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Huffman Algorithm for Secured Data Transmission

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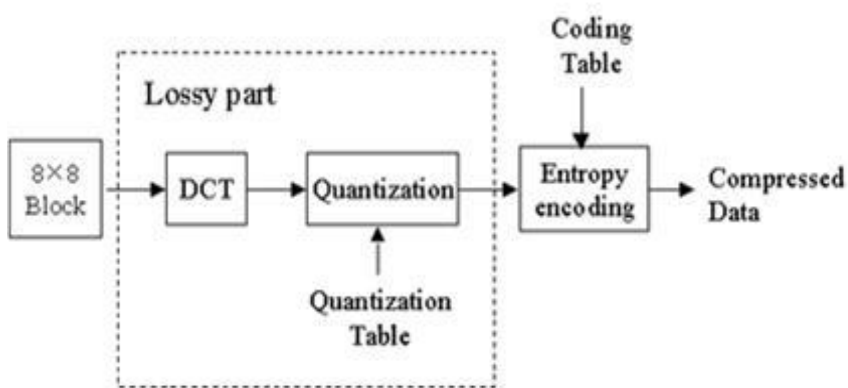
Abstract--- *Neither watermarking nor compression can alone make the data transmission completely secure. Hence the new technique is been proposed in order to achieve secure transmission of data by making combine use of image watermarking using DCT technique and then applying image compression technique using improved adaptive Huffman algorithm to it.*

Keywords--- *Huffman Algorithm, Frequency Domain.*

I. INTRODUCTION

1. Transform the RGB color of the original image into the formation of Gray color.
2. Then the image is divided into 8 × 8 blocks by applying JPEG standard as below.
3. Transform the original 8 x 8 block into a cosine-frequency domain

- C(h) = if (h == 0) then 1/sqrt(2) else 1.0--C(h) is a auxiliary function been used in main function F(u,v)
- F(u,v) = ¼ x C(u) x C(v) Σx=0..7 Σy=0..7 Dxy x cos(π(2u + 1)u/16) x cos(π(2y + 1)v/16)
- Gives encoded pixel at row u, column v
- Dxy is original pixel value at row x, column y -F(u,v) is new matrix value after DCT apply. [2]



4. Static Huffman algorithm The Static Huffman algorithm was developed by David Huffman in (1952) is used to generate the encoded data in two passes that are as follows:

- The frequency of each of the different symbol present in the source data is been calculated. After calculating frequencies.

But in this method some time the source data available is so lengthy that it takes so much time to construct a table which in turns waste a lot of time as well as space required to store the table. [4]

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5. Adaptive Huffman Algorithm Expanding the static Huffman algorithm, Faller and Gallagher [Faller 1973; Gallagher 1978], and later Knuth [Knuth 1985] and Vitter [Vitter 1987], developed a way to perform Static Huffman algorithm by using one pass method that is as follows:

Initially Adaptive Huffman algorithm generates a Huffman tree with all different symbols with frequency count to one and then it takes the code for first symbol in the source data.

For the second symbol it generates the second Huffman tree and takes the code for second symbol and so on till last bit (byte) of source data. [4]

II. CONCEPT

The basic concept behind an adaptive compression algorithm is very simple:

1. At the beginning the model is to be initialized
2. Repetition is done for each character
3. {
4. Then encoding is done for the character
5. Finally the model is updated
6. }

Decompression also works in the same way. As long as both sides have the same initialize and update model algorithms, they will have the same information. [4]

In Adaptive Huffman algorithm, at the time of encoding of symbols, we need to update the tree after each symbol is encoded. Same thing is also been performed in decoding the code. That means there is processing overburden that is involved in the process. The encoded data by Adaptive Huffman algorithm requires more space than Static Huffman encoded data. The other major drawback of the Adaptive Huffman algorithm for encoding the data is that it requires in advance the amount of different symbols that are present in the source data. So it first needs to scan all the source data to determine that how many different symbols are present in the source data. Besides all this some other major drawbacks of adaptive Huffman algorithm are as follows:

- It is very time consuming, as it first constructs the tree and then take the code for the symbol, for the next symbol it adopt the same procedure and same is repeated (up to the last symbol).
- In adaptive Huffman algorithm many different symbols have same code in the encoded data that creates a lot of confusion while decompressing the data.
- In adaptive Huffman same symbol that occurs frequently has different code which can create a lot of confusion while decompressing the data.

Finally while decompressing the data we need all trees, for smaller data it is ok but for large data it demands a huge storage space.

Thus to overcome all these shortcomings we have new compression algorithm named Improved adaptive Huffman.

Improved Adaptive Huffman algorithm is based on existing Huffman algorithm. [4] It have one pass in comparison to the existing static Huffman algorithm and at the same times requires less space for storing the encoded data as compared to adaptive Huffman algorithm. The proposed method with this algorithm is as follows:

At initial step Improved adaptive Huffman algorithm will generate a strictly binary tree by reading first symbol from the source data, then for the next symbol it generates a tree and so on up to last symbol of source data.

On reading the last symbol it makes the final Huffman tree. [4]

1) Advantages

Advantages of Improved Adaptive Huffman over Adaptive Huffman are:

- Improved adaptive Huffman utilizes less space to store the compressed data.
- It saves the time because here, there is no need to scan the whole string for constructing the first tree. It also saves the time while constructing trees e.g. it needs only one symbol for constructing the first tree unlike in adaptive Huffman that requires all different symbols to construct the tree.
- In Improved adaptive Huffman even if one symbol occurs frequently will tend to have same code.
- In improved adaptive Huffman, while constructing the next tree there is no need to remember the previous tree.
- Finally during the process of decompressing the only final tree is needed.

2) Algorithm

1. Scan the first Symbol and initialize its frequency to 1
2. Then next symbol is been scanned from the source data

If any previous symbol = next symbol then the frequency of that previous symbol needs to be incremented

If any previous symbol frequency < recently incremented symbol frequency

Then

Both nodes needs to be interchanged

Else

Initialize their frequency to 1

3. Create strictly binary tree with left and right node (Left or Right node can be NULL). The root is the composite Symbols of left and right nodes. Assign value 0 to Right node and 1to Left node.

4. Step 2 to 4 needs to be repeated till End of Source data is been reached. [4]

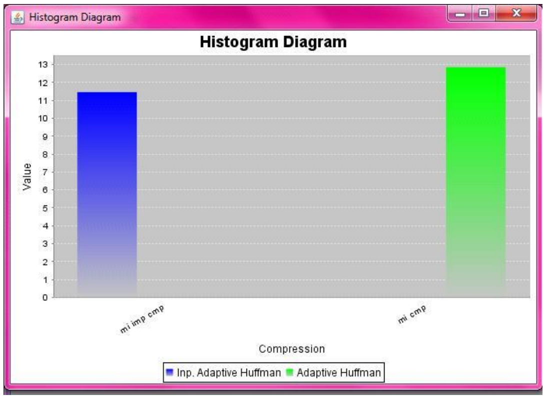

Fig. 1: Visible Watermarking using DCT

By the use of this algorithm the storage space will be reduced and time is also been saved. Thus the combination of the two processes watermarking and compression will results in providing high security level to the data to be transmitted.

III. Implementation And Result

The above described work is implemented in JAVA. Firstly visible watermarking using DCT technique is used to watermark an image. After that improved adaptive Huffman algorithm is used to compress the watermarked image to further enhance security needs of the system.

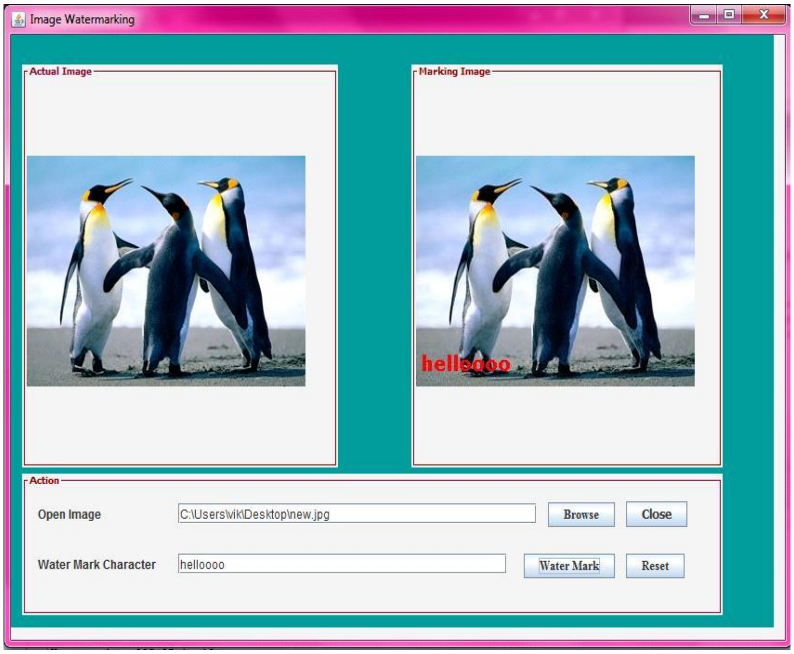

Fig. 2: Compression using adaptive Huffman algorithm

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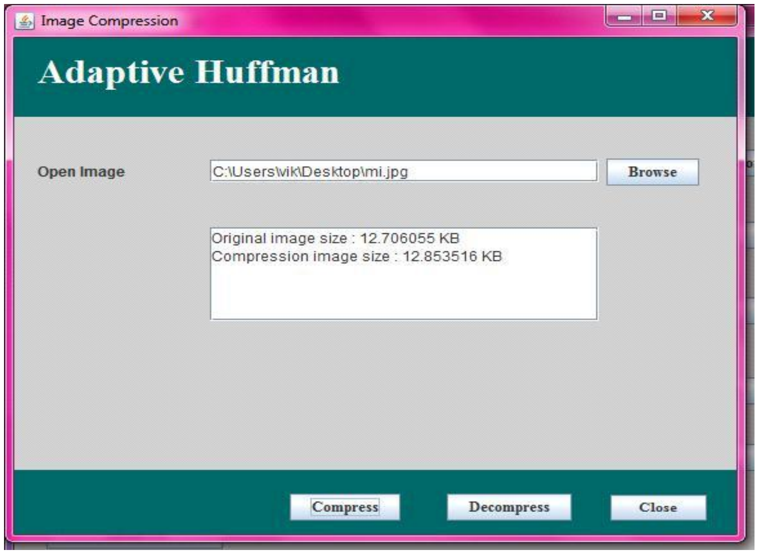

Fig. 3: Comparison graph for adaptive Huffman and improved adaptive Huffman

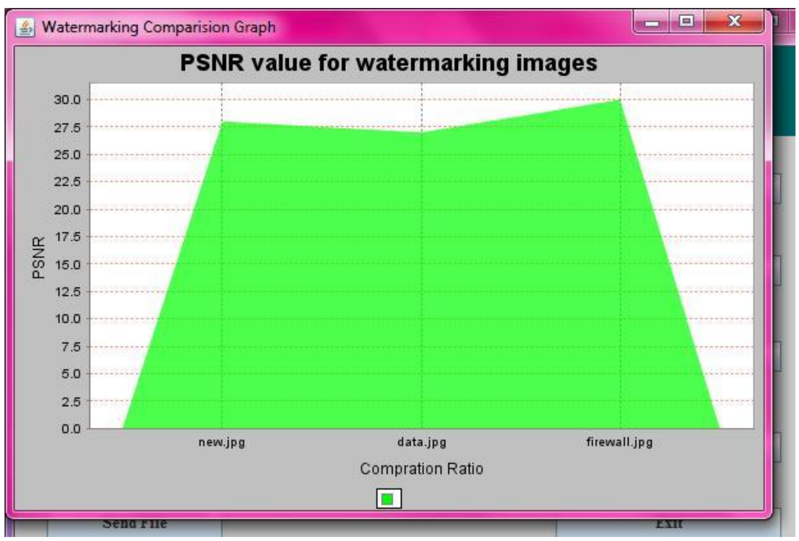

Fig. 4: PSNR value of watermarked image

IV. CONCLUSION

The new technique watermarking using DCT combined with image compression using improved adaptive Huffman algorithm is been presented to enhance the level of security for the data to be transmitted.

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REFERENCES

[1] Tamilselvi, N., Krishnamoorthy, P., Dhamotharan, R., Arumugam, P., & Sagadevan, E. (2012). Analysis of total phenols, total tannins and screening of phytocomponents in Indigofera aspalathoides (Shivanar Vembu) Vahl EX DC. *Journal of Chemical and Pharmaceutical Research*, *4*(6), 3259-3262.

[2] Abraham, A.G., Manikandan, A., Manikandan, E., Jaganathan, S.K., Baykal, A., & Renganathan, P. (2017). Enhanced opto-magneto properties of Ni x Mg1–x Fe2O4 (0.0≤ x≤ 1.0) ferrites nano-catalysts. *Journal of Nanoelectronics and Optoelectronics*, *12*(12), 1326-1333.

[3] Barathiraja, C., Manikandan, A., Mohideen, A.U., Jayasree, S., & Antony, S.A. (2016). Magnetically recyclable spinel Mn x Ni 1− x Fe 2 O 4 (x=0.0–0.5) nano-photocatalysts: structural, morphological and opto-magnetic properties. *Journal of Superconductivity and Novel Magnetism*, *29*(2), 477-486.

[4] Kaviyarasu, K., Manikandan, E., Nuru, Z.Y., & Maaza, M. (2015). Investigation on the structural properties of CeO2 nanofibers via CTAB surfactant. *Materials Letters*, *160*, 61-63.

[5] Kaviyarasu, K., Manikandan, E., & Maaza, M. (2015). Synthesis of CdS flower-like hierarchical microspheres as electrode material for electrochemical performance. *Journal of Alloys and Compounds*, *648*, 559-563.

[6] Sachithananantham, P., Sankaran, S., & Elavenil, S. (2015). Experimental study on the effect of rise on shallow funicular concrete shells over square ground plan. *International Journal of Applied Engineering Research*, *10*(20), 41340-41345.

[7] Jayalakshmi, T., Krishnamoorthy, P., Ramesh Kumar, G., &Sivaman, I.P. (2011). Optimization of culture conditions for keratinase production in Streptomyces sp. JRS19 for chick feather wastes degradation, *Journal of Chemical and Pharmaceutical Research*, *3*(4), 498-503.

[8] Kumarave, A., & Rangarajan, K. (2013). Routing alogrithm over semi-regular tessellations. In *2013 IEEE Conference on Information & Communication Technologies*, 1180-1184.

[9] Sonia, M.M.L., Anand, S., Vinosel, V.M., Janifer, M.A., Pauline, S., & Manikandan, A. (2018). Effect of lattice strain on structure, morphology and magneto-dielectric properties of spinel NiGdxFe2− xO4 ferrite nano-crystallites synthesized by sol-gel route. *Journal of Magnetism and Magnetic Materials*, *466*, 238-251.

[10] Rebecca, L.J., Susithra, G., Sharmila, S., & Das, M.P. (2013). Isolation and screening of chitinase producing Serratia marcescens from soil. *Journal of Chemical and Pharmaceutical Research*, *5*(2), 192-195.

[11] Banumathi, B., Vaseeharan, B., Rajasekar, P., Prabhu, N.M., Ramasamy, P., Murugan, K., & Benelli, G. (2017). Exploitation of chemical, herbal and nanoformulated acaricides to control the cattle tick, Rhipicephalus (Boophilus) microplus–a review. *Veterinary parasitology*, *244*, 102-110.

[12] Gopinath, S., Sundararaj, M., Elangovan, S., & Rathakrishnan, E. (2015). Mixing characteristics of elliptical and rectangular subsonic jets with swirling co-flow. *International Journal of Turbo & Jet-Engines*, *32*(1), 73-83.

[13] Thooyamani, K.P., Khanaa, V., & Udayakumar, R. (2014). Efficiently measuring denial of service attacks using appropriate metrics. *Middle - East Journal of Scientific Research*, *20*(12): 2464-2470.

[14] Padmapriya, G., Manikandan, A., Krishnasamy, V., Jaganathan, S.K., & Antony, S.A. (2016). Enhanced Catalytic Activity and Magnetic Properties of Spinel MnxZn1−xFe2O4 (0.0 ≤ x ≤ 1.0) Nano-Photocatalysts by Microwave Irradiation Route. *Journal of Superconductivity and Novel Magnetism*, *29*(8): 2141-2149.

[15] Rajesh, E., Sankari, L.S., Malathi, L., & Krupaa, J.R. (2015). Naturally occurring products in cancer therapy. *Journal of pharmacy & bioallied sciences*, *7*(1), S181-S183.

[16] Vanangamudi, S., Prabhakar, S., Thamotharan, C., & Anbazhagan, R. (2014). Dual fuel hybrid bike. *Middle-East Journal of Scientific Research*, *20*(12): 1819-1822.

[17] Brindha, G., Krishnakumar, T., & Vijayalatha, S. (2015). Emerging trends in tele-medicine in rural healthcare. *International Journal of Pharmacy and Technology*, *7*(2): 8986-8991.

[18] Sharmila, S., Rebecca, L.J., Chandran, P.N., Kowsalya, E., Dutta, H., Ray, S., & Kripanand, N.R. (2015). Extraction of biofuel from seaweed and analyse its engine performance. *International Journal of Pharmacy and Technology*, *7*(2), 8870-8875.

[19] Thooyamani, K.P., Khanaa, V., & Udayakumar, R. (2014). Using integrated circuits with low power multi bit flip-flops in different approch. *Middle-East Journal of Scientific Research*, *20*(12): 2586-2593.

[20] Thooyamani, K.P., Khanaa, V., & Udayakumar, R. (2014). Virtual instrumentation based process of agriculture by automation. *Middle-East Journal of Scientific Research*, *20*(12): 2604-2612.

[21] Udayakumar, R., Kaliyamurthie, K.P., & Khanaa, T.K. (2014). Data mining a boon: Predictive system for university topper women in academia. *World Applied Sciences Journal*, *29*(14): 86-90.

[22] Anbuselvi, S., Rebecca, L.J., Kumar, M.S., & Senthilvelan, T. (2012). GC-MS study of phytochemicals in black gram using two different organic manures. *J Chem Pharm Res*., *4*, 1246-1250.

[23] Subramanian, A.P., Jaganathan, S.K., Manikandan, A., Pandiaraj, K.N., Gomathi, N., & Supriyanto, E. (2016). Recent trends in nano-based drug delivery systems for efficient delivery of phytochemicals in chemotherapy. *RSC Advances*, *6*(54), 48294-48314.

[24] Thooyamani, K.P., Khanaa, V., & Udayakumar, R. (2014). Partial encryption and partial inference control based disclosure in effective cost cloud. *Middle-East Journal of Scientific Research*, *20*(12): 2456-2459.

[25] Lingeswaran, K., Prasad Karamcheti, S.S., Gopikrishnan, M., & Ramu, G. (2014). Preparation and characterization of chemical bath deposited cds thin film for solar cell. *Middle-East Journal of Scientific Research*, *20*(7), 812-814.

[26] Maruthamani, D., Vadivel, S., Kumaravel, M., Saravanakumar, B., Paul, B., Dhar, S.S., & Ramadoss, G. (2017). Fine cutting edge shaped Bi2O3rods/reduced graphene oxide (RGO) composite for supercapacitor and visible-light photocatalytic applications. *Journal of colloid and interface science*, *498*, 449-459.

[27] Gopalakrishnan, K., SundeepAanand, J., & Udayakumar, R. (2014). Electrical properties of doped azopolyester. *Middle-East Journal of Scientific Research*, *20*(11), 1402-1412.

[28] Subhashree, A.R., Parameaswari, P.J., Shanthi, B., Revathy, C., & Parijatham, B.O. (2012). The reference intervals for the haematological parameters in healthy adult population of chennai, southern India. *Journal of Clinical and Diagnostic Research: JCDR*, *6*(10), 1675-1680.

[29] Niranjan, U., Subramanyam, R.B.V., & Khanaa, V. (2010). Developing a web recommendation system based on closed sequential patterns. *International Conference on Advances in Information and Communication Technologies*, 171-179.

[30] Slimani, Y., Baykal, A., & Manikandan, A. (2018). Effect of Cr3+ substitution on AC susceptibility of Ba hexaferrite nanoparticles. *Journal of Magnetism and Magnetic Materials*, *458*, 204-212.

[31] Premkumar, S., Ramu, G., Gunasekaran, S., & Baskar, D. (2014). Solar industrial process heating associated with thermal energy storage for feed water heating. *Middle East Journal of Scientific Research*, *20*(11), 1686-1688.

[32] Kumar, S.S., Karrunakaran, C.M., Rao, M.R.K., & Balasubramanian, M.P. (2011). Inhibitory effects of Indigofera aspalathoides on 20-methylcholanthrene-induced chemical carcinogenesis in rats. *Journal of carcinogenesis*, *10*, 2011.

[33] Beula Devamalar, P.M., Thulasi Bai, V., & Srivatsa, S.K. (2009). Design and architecture of real time web-centric tele health diabetes diagnosis expert system. *International Journal of Medical Engineering and Informatics*, *1*(3), 307-317.

[34] Ravichandran, A.T., Srinivas, J., Karthick, R., Manikandan, A., & Baykal, A. (2018). Facile combustion synthesis, structural, morphological, optical and antibacterial studies of Bi1− xAlxFeO3 (0.0≤ x≤ 0.15) nanoparticles. *Ceramics International*, *44*(11), 13247-13252.

[35] Thovhogi, N., Park, E., Manikandan, E., Maaza, M., & Gurib-Fakim, A. (2016). Physical properties of CdO nanoparticles synthesized by green chemistry via Hibiscus Sabdariffa flower extract. *Journal of Alloys and Compounds*, *655*, 314-320.

[36] Thooyamani, K.P., Khanaa, V., & Udayakumar, R. (2014). Wide area wireless networks-IETF. *Middle-East Journal of Scientific Research*, *20*(12), 2042-2046.

[37] Sundar Raj, M., Saravanan, T., & Srinivasan, V. (1785). Design of silicon-carbide based cascaded multilevel inverter. *Middle-East Journal of Scientific Research*, *20*(12), 1785-1791.

[38] Achudhan, M., & Prem Jayakumar, M. (2014). Mathematical modeling and control of an electrically-heated catalyst. *International Journal of Applied Engineering Research*, *9*(23).

[39] Thooyamani, K.P., Khanaa, V., & Udayakumar, R. (2013). Application of pattern recognition for farsi license plate recognition. *Middle-East Journal of Scientific Research*, *18*(12), 1768-1774, 2013.

[40] Jebaraj, S., & Iniyan S. (2006). Renewable energy programmes in India. *International Journal of Global Energy*, 26: 232-257.

[41] Dhinakaran, M., Sowndarya, S., Shobana, R., Sivasankari, R., & Sindhu, R. (2017).Wireless Power Transfer to Biomedical Implants for Patient Monitoring. *The SIJ Transactions on Computer Networks & Communication Engineering (CNCE), 5*(5), 10-12.

[42] Nagarajan, S., Nithya, A., Nivetha, M., Pooja Lakshmi, P., & Priya Dharshini, K.(2017).Secure Communication in Relay Selection based on Cognitive Radio Systems. *The SIJ Transactions on Computer Networks & Communication Engineering (CNCE), 5*(6), 1-5.

[43] Archana, K.S. (2018). Kalman and Camshift Algorithm for Tracking Fast Moving Object through Image Processing. *Journal of Computational Information Systems, 14*(6), 134 - 138.

[44] Latha, M. (2018). Automatically Detecting Oral Cancer Status. *Journal of Computational Information Systems, 14*(6), 169 - 172.

[45] Monica, K.M. (2018). Three Dimensional Modernization Using Stereo Images. *Journal of Computational Information Systems, 14*(6), 180 - 189.

[46] Abinaya, M., & Mahesh, C. (2018). Earlier Detection Of Myocardial Infarction(MI) By Analysing ST Segment Of ECG Signal Using Discrete Wavelet Transform Algorithm In LabVIEW Software. *Journal of Computational Information Systems, 14*(01-SP), 11 - 17.

[47] Banupriya, C., & Tholhappiyan, T. (2015). Semantic Keyword Routing and Vocabulary of the Mining Service Ontology. *International Journal of Advances in Engineering and Emerging Technology, 7*(6), 354-366.

[48] Anbarasi, K., Gayathri, R., Dr. Venkatesa Kumar, P., & Dr. Newlin Rajkumar, M. (2015). Intrusion Detection using Naive Bayes Classifier with Feature Reduction. *International Journal of Advances in Engineering and Emerging Technology, 7*(6), 377-385.

[49] Karpaga Iswarya, S., & Yuvaraj, V. (2015). Random Key Predistribution based Authentication and Source Privacy in Wireless Sensor Networks. *International Journal of Advances in Engineering and Emerging Technology, 7*(6), 393-403.

[50] Karthikeyan, T., & Venkatesh Kumar, S. (2015). Restricted Bipartite Graphs and Kernalized Generalized Learning Vector Quantization based Method for Object and Anamoly Detection of Hyperspectral MANFIS Based Image Classification with Multi Feature Selection Using MFSA- LFDA. *International Journal of Advances in Engineering and Emerging Technology, 7*(8), 517- 538.

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