Bulletin of Electrical Engineering and Informatics
Vol. 10, No. 1, February 2021, pp. 427~433
ISSN: 2302-9285, DOI: 10.11591/eei.v10i1.2508

Review on feature-based method performance in text steganography

Mohd Hilal Muhammad[1], Hanizan Shaker Hussain[2], Roshidi Din[3], Hafiza Samad[4], Sunariya Utama[5]
[1]Department of Computing & Management Sciences, Universiti Islam Antarabangsa Sultan Abdul Halim Mu'adzam Shah, Malaysia
[2]SP Intellect Resources, Malaysia
[3,5]School of Computing, College Arts and Sciences, Universiti Utara Malaysia, Malaysia
[4]Kolej Universiti Poly-Tech MARA Kuala Lumpur, Malaysia

Article Info

Article history:

Received Apr 8, 2020
Revised Jun 15, 2020
Accepted Jul 28, 2020

Keywords:

Capacity performance
Hidden message
Robustness performance
Security performance
Word-rule based

ABSTRACT

The implementation of steganography in text domain is one the crutial issue that can hide an essential message to avoid the intruder. It is caused every personal information mostly in medium of text, and the steganography itself is expectedly as the solution to protect the information that is able to hide the hidden message that is unrecognized by human or machine vision. This paper concerns about one of the categories in steganography on medium of text called text steganography that specifically focus on feature-based method. This paper reviews some of previous research effort in last decade to discover the performance of technique in the development the feature-based on text steganography method. Then, ths paper also concern to discover some related performance that influences the technique and several issues in the development the feature-based on text steganography method.

Corresponding Author:

Roshidi Din,
School of Computing, College Arts and Sciences,
Universiti Utara Malaysia,
06010, Sintok, Kedah, Malaysia.
Email: roshidi@uum.edu.my

1. INTRODUCTION

The impact of IT application has a vital influence in every activity and productivity of the people at work [1, 2]. However, the existence of intruders in the communication technology enables anyone to easily retrieve and modify information [3]. Hence, one of considerations to deal with this matter is steganography as a part of information. Steganoraphy is the scientific knowledge information that hide the hidden message implementation in several media that are unrecognized by human vision [4]. The steganography impelementationis could be applied in private communication, security system protection and any confidential data that is commonly used by government, military, industry and etc [5]. From that history, steganography is introduced as information hiding field that hides the confidential information to avoid the message from the third party [6]. Moreover, one characteristic of steganography is securing the important message in every medium to hide in the text [7]. The implementation of steganography knowledge field is divided into two main parts such as digital steganography and natural language steganography. Digital steganography conceals the hidden message through some media which are images, audios, video, network performance and other digitally undetectable codes [8]. Meanwhile, natural language steganography is the implementation of steganography that hides the hidden message in medium of text [4]. This study focuses on natural language steganography that is developed in text domain. It because text medium has a limited space

to hide information, it is becoming a challenge to this study to implement the technique of steganography [9]. Generally, steganography can be classified into two parts which are digital steganography and natural language steganography. Digital steganography consists of four media such as image, audio, video, and protocol in order to cover the hidden message [8]. On the other hand, natural language steganography hide the hidden message in a medium of text so that the third party is unable to discover the presence of the message. There are two main groups in natural language steganography which are linguistic steganography and text steganography. The linguistic steganography domain is a type of steganography that is dependable with linguistic order of sentence in the text [10]. Meanwhile, text steganography manipulates the component of text such as word, line, space and other componenst of text in order to hide the message [11]. The development of text steganography method consists of two which are word-rule based method and feature-based method. This paper focuse on review some technique in feature-based method in order to discover the related the performance and aslo issue that had happened in some of the technique by previouse researcher's effort.

2. RESEARCH METHOD

Text steganography conceals the hidden messages in the cover text based on structure in the text and any other characters of text without influencing the linguistic rule of text. There are two methods of text steganography which are word-rule based and feature-based method. The knowledge about word-rule based method consists of two category of hiding the message which are line-shift coding and word-shift coding. Line-shift coding is implemented to hide a message that can be embedded vertically to conceal the message in the text. This technique measures the length between the centroid texts that calculate the position based on the difference between spacing and the original text [12]. According to Sing *et al.* [13] about line-shift coding, the shifted development are those of 0 for a line-shifted up and 1 for a line-shifted down. Based on Roy and Manamisti [12], line-shift coding develops a unique shape in some degree of text shifted vertically and also explains the weakness of this technique in retyped text that can destroy secret information in the text. Meanwhile, the word-shift coding can embed the hidden message horizontally to conceal the message in the text.

This technique mostly justifies the document and is not shifted by the first and last word on each line of the text, [13]. Moreover, Liu *et al*. [14] proposed a technique adjacent character adjusted within sequence words in English text as the word-shift coding technique. This technique encoded the hidden message in matrix mode based on online chat and inferior of encoded shipping adjacent letters in text. The implementation of feature-based method can modify the uniqueness of letter by manipulating in the shape, size, and position in the text. This technique used the cover ext as the medium that embed with the hidden message based on uniqueness of text structure in cover text [15]. The cover text that embed with hidden message is named as stego text that will send to receiver that will extract to discover the hidden message that unknown by intruder [16]. The characteristic of this technique could be used by many researchers based on the characters of language in the world and also can be used in website text [17]. A lot of developments of techniques create several implementations of technique in covering the hidden message. Table 1 illustrates several techniques of feature-based method that is considering with the advantages and drawback that become a discovered issue and achievement in performance of technique. However, there are three main concerns of the performance that are elaborated in the next section.

Table 1. the feature-based method performance

Technique	Schemes Used	Advantages	Disadvantages
Coverless steganography Single Bit Rules [16]	Coding matching binary transition	The effectiveness of algorithm in implementing the steganography	The technique does not fully cover the transition order of hidden message
HTML Web page steganography [17]	Based on Italy and underline tags	High robustness because it exists in the back end web page	Low security that has to combine with cryptography
Pseudo space kashida Arabic text [18]	Based on Khasida-PS of Arabic text	High capacity in the hidden message	Low security in extracting process
Content-based sharing Arabic Text [19]	Based on Khasida of Arabic text	High capacity secret shares based improvement development technique	Low security against the strength attack
Letter shaping in Arabic Text [20]	Based on two diacritics (Fatah and Kasrah) of Arabic text	Strong against the attack in the stego text from intruder	Easily noticed in insertion text and low imperceptible capacity
Transliteration in Bengali text [21]	Based on characteristic of Bengali text	High efficiency for steganography purpose; able to use in Roman text	Easy to detect the changes in text after embedding process

Table 1. The feature-based method performance *(continue)*

Technique	Schemes used	Advantages	Disadvantages
Character based of Chinese text [15]	Based on even and odd characteristic of Chinese text	This method is high in embedding capacity, good robustness	Dependable with corpus text that has coverless application
RNN-Generated Lyrics in Chinese text [22]	Based on the four sizes of candidate pool and structure lyric in Chinese text	Effective to resist the detection in traditional to avoid steganalysis algorithm	Less quality in capacity, security and robustness performance
Font color MS excel [23]	Based on the numbers and colour of Excel cells	High capacity embed that used in MS excel; easy extracting processing	Low robustness of the hidden message shown based on RGB colour. Easy to detect the embed process
Coverless English text [16]	Based on the letter in the Text	The security performance is guaranteed	It has plenty of space and low capacity
Character pair text [24]	Based on character starting, ending and character depicted	Large capacity in embedding space	Easy to detect any existence of hidden message
AITSteg Via social media [25]	Based on ASCII code characteristics	Large capacity embedding with short cover text	It suffers the low robustness of stego text
Binary digit mapping on ASCII letters [26]	Based on ASCII characteristics	High capacity ratio to hide the hidden message in the cover text	Dependable with ASCII characters and easy to detect the changes
Arabic text hiding information [27]	Based on Fatah in the Arabic text	High capacity for embedding process in domain	If printed and retyped, the text will destroy; low invisibility
Multilayer Partially Homomorphic in Text steganography [28]	Based on numbering streem of text.	It has high hidden capacity than other techniques and high efficient selection letter	Lack robustness in avoiding possible attack in Homomorphic algorithm
English text using number oriented [29]	Based numbering and letter in English text	Fast loading time in embedding process steganography	Low robustness of stego text and security the security performance
Glyph perturbation [30]	Based on the alphabetical codebook in the text	High robustness in any format conversion the of text	Retyping process will destroy the message in document
Content-based Feature extraction [31]	Based on letters of vowel, consonants, lines and writable	Developed with maximum capacity, high embedding ratio with minimum time	Lack robustness and less security protection in encryption algorithm
Alphabet Pairing Text [32]	Based on letter and ASCII aproach	High robustness and large embedding capacity	The technique is complex that is dependable with ASCII approach
Huffman Compression in Email Based [33]	Based on symbol @ in the email address	Large hiding capacity for embedding hidden message	Unavailable to execute in online condition
Right remark, Left remark, Zero width joiner, and Zero width joiner [34]	Based on characteristics and position of the letter	Easy to modify with simple requirement	This technique is unable to execute ASCII and Unicode
Compression ratio in Email [35]	Based on ratio vector letter on the text	Large capacity for embedding the hidden message	This technique can only develop in e-mail environment
Encryption with Cover Text and Reordering (ECR) [36]	Based on characteristic letter and inter-Word in the text	Large capacity embedding; has quick time to embed process	It has complex requirement in embedding and process of technique
Chain code using *ANOVA* [37]	Based on chain-code histogram in Bangla text	It is possible for the letters to embed the hidden message	Low security in covering the hidden message
Back end interface web page [38]	Based on characteristic HTML in Web page	It is able to embed large capacity and to transmit in internet	It is time consuming to implement and is only able to use in HTML
SKT and CCM [39]	Based on classification letter table dictionary in Chinese text	It has good performance in embedding and extracting	Low security to cover the hidden message
Vertical displacement of the point [34]	Based on Khasida variation in Arabic text	It can embed large capacity of hidden message	Easy to attack with retyping that can remove the hidden message
Secret steganography code for embedding (SSCE)[40]	Based on letter of a or an in English text	It has high robustness to avoid the intruder to discover the hidden message	It only embeds inconsonant and vowel word that makes low capacity to embed
Change alphabet letter pattern (CALP) [11]	Based on characteristic letters in the text	This technique is able avoid steganalysis technique	This technique is dependable with pattern and low robustness
Curve subheading (CURVE), vertical straight line (VERT), and quadruple [41]	Based on characteristic letters in the text	Applicable to the soft-copy texts and cannot decode until it becomes an unaware technique	Low security and easily to detect the changes in the text
Numerical code [42]	Based on consonant letters of Hindi text	This technique has high security	This technique takes a long time for embedding the hidden message
SSM and HESM [43]	Based on traditional letter of Chinese	It has large capacity for embedding	Low security in covering the hidden message

Table 1. The feature-based method performance *(continue)*

Technique	Schemes used	Advantages	Disadvantages
Specific matra [44]	Based on syntactic structure and sequence model	It has Large capacity for embedding the hidden message	Retyping of medium text and remove the existences hidden message
Reversed Fatah [45]	Based on characteristic fatah in Arabic text	It can embed large capacity and high invisibility	Retyping the text can remove the existence of hidden message
Letter point in novel Arabic [46]	Based on characteristic of letter point in the text	It has high security to cover the hidden message	It has low capacity to embed hidden message
Rectangular region [47]	Based on occlusive component in Chinese text	It has transparency in extracting process	It has limited medium letter that makes it have less capacity to embed
Machine translation[48]	Based on parallel corpus and protocol overhead in the language text	This technique has a constant capacity	The technique has high possible error
Mark up letter [49]	Based on segment nodes in Hypertext	This technique is useful for hypertext and online environment	This technique has low performance in development and low security

3. COMPARATIVE PERFOMANCE ON FEATURE-BASED METHODS

According to Febryan, Purboyo and Saputra [50], there are three main performances in steganography that have a relation application performance which influence each other. The three relations are highly possible to become the achievement performance or as the drawback performance in implementing the steganography in covering the hidden message. The three relation performance of steganography is shown in Figure 1.

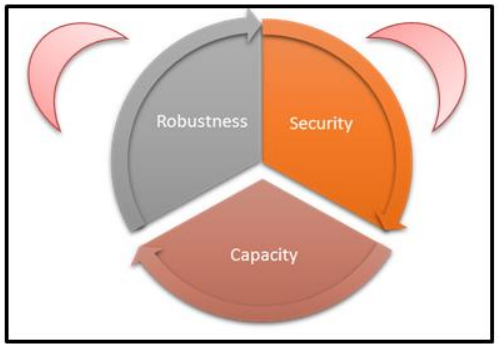

Figure 1. The relation of three performances in steganography [50]

In Figure 1, there three performances in steganography which are robustness, security, and capacity are considered to conceal the hidden message in some medium. However, the relation of the three performances has a contrary relation that is unable to adjust independently [50]. As such, the robustness and security will be decreased when the capacity performance is increased in applying the implementation of steganography. Based on the three performances, it is considered that the achievement and the possible issue happen in hiding the hidden message in text using the feature-based of text steganography method. The criteria of the three relation performance the procedure of steganography as as follows:

a. *Robustness* : This is the capability to hide the hidden message in embedding process that is protected from an attacker to protect the stego text [31, 50].
b. *Security*: The level of safety performance that avoids the third party that has no connection with the sender and the receiver in steganography process to detect the existence of hidden message that is embedded in the text [20, 50].
c. *Capacity*: The quantity of data in the hidden message that is able to hide by embedding the hidden message in the text. The capacity data could be classified with size bit, number bit, and length of the text in performing the text steganography [25, 50]

The three relations are anticipated as an indicator to achieve the expected performance in steganography. However, the implementation is more dominant in achieving the high capacity rather than robustness and security in the feature-based of text steganography as shown in Figure 2. Figure 2 illustrates

the comparison among the performances of robustness, security and capacity in the feature-based of text steganography method based on previous researchers in last decade. This figure classified the three performances based on advantages and disadvantages of the research effort in the development of the feature-based. It clearly seems that there is also four researchers' effort that achieved high robustness and six researchers' effort with low performance of robustness in the development technique of feature-based. For security performance, there are only two researchers' effort that achieve high security and eight researchers' effort which have some issues about security performance. However, the capacity performance in the development of the technique have 22 researchers' effort and only three researchers' effort with some issue in the development of the feature-based of text steganography method in the last decade.

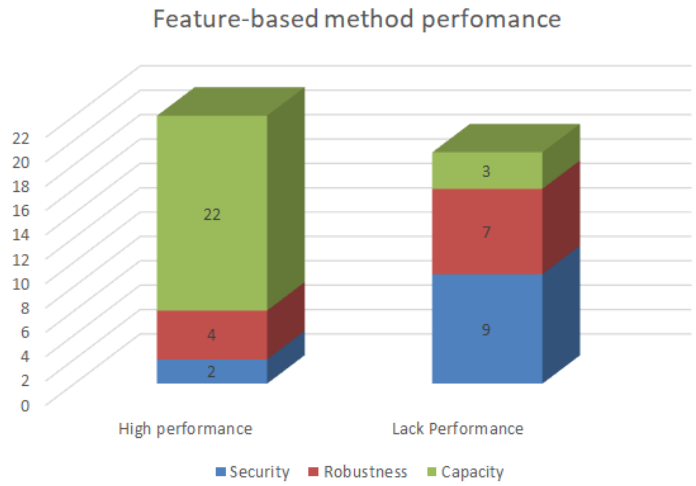

Figure 2. The comparison relation performance in feature-based method in last decade

4. CONCLUSION

This paper is reviewed about feature-based method on text steganography based on several researchers' effort in develop their techniques. It begins with the classification of the steganography category consisting of digital steganography and natural language steganography. This paper focuses on text steganography as a part of natural language. Then, the development of feature-based method by past researchers' effort are reviewed along with the advantages and disadvantages between both methods in text steganography. This paper also presents the three relation performances in the development of the feature-based method which are robustness, security and capacity. It has discovered the most achievement performance in previous research effort, which is capacity performance while the highest issue in the feature-based of text steganography method is security performance.

ACKNOWLEDGEMENTS

We would like thank to Dean of School of Computing, Universiti Utara Malaysia (SoC CAS UUM) and Director of Awang Had Salleh Graduate School (AHSGS), Universiti Utara Malaysia for their moral support for the realization of this work.

REFERENCES

[1] R. Kaur, Pooja and Varsha, "A hybrid approach for video steganography using edge detection and identical match techniques," *2016 International Conference on Wireless Communications, Signal Processing and Networking (WiSPNET)*, Chennai, pp. 867-871, 2016.

[2] M. T. Ahvanooey, *et al.*, "Modern text hiding, text steganalysis, and applications: A comparative analysis," *Entropy*, vol. 21 no. 4 pp. 1-29, 2019.

[3] S. D. Torvi, K. B. ShivaKumar and R. Das, "An unique data security using text steganography," *2016 3rd International Conference on Computing for Sustainable Global Development (INDIACom)*, New Delhi, pp. 3834-3838, 2016.

[4] R. Din, *et al.*, "The evaluation performance of letter-based technique on text steganography system," *Bulletin of Electrical Engineering and Informatics*, vol. 8, no. 1, pp. 291-297, March 2019.

[5] R. Din, *et al.*, "Performance analysis on secured data method in natural language steganography," *Bulletin of Electrical Engineering and Informatics*, vol. 8, no. 1, pp. 298-304, March 2019.
[6] A. Odeh, *et al.*, "Text Steganography Using Language Remarks," in *Northeast Section Conference of the American Society for Engineering Education (ASEE)*, pp. 1-7, 2013.
[7] A. Odeh, A. Alzubi, Q. B. Hani and K. Elleithy, "Steganography by multipoint Arabic letters," *2012 IEEE Long Island Systems, Applications and Technology Conference (LISAT)*, Farmingdale, NY, pp. 1-7, 2012.
[8] R. Din and A. J. Qasim, "Steganography Analysis Techniques Applied to Audio and Image Files," *Bulletin of Electrical Engineering and Informatics*, vol. 8, no. 4, pp. 1297-1302, Dec 2019.
[9] Nasab. M.V., Shafiei B. M, "Steganography in programming," *Australian Journal of Basic and Applied Sciences*; vol. 5, no.12, pp. 1496-1499, 2011.
[10] C.-Y. Chang and S. Clark, "Practical Linguistic Steganography using Contextual Synonym Substitution and a Novel Vertex Coding Method," *Computational Linguistiucs*, vol. 40, no. 2, pp. 403-448, 2014.
[11] S. Bhattacharyya, et al., "Hiding Data in Text Through Changing in Alphabet Letter Patterns (CALP)," *Journal of Global Research in Computer Science*, vol. 2, no. 3, pp. 33-39, 2011.
[12] S. Roy and M. Manasmita, "A novel approach to format based text steganography," *Proc. 2011 International Conference Communication Computer Secururity ICCCS '11*, pp. 511-516, 2011.
[13] H. Sing, *et al.*, "A Survey on Text Based Steganography," in *Proceedings of the 3rd National Conference; INDIACom--2009 Computing For Nation Development*, pp. 26-27, 2009.
[14] M. Liu, Y. Guo and L. Zhou, "Text Steganography Based on Online Chat," *2009 Fifth International Conference on Intelligent Information Hiding and Multimedia Signal Processing*, Kyoto, pp. 807-810, 2009.
[15] K. Wang and Q. Gao, "A Coverless Plain Text Steganography Based on Character Features," in *IEEE Access*, vol. 7, pp. 95665-95676, 2019.
[16] Y. Wu *et al.*, "Coverless steganography based on english texts using binary tags protocol," *Journal of Internet Technology*, vol. 19, no. 2, pp. 599-606, 2018.
[17] I. Bajaj and R. K. Aggarwal, "Steganography using HTML Web Pages as a Carrier: A Survey," *Proceedings of 2nd International Conference on Advanced Computing and Software Engineering (ICACSE)*, pp. 571-574, 2019.
[18] S. M. A. Al-Nofaie and A. A.-A. Gutub, "Utilizing pseudo-spaces to improve Arabic text steganography for multimedia data communications," *Multimedia Tools and Applications*, vol. 79, pp. 19-67, 2020.
[19] A. Gutub and K. Alaseri, "Hiding Shares of Counting-Based Secret Sharing via Arabic Text Steganography for Personal Usage," *Arabian Journal for Science and Engineering*, vol. 45, pp. 2433-2458, 2020.
[20] A. F. Al Azzawi, "A Multi-Layer Arabic Text Steganographic Method Based on Letter Shaping," *International Journal of Network Security & Its Applications (IJNSA)*, vol. 11, no. 1, pp. 27-40, 2019.
[21] M. Khairullah, "A Novel Steganography Method using Transliteration of Bengali t Text," *Journal of King Saud University - Computer and Information Sciences*, vol. 31, no. 3, pp. 348-366, 2019.
[22] Y. Tong *et al.*, "Text steganography on RNN-Generated lyrics," *Mathematical Biosciences and Engineering*, vol. 16, no. 5, pp. 5451-5463, 2019.
[23] H. I. Alsaadi *et al.*, "Text steganography in font color of MS excel sheet," *Proceedings of the First International Conference on Data Science, E-learning and Information Systems*, no. 10, pp. 1-7, 2018.
[24] F. X. K. Akotoye, Y. E. Yakavor, J. Kwofie and F. Tirogo, "Character Pair Text Steganography Based on the Enhanced," *2018 IEEE 7th International Conference on Adaptive Science & Technology (ICAST)*, Accra, pp. 1-5, 2018.
[25] M. Taleby Ahvanooey, Q. Li, J. Hou, H. Dana Mazraeh and J. Zhang, "AITSteg: An Innovative Text Steganography Technique for Hidden Transmission of Text Message via Social Media," *in IEEE Access*, vol. 6, pp. 65981-65995, 2018.
[26] A. Naharuddin, A. D. Wibawa and S. Sumpeno, "A High Capacity and Imperceptible Text Steganography Using Binary Digit Mapping on ASCII Characters," *2018 International Seminar on Intelligent Technology and Its Applications (ISITIA)*, Bali, Indonesia, pp. 287-292, 2018.
[27] A. Taha *et al.*, "A high capacity algorithm for information hiding in Arabic text," *Journal of King Saud University - Computer and Information Sciences*, vol. 32, no. 6, pp. 658-665, July 2020.
[28] N. Naqvi *et al.*, "Multilayer Partially Homomorphic Encryption Text Steganography (MLPHE-TS): A Zero Steganography Approach," *Wireless Personal Communications*, vol. 103, no. 2, pp. 1563-1585, 2018.
[29] K. K. Mandal, S. Koley and S. Dhar, "A mathematical model for secret message passing using Steganography," *2016 IEEE International Conference on Computational Intelligence and Computing Research (ICCIC)*, Chennai, pp. 1-6, 2016.
[30] C. Xiao *et al.*, "FontCode: Embedding Information in Text Documents using Glyph Perturbation," *ACM Transactions on Graphics*, vol. 1, no. 1, pp. 1-16, 2017.
[31] S. Kouser *et al.*, "A Novel Content-Based Feature Extraction Approach : Text Steganography," *International Journal of Computer Science and Information Security*, vol. 14, no. 12, pp. 916-922, Dec 2016.
[32] S. S. Iyer and K. Lakhtaria, "Clustering Algorithm for Text Steganography," *International Journal of Advanced Research in Computer and Communication Engineering*, vol. 5, no. 3, pp. 74-77, 2016.
[33] R. Kumar, S. Chand and S. Singh, "An Email based high capacity text steganography scheme using combinatorial compression," *2014 5th International Conference - Confluence The Next Generation Information Technology Summit (Confluence)*, Noida, pp. 336-339, 2014.
[34] A. Odeh, K. Elleithy and M. Faezipour, "Steganography in Arabic text using Kashida variation algorithm (KVA)," *2013 IEEE Long Island Systems, Applications and Technology Conference (LISAT)*, Farmingdale, NY, pp. 1-6, 2013.

[35] R. Kumar, S. Chand and S. Singh, "An Email based high capacity text steganography scheme using combinatorial compression," *2014 5th International Conference - Confluence The Next Generation Information Technology Summit (Confluence)*, Noida, pp. 336-339, 2014.
[36] S. Kataria, T. Kumar, K. Singh and M. S. Nehra, "ECR (encryption with cover text and reordering) based text steganography," *2013 IEEE Second International Conference on Image Information Processing (ICIIP-2013)*, Shimla, pp. 612-616, 2013.
[37] M. N. Alam and M. A. Naser, "Re-evaluating chain-code as features for Bangla script," *2013 International Conference on Electrical Information and Communication Technology (EICT)*, Khulna, pp. 1-5, 2014.
[38] S. Mahato, D. K. Yadav and D. A. Khan, "A Modified Approach to Text Steganography Using HyperText Markup Language," *2013 Third International Conference on Advanced Computing and Communication Technologies (ACCT)*, Rohtak, pp. 40-44, 2013.
[39] M. Talip, A. Jamal and G. Wenqiang, "A Proposed Steganography Method to Uyghur Script," *2012 International Conference on Cyber-Enabled Distributed Computing and Knowledge Discovery*, Sanya, pp. 125-128, 2012.
[40] I. Banerjee *et al.*, "Novel text steganography through special code generation," in *Proceedings of International Conference on Systemics, Cybernetics and Informatics ICSCI-2011*, pp. 298-303, 2011.
[41] S. Dulera *et al.*, Experimenting with the Novel Approaches in Text Steganography," *International Journal of Network Security & Its Applications*, vol. 3, no. 6, pp. 213-225, Nov 2011.
[42] M. Pathak, "A New Approach for Text Steganography Using Hindi Numerical Code," International Journal of Computer Applications, vol. 1, no. 8, pp. 56-59, 2010.
[43] Xinmei Sun, Peng Meng, Yun Ye, and Liusheng Hang, "Steganography in Chinese Text," *2010 Int. Conference Computer Applications System Model. (ICCASM 2010)*, vol. 8, no. Iccasm, pp. V8-651-V8-654, 2010.
[44] S. Changder, S. Das and D. Ghosh, "Text steganography through Indian languages using feature coding method," *2010 2nd International Conference on Computer Technology and Development*, Cairo, pp. 501-505, 2010.
[45] J. A. Memon, *et al.*, "Evaluation of Steganography for Urdu/Arabic Text," *Journal of Theoretical and Applied Information Technology*, pp. 232-237, 2008.
[46] A. A. A. Gutub *et al.*, "A Novel Arabic Text Steganography Method Using Letter Points and Extensions," *International Conference on Computer, Information and Systems Science and Engineering*, vol. 1, no. 3, pp. 483-486, 2007.
[47] Wenyin Zhang, Zhenbin Zeng, Geguang Pu and Huibiao Zhu, "Chinese Text Watermarking Based on Occlusive Components," *2006 2nd International Conference on Information & Communication Technologies*, Damascus, pp. 1850-1854, 2006.
[48] R. Stutsman, *et al.*, "Lost in just the translation," *Proceedings of the 2006 ACM symposium on Applied computing*, pp. 338-345, 2006.
[49] Xin-Guang Sui and Hui Luo, "A new steganography method based on hypertext," *2004 Asia-Pacific Radio Science Conference, 2004. Proceedings.*, Qingdao, China, pp. 181-184, 2004.
[50] A. Febryan, *et al.*, "Steganography methods on text, audio, image and video: A survey," *International Journal of Applied Engineering Research*, vol. 12, no. 21, pp. 10485-10490, 2017.