel, H. (2015). A security framework for nationwide health information exchange based on telehealth strategy. Journal of medical systems, 39(5), 1-19.

[44] Zaidan, A. A., Zaidan, B. B., Al-Haiqi, A., Kiah, M. L. M., Hussain, M., & Abdulnabi, M. (2015). Evaluation and selection of open-source EMR software packages based on integrated AHP and TOPSIS. Journal of biomedical informatics, 53, 390-404.

[45] Kiah, M. M., Al-Bakri, S. H., Zaidan, A. A., Zaidan, B. B., & Hussain, M. (2014). Design and develop a video conferencing framework for real-time telemedicine applications using secure group-based communication architecture. Journal of medical systems, 38(10), 1-11.

[46] Nadeem, M. W., Goh, H. G., Hussain, M., Hussain, M., & Khan, M. A. (2021). Internet of Things for Green Building Management: A Survey. In Role of IoT in Green Energy Systems (pp. 156-170). IGI Global.

[47] Iqbal, S., Hussain, M., Munir, M. U., Hussain, Z., Mehrban, S., & Ashraf, M. A. (2021). Crypto-Currency: Future of FinTech. In Research Anthology on Blockchain Technology in Business, Healthcare, Education, and Government (pp. 1915-1924). IGI Global.

[48] Hussain, M., Nadeem, M. W., Iqbal, S., Mehrban, S., Fatima, S. N., Hakeem, O., & Mustafa, G. (2021). Security and Privacy in FinTech: A Policy Enforcement Framework. In Research Anthology on Concepts, Applications, and Challenges of FinTech (pp. 372-384). IGI Global.

[49] Khan, A. G., Zahid, A. H., Hussain, M., & Riaz, U. (2019, November). Security Of Cryptocurrency Using Hardware Wallet And QR Code. In 2019 International Conference on Innovative Computing (ICIC) (pp. 1-10). IEEE.

[50] Khan, A. G., Zahid, A. H., Hussain, M., Farooq, M., Riaz, U., & Alam, T. M. (2019, November). A journey of WEB and Blockchain towards the Industry 4.0: An Overview. In 2019 International Conference on Innovative Computing (ICIC) (pp. 1-7). IEEE.

[51] Nadeem, M. W., Hussain, M., Khan, M. A., Munir, M. U., & Mehrban, S. (2019, November). Fuzzy-Based Model to Evaluate City Centric Parameters for Smart City. In 2019 International Conference on Innovative Computing (ICIC) (pp. 1-7). IEEE.

[52] Zainab, M., Usmani, A. R., Mehrban, S., & Hussain, M. (2019, November). Fpga based implementations of rnn and

cnn: A brief analysis. In 2019 International Conference on Innovative Computing (ICIC) (pp. 1-8). IEEE.

[53] Hassan, M., Hussain, M., & Irfan, M. (2019, November). A Policy Recommendations Framework To Resolve Global Software Development Issues. In 2019 International Conference on Innovative Computing (ICIC) (pp. 1-10). IEEE.

[54] Rafique, I., Fatima, K., Dastagir, A., Mahmood, S., & Hussain, M. (2019, November). Autism Identification and Learning Through Motor Gesture Patterns. In 2019 International Conference on Innovative Computing (ICIC) (pp. 1-7). IEEE.

[55] Nadeem, M. W., Hussain, M., Khan, M. A., & Awan, S. M. (2019, July). Analysis of Smart Citizens: A Fuzzy Based Approach. In 2019 International Conference on Electrical, Communication, and Computer Engineering (ICECCE) (pp. 1-5). IEEE.

[56] Q. Li, S. Jin, and J. Yan, "Mimicking very efficient network for object detection," in Proceedings of the ieee conference on computer vision and pattern recognition, 2017, pp. 6356-6364.

[57] H. Takeda, P. Milanfar, M. Protter, and M. J. I. T. o. I. P. Elad, "Super-resolution without explicit subpixel motion estimation," vol. 18, no. 9, pp. 1958-1975, 2009.

[58] Y. Zhang, Y. Tian, Y. Kong, B. Zhong, and Y. Fu, "Residual dense network for image super-resolution," in Proceedings of the IEEE conference on computer vision and pattern recognition, 2018, pp. 2472-2481.

[59] N. Ahn, B. Kang, and K.-A. Sohn, "Fast, accurate, and lightweight super-resolution with cascading residual network," in Proceedings of the European Conference on Computer Vision (ECCV), 2018, pp. 252-268.

[60] D. Liu et al., "Learning temporal dynamics for video super-resolution: A deep learning approach," vol. 27, no. 7, pp. 3432-3445, 2018.

[61] L. Wolf, T. Hassner, and I. Maoz, "Face recognition in unconstrained videos with matched background similarity," in CVPR 2011, 2011, pp. 529-534: IEEE.

[62] L. Wang, Y. Guo, L. Liu, Z. Lin, X. Deng, and W. J. I. T. o. I. P. An, "Deep video super-resolution using HR optical flow estimation," vol. 29, pp. 4323-4336, 2020.

[63] A. A. Zaidan, B. B. Zaidan, A. Al-Haiqi, M. L. M. Kiah, M. Hussain, and M. J. J. o. b. i. Abdulnabi, "Evaluation and selection of open-source EMR software packages based on integrated AHP and TOPSIS," vol. 53, pp. 390-404, 2015.

[64] P. Yang, H. Zhang, Y. Wang, Y. Wang, and Y. J. J. o. H. Wang, "Overland flow velocities measured using a high-resolution particle image velocimetry system," vol. 590, p. 125225, 2020.

[65] C. B. Aschner, D. M. Knipe, and B. C. J. n. V. Herold, "Model of vaccine efficacy against HSV-2 superinfection of HSV-1 seropositive mice demonstrates protection by antibodies mediating cellular cytotoxicity," vol. 5, no. 1, pp. 1-8, 2020.

[66] V. V. Bodryshev, N. P. Korzhov, and L. N. J. T. J. Rabinskiy, "Grapho-analytical Analysis of Video Frames of Supersonic Flow Around Two Solid Revolutions using the Digital Image Processing Method," vol. 9, no. 2, p. 449, 2020.

[67] L. Li et al., "Artificial intelligence distinguishes COVID-19 from community acquired pneumonia on chest CT," 2020.