FAKE NEWS DETECTION USING MACHINE LEARNING

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ABSTRACT

Fake news has become a major challenge in today's digital world, where the rapid spread of misinformation on social media and online platforms can have serious consequences. To combat this issue, a Fake News Detection System using machine learning can be highly effective. This system relies on various machine learning models, including Logistic Regression, Decision Tree, and Gradient Boosting classifiers, to classify news articles as real or fake. The first step in building such a system is to pre-process the dataset, which typically consists of labeled real and fake news articles. Textual data is converted into numerical features using techniques. This method captures the importance of words in each document relative to their frequency across the entire dataset, enabling the model to understand the content of the articles better. Once the data is processed, machine learning models are trained on the dataset to learn patterns and make predictions. Logistic Regression provides a simple yet effective linear approach, while Decision Trees offer a more interpretable and hierarchical structure for decision-making. Gradient Boosting, a more advanced technique, combines the predictions of multiple weak models to enhance overall performance. These models are evaluated based on their classification accuracy, precision, recall, and F1 score to ensure their effectiveness in identifying fake news.

Keywords: Fake News Detection, Machine Learning, Text Classification, Logistic Regression, Decision Tree, Gradient Boosting.

1. INTRODUCTION

Fake news, as false or inaccurate information passed as true news, has emerged as a significant problem in the digital age. The proliferation of social media and internet-based news platforms has made rapid dissemination of disinformation a concern for public confidence, political order, and public welfare. Since the amount of news and its speed of distribution are so massive, it is not possible for humans to validate information manually and thus there has been a need to create artificial fake news detection systems.

The article seeks to solve this problem by using text classification methods to distinguish between real and false news articles. It does this through the use of machine learning models such as Logistic Regression, Decision Tree, and Gradient Boosting that have been trained on a dataset of fake or genuine labeled news articles. The text data is preprocessed and converted with TF-IDF vectorization to derive useful features so that the models can learn linguistic structure patterns and word usage. One of the fundamental strengths of this article is that it can automate the detection process, thus helping fact-checkers, journalists, and online platforms filter out false content. The system can process textual input and categorize news articles with high accuracy, minimizing the need for human intervention.

To provide usability and accessibility, the trained machine learning model is hosted as a web application via Streamlit. The friendly interface provides people with the ability to feed in news text and obtain real-time classification outcomes, hence becoming an asset in the fight against the spread of misinformation.

2. LITERATURE SURVEY

The authors [1] explore different textual properties that can be used to distinguish fake contents from real. This model [2] uses n-gram analysis and machine learning techniques. This work [3] aims to create a model S-HAN, an improved version of Hierarchical Attention Networks using stacked bidirectional Gated Recurrent Units (GRU) to identify the important words and sentences in the news which assists in the identification of misinformation.

The authors proposed [4] a hypothesis that there exists a relation between fake messages or rumours and sentiments of the texts posted online.

The authors proposed [5] approach aimed to reduce the number of symmetrical features and obtain a high accuracy after implementing three wrapper feature selections for evolutionary classifications using particle swarm optimization, the genetic algorithm. The experiments [6] were performed in two environments namely RapidMiner and Python to tackle the binary-class problem of assigning "fake" or "real" to news. One [7] of the main challenges is identifying useful information that is exploited as a way to detect fake news. Detecting [8] the widespread fake news over the numerous social media platforms presents new challenges that make the currently deployed algorithms ineffective or not applicable anymore. The authors explored [9] how changing the detector complexity, the input sequence length, and the training loss affect the robustness of the learned model.

The experiment [10] is that the linear classification works the best with the TF-IDF model in the process of content classification. The author proposed [11] an ensemble-based deep learning model to classify news as fake or real using LIAR dataset. The authors proposed [12] models are evaluated on two recent well-known datasets in the field, namely ISOT and LIAR. Since the [13] discerning of fake news through their contents by individuals is very difficult, the existence of an automatic fake news detection approach for preventing the spread of such false information is mandatory. In these [14] modern times where internet has become widely popular and used by almost everyone, anyone can share or upload articles without any credibility. The authors in [15-19] explore the deep learning for misinformation detection on online social networks, detection using deep recurrent neural networks, stacking approach for accurate detection, fakeBERT and FNDnet models to detect the fake news.

The authors in [20-24] explore the fake news detection using deep learning models, an efficient news detection system using machine learning, literature review, challenges and innovations in the creation of digital twins in healthcare. The authors in [25-31] explore the intrusion detection system, cyber-physical systems security and quantum computing applications and AI, internet of lighting for smart cities, twitter sentimental data analysis. The authors in [32-37] explores the detection of plant leaf diseases, heart disease prediction, distribute the message over the network, prediction of dengue disease, future drifts and modern investigation tests in wireless sensor networks, system for packed and polymorphic malware.

The authors in [38-42] explore the traffic communication, detecting cuts in the networks, secure model for cloud computing, protection of cloud and authentication mechanism. The authors explores understanding and addressing human factors in cyber security vulnerabilities, integration of AI and quantum computing in cyber security, AI and IoT in mental health care, understandings of the deep fakes, personalization and customization strategies with AI [43-47].

3. METHODOLOGIES

Data Preprocessing & Collection: Collecting labeled datasets with fake and real news articles, then text cleaning and feature extraction through TF-IDF vectorization.Model Training & Evaluation: Applying and training machine learning models to classify news, then performance evaluation using evaluation metrics like accuracy, precision, recall, and F1-score.User Interaction & Deployment: Creating a Streamlit-based web application to allow real-time detection of spurious news articles.

The dataset used in this article was collected from Kaggle, a widely recognized platform for datasets and machine learning research. The dataset consists of labeled news articles classified as either fake or real, providing a structured foundation for training machine learning models.The data collection process is a crucial step in building an accurate and effective Fake News Detection System. The dataset used in this article was collected from Kaggle, which provides structured and labeled news articles categorized as real or fake. The following steps were followed during the data collection process: The first step was to find a suitable dataset that contains labeled news articles. Kaggle provides multiple fake news datasets, and the chosen dataset includes both fake and real news articles with structured text data.

The dataset was downloaded from Kaggle's open-source repository. The dataset was available in CSV format, making it easy to handle and pre-process. Once the dataset was downloaded, it was examined to understand its structure. The key attributes in the dataset include: Title: The headline of the news article. Text: The main content of the news article. Subject: The category of the news article (e.g., politics, world news). Date: The publication date of the article. Label: The classification of the article (1 = Real, 0 = Fake). Checked for missing values in the dataset. Removed duplicate records to avoid biased training. Verified the balance of fake and real news articles to prevent model bias. The dataset was split into training (80%) and testing (20%) sets.

The cleaned dataset was saved for further pre-processing and feature extraction.For this article, the Fake News Detection dataset was collected from Kaggle, a widely used platform for open-source datasets and machine learning research. The dataset contains labeled news articles categorized as real and fake, making it suitable for training and evaluating machine learning models.

The dataset consists of the following key attributes,

1. Title – The headline of the news article.

2. Text – The full content of the news article.

3. Subject – The category of the news (e.g., politics, world news).

4. Date – The publication date of the article.

5. Label – The classification of the article:

1 → Real News

0 → Fake News

Preprocessing Considerations:

-Duplicate news articles were removed to avoid bias.

-Missing values were handled appropriately.

-The dataset was balanced to ensure that fake and real news articles were proportionally represented during model training.

We have used the different ML Algorithms and Techniques which are Logistic Regression,

Decision Tree Classifier, Gradient Boosting Classifier, and the Feature Engineering Techniques, TF-IDF (Term Frequency-Inverse Document Frequency) Vectorization, N-grams (Unigrams, Bigrams, Trigrams), Sentiment Analysis, Readability Scores.

4. RESULTS

The Fig.1 shows the developed fake news detection application where we can enter the text to check.
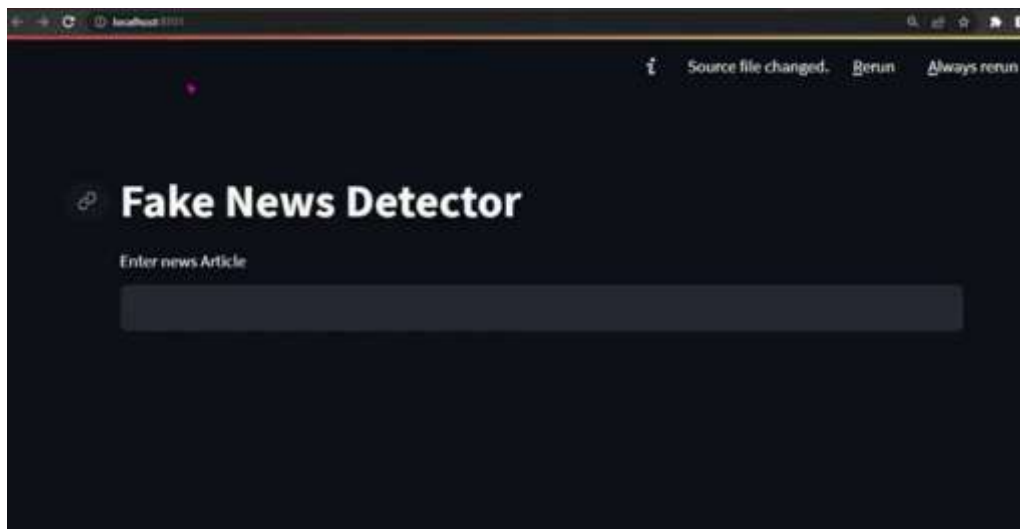

Fig.1 Fake News Detector - Web App

The Fig.2 represents both the results of real and fake news detection after entering the text.
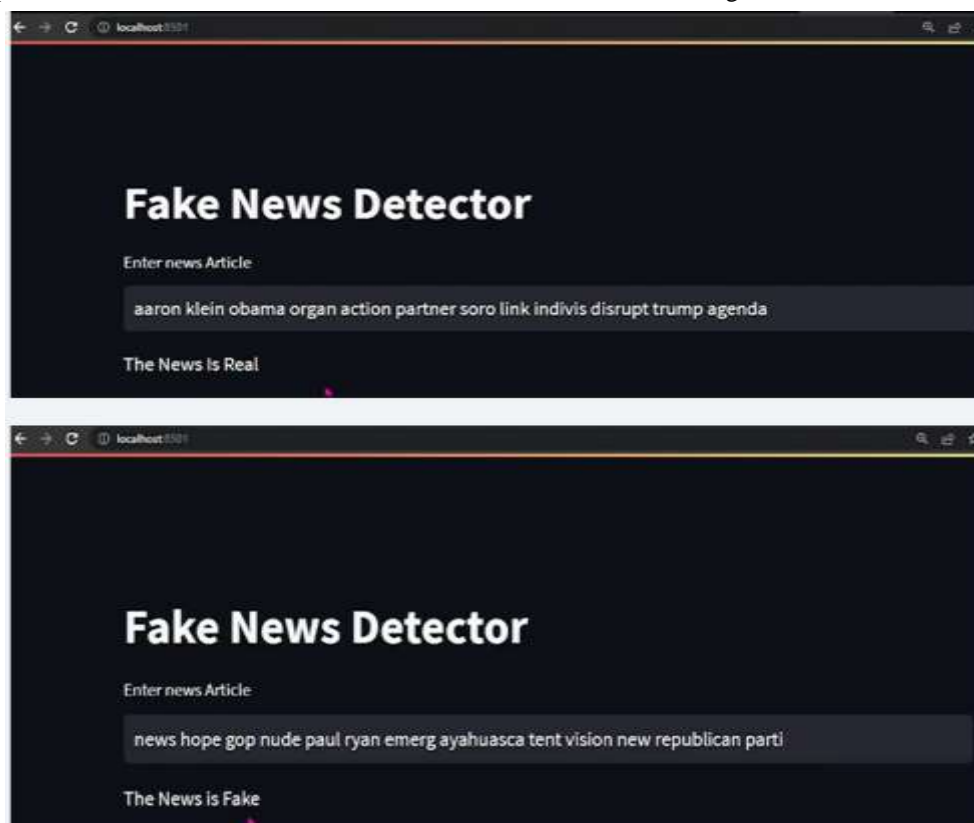

Fig.2 fake news detector: for real and fake news

5. CONCLUSIONS

The article successfully built a model that uses machine learning to identify key indicators of real and fake news, and its performance was assessed using multiple evaluation methods toensure its effectiveness.

The Fake News Detection System features a user-friendly interface built with Streamlit, ensuring an intuitive and accessible experience for all users. It provides quick, automated detection of whether news is real or fake in just seconds, leveraging machine learning and Natural Language Processing (NLP) techniques to analyze text and improve accuracy over time. With the potential for further enhancement, the system can integrate advanced models like BERT or RoBERTa to boost performance. Ultimately, the system helps prevent the spread of misinformation by enabling users to verify the credibility of news before sharing it.

The system has some limitations, including limited accuracy, as the model's performance depends on the quality of training data and may not detect subtly manipulated news. It also lacks context awareness, as it doesn't check sources or cross-reference facts, making it vulnerable to bias. The model operates on a binary classification system, without providing a confidence score or probability percentage for its predictions. Additionally, it struggles with detecting sarcasm and satire, making it prone to misclassifying satirical articles or sarcastic content as fake news. There's also the risk of model bias; if trained on biased data, the model may incorrectly classify legitimate news as fake.

6. REFERENCES

[1] Ahmad, I., Yousaf, M., Yousaf, S., & Ahmad, M.O. (2020). Fake news detection using machine learning ensemble methods. Hindawi, 1-11. https://doi.org/10.1155/2020/8885861

[2] Ahmed, H., Traore, I., & Saad, S. (2017). Detection of online fake news using NGram analysis and machine learning techniques. Proceedings of International Conference on Intelligent, Secure, and Dependable Systems in Distributed and Cloud Environments, Springer, Cham, pp. 127-138.

[3] Ahuja, N., & Kumar, S. (2020). S-HAN: Hierarchical attention networks with stacked gated recurrent unit for fake news detection. Proceedings 8th International Conference on Reliability, Infocom Technologies and Optimization, Noida, India, pp. 873-877.

[4] Ajao, O., Bhowmik, D., & Zargari, S. (2019). Sentiment aware fake news detection on online social networks. Proceedings ICASSP 2019 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP), Brighton, UK, pp. 2507-2511. https://doi.org/10.1109/ICASSP.2019.8683170

[5] Al-Ahmad, B., Al-Zoubi, A.M., Abu Khurma, R., & Aljarah, I. (2021). An evolutionary fake news detection method for COVID-19 pandemic information. Symmetry, 13(6):1-16.

[6] Alanazi, S.S., & Khan, M.B. (2020). Arabic fake news detection in social media using readers' comments: Text mining techniques in action. International Journal of Computer Science and Network Security, 20(9):29-35.

[7] Albahar, M. (2021). A hybrid model for fake news detection: Leveraging news content and user comments in fake news. IET Information Security, 15(2):169-177.

[8] Albahr, A., & Albahar, M. (2020). An empirical comparison of fake news detection using different machine learning algorithms. International Journal of Advanced Computer Science and Applications, 11(9):146-152.

[9] Ali, H., Khan, M.S., AlGhadhban, A., Alazmi, M., Alzamil, A., Al-Utaibi, K., & Qadir, J. (2021). All your fake detector are belong to us: Evaluating adversarial robustness of fake-news detectors under black-box settings. IEEE Access, 9:81678-81692.

[10] Asaad, B., & Erascu, M. (2018). A tool for fake news detection. Proceedings 2018 20th International Symposium on Symbolic and Numeric Algorithms for Scientific Computing (SYNASC), Timisoara, Romania, pp. 379-386. https://doi.org/10.1109/SYNASC.2018.00064

[11] Aslam, N., Ullah Khan, I., Alotaibi, F.S., Aldaej, L.A., & Aldubaikil, A.K. (2021). Fake detect: A deep learning ensemble model for fake news detection. Hindawi, 1-8. https://doi.org/10.1155/2021/5557784

[12] Goldani, M.H., Momtazi, S., & Safabakhsh, R. (2021). Detecting fake news with capsule neural networks. Applied Soft Computing, 101:1-8. https://doi.org/10.1016/j.asoc.2020.106991

[13] Goldani, M.H., Safabakhsh, R., & Momtazi, S. (2021). Convolutional neural network with margin loss for fake news detection. Information Processing & Management, 58(1):1-12. https://doi.org/10.1016/j.ipm.2020.102418

[14] Lingala, Thirupathi & Gangula, Rekha & Ravikanti, Sandeep & Sowmya, Jujuroo & Shruthi, S. (2021). False News Recognition Using Machine Learning. Journal of Physics: Conference Series. 2089. 012049. 10.1088/1742-6596/2089/1/012049.

[15] Islam, M.R., Liu, S., Wang, X., & Xu, G. (2020). Deep learning for misinformation detection on online social networks: A survey and new perspectives. Social Network Analysis and Mining, 10(1):1-20. https://doi.org/10.1007/s13278-020-00696-x

[16] Jiang, T., Li, J.P., Haq, A.U., & Saboor, A. (2020). Fake news detection using deep recurrent neural networks. Proceedings of 17th International Computer Conference on Wavelet Active Media Technology and Information Processing (ICCWAMTIP), Chengdu, China, pp. 205-208. https://doi.org/10.1109/ICCWAMTIP51612.2020.9317325

[17] Jiang, T.A.O., Li, J.P., Haq, A.U., Saboor, A., & Ali, A. (2021). A novel stacking approach for accurate detection of fake news. IEEE Access, 9:22626-22639. https://doi.org/10.1109/ACCESS.2021.3056079

[18] Kaliyar, R.K., Goswami, A., & Narang, P. (2021). FakeBERT: Fake news detection in social media with a BERT-based deep learning approach. Multimedia Tools and Applications, 80(8):11765-11788. https://doi.org/10.1007/s11042-020-10183-2

[19] Kaliyar, R.K., Goswami, A., Narang, P., & Sinha, S. (2020a). FNDNet – A deep convolutional neural network for fake news detection. Cognitive Systems Research, 61:32–44. https://doi.org/10.1016/j.cogsys.2019.12.005

[20] Kumar, S., Asthana, R., Upadhyay, S., Upreti, N., & Akbar, M. (2020). Fake news detection using deep learning models: A novel approach. Transactions on Emerging Telecommunications Technologies, 31(2):1-23. https://doi.org/10.1002/ett.3767

[21] Lakshmanarao, A., Swathi, Y., & Kiran, T.S.R. (2019). An efficient fake news detection system using machine learning. International Journal of Innovative Technology and Exploring Engineering, 8(10):3125-3129.

[22] Lin, J., Tremblay-Taylor, G., Mou, G., You, D., & Lee, K. (2019). Detecting fake news articles. Proceedings IEEE International Conference on Big Data (Big Data), Los Angeles, CA, USA, pp. 3021-3025. https://doi.org/10.1109/BigData47090.2019.9005980

[23] Villela et al. (2023). Fake news detection: A systematic literature review of machine learning algorithms and datasets. ICCMC, 1230–1237. https://doi.org/10.1109/ICCMC51019.2021.94

[24] Thirupathi, L., SrihaReddy, E., & Deepika, J. V. (2024). Challenges and Innovations in the Creation of Digital Twins in Healthcare. In A. Dubey, C. Kumar Reddy, S. Doss, & M. Hanafiah (Eds.), Exploring the Advancements and Future Directions of Digital Twins in Healthcare 6.0 (pp. 69-85). IGI Global Scientific Publishing. https://doi.org/10.4018/979-8-3693-5893-1.ch004

[25] Shailaja, K., Srinivasulu, B., Thirupathi, L. et al. An Intelligent Deep Feature Based Intrusion Detection System for Network Applications. Wireless Pers Commun 129, 345–370 (2023). https://doi.org/10.1007/s11277-022-10100-w

[26] Thirupathi, L., Bandari, M., Sreeramamurthy, K., Gangula, R. (2024). Cyber-Physical Systems Security and Quantum Computing Applications in Disaster Recovery for Industry 6.0. In: Reddy, C.K.K., Nag, A., Ouaissa, M., Bhushan, B., Hanafiah, M.M. (eds) The Rise of Quantum Computing in Industry 6.0 Towards Sustainability. Advances in Science, Technology & Innovation. Springer, Cham. https://doi.org/10.1007/978-3-031-73350-5_14.

[27] Thirupathi, L., Boya, T.R., Gattoju, S., Reddy, E.S. (2024). Quantum Computing and AI: Synergizing for Sustainable Disaster Management in Industry 6.0. In: Reddy, C.K.K., Nag, A., Ouaissa, M., Bhushan, B., Hanafiah, M.M. (eds) The Rise of Quantum Computing in Industry 6.0 Towards Sustainability. Advances in Science, Technology & Innovation. Springer, Cham. https://doi.org/10.1007/978-3-031-73350-5_3.

[28] Lingala Thirupathi et al 2021 J. Phys.: Conf. Ser. 2089 012049; DOI: 10.1088/1742-6596/2089/1/012049.

[29] Thirupathi, L., Rajesh, A., Sandeep, R. (2023). Internet of Lighting for Smart Cities. In: Tiwari, M., Ismail, Y., Verma, K., Garg, A.K. (eds) Optical and Wireless Technologies. OWT 2021. Lecture Notes in Electrical Engineering, vol 892. Springer, Singapore. https://doi.org/10.1007/978-981-19-1645-8_41

[30] Thirupathi, L., Rekha, G., Shruthi, S.K., Sowjanya, B., Jujuroo, S. (2023). A Novel Twitter Sentimental Analysis Approach Using Naive Bayes Classification. In: Bhateja, V., Sunitha, K.V.N., Chen, YW., Zhang, YD. (eds) Intelligent System Design. Lecture Notes in Networks and Systems, vol 494. Springer, Singapore. https://doi.org/10.1007/978-981-19-4863-3_39

[31] Thirupathi Lingala et al 2021 J. Phys.: Conf. Ser. 2089 012050; DOI: 10.1088/1742-6596/2089/1/012050.

[32] S. Pratapagiri, R. Gangula, R. G, B. Srinivasulu, B. Sowjanya and L. Thirupathi, "Early Detection of Plant Leaf Disease Using Convolutional Neural Networks," 2021 3rd Interna-tional Conference on Electronics Representation and Algorithm (ICERA), 2021, pp. 77-82, doi: 9.1109/ICERA53111.2021.9538659.

[33] Thirupathi, L., Srinivasulu, B., Khanapurkar, U., Rambabu, D., Preeti, C.M. (2023). Heart Disease Prediction in Healthcare Communities by Machine Learning Over Big Data. In: Bhateja, V., Sunitha, K.V.N., Chen, YW., Zhang, YD. (eds) Intelligent System Design. Lecture Notes in Networks and Systems, vol 494. Springer, Singapore. https://doi.org/10.1007/978-981-19-4863-3_38

[34] Padmaja P, Sophia IJ, Hari HS, Kumar SS, Somu K, et al., (2021) Distribute the Message over the Network Using another Frequency and Timing Technique to Circumvent the Jam-mers. J Nucl Ene Sci Power Generat Techno 10:9.

[35] Rekha Gangula, Lingala Thirupathi, Rajashekar Parupati, K. Sreeveda, Saritha Gattoju, Ensemble machine learning based prediction of dengue disease with performance and accuracy elevation patterns, Materials Today: Proceedings, 2021, ISSN 2214-7853, https://doi.org/10.1016/j.matpr.2021.07.270.

[36] L. Thirupathi, G. Rekha, "Future drifts and Modern Investigation Tests in Wireless Sensor Networks" , International Journal of Advance Research in Computer Science and Management Studies, Volume 4, Issue 8 (2016).

[37] L Thirupati, R Pasha, Y Prathima, "Malwise System for Packed and Polymorphic Malware", International Journal of Advanced Trends in Computer Science and Engineering, Vol. 3 , No.1, Pages : 167– 172 (2014).

[38] Thirupathi Lingala, Ashok Galipelli, Mahesh Thanneru, "Traffic Congestion Control through Vehicle-to-Vehicle and Vehicle to Infrastructure Communication", (IJCSIT) International Journal of Computer Science and Information Technologies, volume 5, Issue 4, Pages :5081-5084 (2014).

[39] M.Swathi, L.Thirupathi, "Algorithm For Detecting Cuts In Wireless Sensor Networks" in International Journal of Computer Trends and Technology (IJCTT) – volume 4 Issue10 (2013).

[40] L Thirupathi, Y Reddemma, S Gunti - SIGCOMM Computer Communication Review, "A secure model for cloud computing based storage and retrieval", volume 39, Issue 1, Pages: 50-55 (2009).

[41] Sunanda Nalajala, Lingala Thirupathi, N.L.Pratap,"Improved Access Protection of Cloud Using Feedback and DeDuplication Schemes ", Journal of Xi'an University of Architecture & Technology, Volume XII, Issue IV (2020).

[42] V.Srividya, P.Swarnalatha, L.Thirupathi, "Practical Authentication Mechanism using PassText and OTP" in Grenze International Journal of Engineering and Technology, Special Issue,Grenze ID: 01.GIJET.4.3.27,© Grenze Scientific Society, 2018.

[43] Thirupathi, L., Vasundara, B., Sundaragiri, D., Ch, V. B., Gugulothu, R., & Pulyala, R. (2025). Understanding and Addressing Human Factors in Cybersecurity Vulnerabilities. In R. Kumar, S. Srivastava, & A. Elngar (Eds.), Human Impact on Security and Privacy: Network and Human Security, Social Media, and Devices (pp. 13-38). IGI Global Scientific Publishing. https://doi.org/10.4018/979-8-3693-9235-5.ch002

[44] Thirupathi, L., Akshaya, B., Reddy, P. C., Harsha, S. S., & Reddy, E. S. (2025). Integration of AI and Quantum Computing in Cyber Security. In B. Mishra (Ed.), Integration of AI, Quantum Computing, and Semiconductor Technology (pp. 29-56). IGI Global Scientific Publishing. https://doi.org/10.4018/979-8-3693-7076-6.ch002

[45] Thirupathi, L., Kaashipaka, V., Dhanaraju, M., & Katakam, V. (2025). AI and IoT in Mental Health Care: From Digital Diagnostics to Personalized, Continuous Support. In H. Joshi, C. Kumar Reddy, M. Ouaissa, M. Hanafiah, & S. Doss (Eds.), Intelligent Systems and IoT Applications in Clinical Health (pp. 271-294). IGI Global Scientific Publishing. https://doi.org/10.4018/979-8-3693-8990-4.ch012

[46] Thirupathi, L., Reddy, A. S., Vardhan, V., Panchagnula, T., Miriyala, N. S., Gattoju, S., & Kanth, T. V. (2025). Deepfakes: Understanding, Detection, and Mitigation in Cyber-Politics and Cyber-Economics. In A. Günar (Ed.), Economic and Political Consequences of AI: Managing Creative Destruction (pp. 351-374). IGI Global Scientific Publishing. https://doi.org/10.4018/979-8-3693-7036-0.ch015

[47] Thirupathi, L., Sunkara, S. H., Boodala, I. R., & Vempati, V. S. (2024). Personalization and Customization Strategies With AI in Service Marketing. In V. Nadda, P. Tyagi, A. Singh, & V. Singh (Eds.), Integrating AI-Driven Technologies Into Service Marketing (pp. 499-524). IGI Global Scientific Publishing. https://doi.org/10.4018/979-8-3693-7122-0.ch024.