USING ARTIFICIAL INTELLIGENCE TO FILTER OUT BARKING, TYPING, AND OTHER NOISE FROM VIDEO CALLS IN MICROSOFT TEAMS

Pawankumar Sharma, Bibhu Dash

School of Computer and Information Sciences, University of the Cumberlands, KY, USA

ABSTRACT

The normal method for analyzing technology is formulating many search queries to extract patent datasets and filter the data physically. The purpose of filtering the collected data is to remove noise to guarantee accurate information analysis. With the advancement in technology and machine learning, the work of physical analysis of the patent can be programmed so the system can remove noise depending on the results based on the previous data. Microsoft team generates a new artificial intelligence model that provides solutions on how individuals respond to speakers. Microsoft team, workplace, Facebook, and Google collected data from many active users hence developing artificial intelligence to minimize distracting background noise, barking and typing during the call.

KEYWORDS

Artificial intelligence, Microsoft teams, speech identification, video call, video signal data, machine learning, and data sets

1. INTRODUCTION

Technology is evolving at a very high speed to make human life better. Microsoft is among the technologies implemented to make communication efficient and effective. Due to the high competition level in the industry, Microsoft has to identify strategies to help them remain competitive in the modern world. Microsoft developed new features after Google's Hangout Chats and Facebook's Workplace exceeded 44 million daily active users. Such features included raising a hand to indicate an individual has something to mention, offline and minimal-bandwidth help to read chat texts and write replies even if the network is poor or unavailable. Additionally, the team developed a feature where chats would pop up at a different window. After all the improvements, a unique aspect still stood out, real-time noise suppression. Thus, Microsoft Team had to identify strategies through artificial intelligence to minimize the disturbing background noise when calling.

Almost every individual has experienced distractive background noise when communicating via a call. In most cases, individuals ask the other person to mute or move to a calm place for communication to be effective [1]. Such noise is called real-time noise. The real-time noise dominance can filter out an individual typing on their keyboard when a meeting is in progress. Thus, filtering out individuals making noise or in a noisy environment will enhance effective communication for individuals who are serious about the meeting [2]. With the help of artificial intelligence, Microsoft Team will eliminate background noise in real-time so that individuals will listen to the voice only on the call.

According to Hubbard and Bailey (2018), the application of cooperation and video conferencing instruments has risen significantly since the coronavirus pandemic [3]. Microsoft is directing Teams as the remedies for businesses and consumers, a section of the Microsoft 365 subscription suite [4]. The Microsoft organization depends on machine-learning proficiency to ensure that artificial intelligence is among the significant differentiators. When attained, real-time noise suppression in homesteads and organizations will be a thing of the past, and communication will be more efficient and effective.
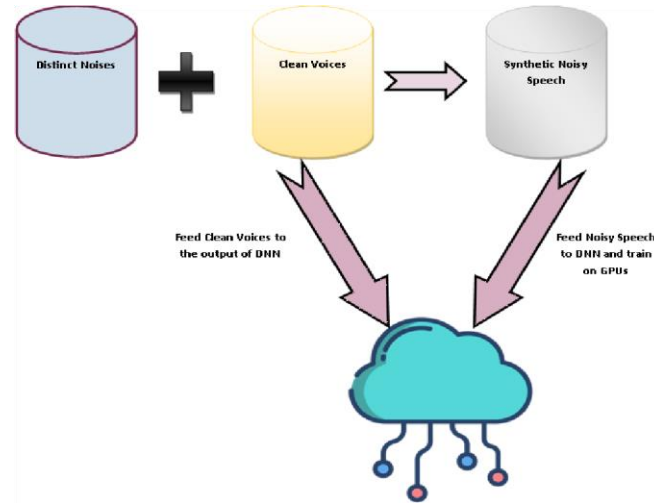

Figure 1. Collection of data and training framework

2. STATIONERY NOISES VS. NON-STATIONERY NOISES

Communication technologies such as Skype, Microsoft Teams, and Skype Business have experienced noise distraction for a long time. Various communication instruments and video conferencing applications still experience noise suppression issues [5]. However, noise suppression only deals with stationery noises, such as the noise produced by a computer fan or an air conditioner in the background. Traditionally, noise suppression could be addressed by determining speech pauses, approximating the baseline noise, supposing that the progressive background noise remains constant, and filtering it out [6]. Microsoft Teams are working towards suppressing non-stationary noises, such as opening the door or a dog barking. This step will be achieved using machine learning, where a training set will be developed with multiple representative noises.

Microsoft Teams have recently developed a training program to conduct further research on avoiding real-time noise when video calling. The training sets to be developed will have unique features because they will have special data sets to ensure specific noises are not filtered out [7]. The Noises to be left unfiltered include sound from musical instruments, real-time noise cancellation, singing, and laughing. The noises will be unfiltered because the Microsoft Team can't separate sounds from human voices. Thus, only distractive noises will be eliminated. Moreover, it is impossible to filter out some noises because undesirable noises appear in the gaps between the speech and overlay with the speech [8]. When an individual's noise and speech overlap, it isn't easy to distinguish between them. Thus, Microsoft Teams will train a neural network to differentiate between noise and speech using artificial intelligence.

3. PREPARE SPEECH IDENTIFICATION VS. NOISE CANCELLATION

Aichner, a communications official in Microsoft Teams, tried to relate machine-learning approaches for noise cancellation with machine-learning methods for speech recognition. Aichner found that a massive corpus of consumers talking into the microphone for voice recognition should be recorded [9]. After recording, human beings should be requested to mark the voice information by recording what has been stated. Rather than mapping the microphone input into written words, individuals will attempt to change from noise to clear speech in noise cancellation. With such strategies, Microsoft Teams will train the model to comprehend the variation between speech and noise, and the model will learn to maintain the speech. In developing the training datasets, Microsoft Teams took thousands of dissimilar speakers with more than 100 forms of noise [10]. The team then integrated the noiseless clear speech with noise to feign a microphone signal. The training model is then fed with clear speech as the foundation of truth. The team enquires from the training model to abstract a pure signal and its features from noisy data. Therefore, the neural network is trained in supervised learning to identify the basic truth.

According to Hinton et al. (2012), the primary truth is the speech in the microphone when recognizing speech [11]. In real-time cancellation, the primary truth speech should be free from noise. The Microsoft Team can effectively train its model by providing massive data sets for hundreds of hours of data. The model will learn to generalize and minimize noise using a clear speech even if the speech was not part of the training data.
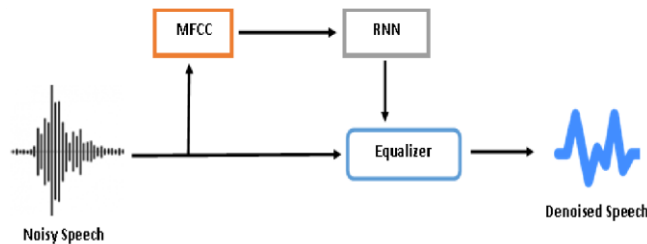

Figure 2. Real-time noise cancellation.

4. METHODOLOGY

The Microsoft team used digital library web science, Scopus, and Google scholar to compile all the facts you need to know about how artificial intelligence is used to filter out background noise when video calling. The study used a search engine to find relevant results across various topics, matched keywords to maximize relevance in this database, and offered thorough up-to-date research.

Furthermore, the information gathered was filtered, and the team was determined to obtain results from only the published papers in the last four years. The research also ensured that the paper's findings are relevant to modern technology using artificial intelligence to filter out barking, typing, and other noise from video calls in the Microsoft team [12]. During the research, the team ensured they examined the conclusion and the abstracts to filter the pertinent information to brief and make authors more confident with the research paper. The research is designed for a data project as part of the intelligence application in the Microsoft team in suppressing the noise [13]. The application of the machine learning model is used for predictive analyses, machine learning services, databases, and cloud systems for storing datasets and big

data clusters. Tools allow members to share the resources and create a consistent computing environment, not to validate and replicate the experiments.

4.1. Challenges

There are some challenges experienced by Microsoft Teams when relating the functionality with speech identification. Some challenges are that when matching speech recognition with functionality, some canceling sound noise becomes easily attainable, even if it takes place in realtime [14]. When developing noise suppression, it becomes difficult to get representative data groups to develop, minimize the model, and leverage machine learning proficiency.

5. REPRESENTATIVE OF DATA

Microsoft team spent a lot of their time understanding how to produce quality audio files that explain what happens throughout a typical call. The Microsoft team has a unique way of representation. For instance, male and female voices are represented using audiobooks. This enables the team because male and female voices differ in speech characteristics. Microsoft taped the information from YouTube, which clearly labeled and required the recording, for instance, music and typing [15]. The Microsoft team must combine the noise data and the speech using the synthesizer scripts, which consist of unlike, signal-to-noise ratios. The team will amplify the noise, producing or mimicking various accurate situations developed during the call. Conference calls and audiobooks are different depending on the outcomes. Artificial intelligence noise destruction mostly depends on machine learning, enabling the system to differentiate between noise and clean speech. The main idea is to train the machine learning model to work in all situations; therefore, it requires the diversification of the data, where the team must create a large dataset to ensure they achieve the diversity of the dataset [16]. The Microsoft team used the available data to collect specific information; this is done to ensure that the customers' privacy is maintained.

6. CONFIDENTIALITY RESTRICTIONS

Rosler (2018) states that the Aichner team has no authority to access customers' data; this is achieved because Microsoft has strict rules and guidelines that protect internal privacy [17]. The Aichner cannot use Microsoft team calls. A smallerscale effort is created to ensure that accurate recording with various speakers and devices. All these devices must be tested to ensure they work before the recording starts. This is done using a convinced training set to the test set to provide the intended results [18]. The participants can only see and follow the conversation when they join the meeting. When individuals are dismissed from the ongoing meeting, they will instantly stop receiving chat massagers; therefore, no need to remove the participant from the group. Also, no evidence was left; for instance, there was no history of the meeting.

7. CLOUD AND EDGE

Cloud and edge are figuring out to establish the neural network. By bringing in more devices and systems, the intelligent edge can collect more data, process it, and make it accessible to end users. The information is delivered by responsive and contextually updated apps [19]. Combining the huge computing power of the cloud with gradually connected technologies leads to possibilities, which are multi-device virtually limitless data and the growing number of multisensory.

Table 1. Collaborative cloud-edge computing framework

Cloud	Edge Side
Edge Node Configuration	Optimal Task Scheme
Collaborative Cloud-edge Learning	Cloud Dormancy Mechanism

Most machine learning activities are done in the cloud; for instance, in voice recognition, when an individual uses a microphone, that voice is sent to the cloud [20]. The cloud contains large calculations that can run this voice and recognize the speech in real-time communication. The authors used the machine learning model to narrow the voices to fit clients.

8. PUSH TREATMENT TO THE EDGE

Push treatment to edge prefers the machine learning model to be live on edge and not in the cloud since the Microsoft team is trying to limit the number of users on the server. The server plays a crucial role in video signal packets sent straight between the two members [21]. Microsoft is responsible for keeping their servers from becoming overcrowded, determining the cost of each connection, and supplying extra network on the delay by creating a more efficient edge from the latency perspective when the image is set up for group calls through their service. The transfer of documents is costless since it only requires a cell phone, personal computer, or laptop to deliver the message to the endpoint; this is achieved when the central processing unit is not overloaded [22]. All this processing equipment should be taken care of; for instance, the battery life should be checked to ensure no fault is committed and progress continues without interference.

9. DOWNLOAD SIZE AND SUSTAINABILITY

The Microsoft team considers future progression in this section since machine learning work continues daily. The Microsoft team is developing a flexible system for future adjustment [23]. Since the industry is trying to invest in noise cancellation after figuring out the first release as much as possible, the team will be looking for a new and better model system; the team should develop a model that affects the client's size. The Microsoft team is needed to develop an app that can be accommodated on a phone, laptop, or desktop [24].

The app should occupy less space and can be transferred quickly among users. This provides future modifications for the app and system into different models.

10. MACHINE LEARNING EXPERT

All the processes cannot go on if the machine learning expertise is equipped; thus, the expertise should understand the purpose of the data collected and the sure models to use. The world consists of numerous model centers with much audio expertise [25]. Data should be open source to allow improvements. Technology allows employees to think outside the box in developing various solutions to tackle challenges facing the current models [26]. Machine learning expertise seeks knowledge from people, not from the collected data alone.

According to Yang and Meals (2014), noise suppression exists in the skype Microsoft team [27]. Skype for the business app, communication tools, and video conferencing app contains noise suppression. These are categorized under stationary noise, for example, the air conditioner and

computer fan [28]. The old noise suppression method considers the baseline estimate of the noise and the speech pause and assumes that the continuous background for the noise does not change, enabling filtering it out.

Using artificial intelligence, the Microsoft team indicated that speech pauses could never be estimated. Therefore, using machine learning techniques to train the algorithms to detect various issues effectively, the bark is built in different forms of concepts [29]. Technology has led to the Creation of awareness that most people should be ready to copy. Connected devices have communicated more easily since the use of mobile phones. The introduction of real-time background artificial intelligence noise suppression to the Microsoft team has boosted communication because the new system can suppress unwanted noise like slamming doors, shuffling papers, and barking dogs [30]. Artificial intelligence base noise suppression has a unique way of working.

The Creation of a large dataset ensures the achievement of data diversity. To achieve a clean speech, balancing female and male speech should prioritize collecting data from more than ten languages [31]. The languages include tonal languages to endure the model does not change the statement's meaning through distortion of the tone of words. Machine learning is also trained to differentiate the suppressed emotions in clean speech, such as crying and laughing [32]. The environment in which an individual joins the meeting is very important for the speech signal. For the model to capture the diversity, it is being trained several times in different room environments.

The deep learning models should have a strong, powerful training infrastructure and Microsoft Azure to give the team a wider view to developing a more improved version of the machine learning model. Extraction of information from the noise needs to be done so that the human ear will perceive it as its original form [33]. The artificial intelligence noise can eliminate unwanted noise automatically during the meeting. Artificial intelligence-based noise suppression can update the existing model to control the noise they want. New highsetting users are available in the Microsoft team that can suppress more background noise. Artificial intelligence noise clampdown is recorded as in development on Microsoft. The artificial intelligence-based noise suppressor is modified by analyzing a specific audio feed in the Microsoft teams and using a train deep neural network that can filter the collected noise and keep the only speech signal. The system will be rolled out to the desktop, iOS, and Android. Suppressing background noise is an option inside Zoom's noise cancellation function, which is used in modern video conferences. The user can set the volume to very loud or very low. IOS and Android users may use Google's noise cancellation feature to block out distracting ambient noises, including door slamming, typing, pen clicking, dog barking, and more [34]. Using artificial intelligence, the presenters can now customize how the content shows up for meeting the members. Microsoft provides more active viewing content knowledge.

Dork et al. (2012) state that the presenters can overlay their content and videos; this can happen by allowing the presenters to move the content or video to the corner of the screen videos [35]. Artificial intelligence enables users to be monitored wherever they are, for instance, to notify other members that a particular user is unavailable in the office [36]. The feature unavailability status can display anytime it reaches out via chat.

Data mining combines various methods, database management, statistics, data visualization, and machine learning. Complex issues can be handled with these methods [37]. For a transaction including various data conditions, types of data, and mining tasks, software or schemes for data mining may employ one or more of these methods. Classification attempts to anticipate the target class for each data example correctly. The prediction model using the regression method and

numerical targets is not a classified algorithm. Data mining is a large data search process for searching patterns that cannot be found using simple analysis techniques [38]. Data mining has several types: illustrating, text, social media, web, audio, and video.

A summary of the most critical findings from each pattern model has started to be included by researchers due to changes in the cyber threat landscape. This model aimed to account for social attacks as they occurred and adapt to the new genesis norms because social attacks like social engineering are on the rise due to outside factors. The paradigm for spotting security flaws and social engineering in modern web apps has been rethought, and it involves launching a fundamental attack on an online application [39]. System intrusions provide evidence of sophisticated attacks, spurring an investigation into the best way to allocate resources to counter future attempts [40]. Various technological and human errors can cause unintentional changes to sensitive data. In contrast, exploitation of additional benefits resulted in a lower rate of security breaches, and misuse of privilege results in the illegal or malicious use of legitimate privileges. Data loss is plausible when an asset is lost, stolen, or both [41]. However, people are losing their electronic equipment more frequently now than they were previously. The company should create a probability-based contingency plan due to the difficulties in identifying and forecasting denial of service assaults. Everything else, which includes all occurrences that nicely fit into other patterns, is included in addition to the environmental breach.

Compromise data, which refers to information hacked recently, is one of the most common categories. Stealing user credentials gives hackers access to the system and private information [42]. Cybercriminals are also interested in finding out personally identifying information about people.

Credentials, individual and business data, money and medical information, and financial and financial information are frequently exposed in security breaches and afterward used by other fraudsters. They draw fraudsters due to the potential value of the information they hold; this location necessitates close monitoring and security [43]. Data breaches may result from several factors, including lax access control, the use of shared credentials, improperly configured cloud storage, unsecured apps, excessive access privileges, and a lack of technical knowledge.

Any industry, regardless of specialty, is susceptible to cyberattacks. Understanding how these activities typically play out is crucial for effective defense because the hospitality and food services industries are particularly vulnerable to hacking, social engineering, and malware attacks. The main threat to this company is from outsiders with financial interests. This market relies heavily on the creative sectors, including ransomware, phishing, and password theft. Compared to the highest event level, threat actors motivated by financial gain are responsible for the lowest rate of data breaches [44]. A potential threat to educational institutions is social engineering, which may take the form of pretexting. System faults and intrusions, both natural and created, are covered by the study of external agents [45]. Credential stuffing and ransomware assaults are two often used strategies by outside parties to influence the financial and insurance industries. Data breaches in this sector are most frequently caused by insiders using methods like social engineering and straightforward online application attacks.

The Microsoft teams contribute to the empowerment of the enterprises such as engineering, marketing, and finance. Microsoft team streamlines common communication, empowering the users with an automated provision that can provide a clear step to resolve the problem without needing the experts [46]. Artificial intelligence provides the Microsoft team with a common and familiar interface to contact and consume the power of cognitive services easily. Microsoft services include facial and image recognition to develop artificial intelligence tools [47]. The tools enable users to learn the process by themselves, unlike the previous where the companies

used to develop cognitive services could be developed from anywhere by developing a business vision, involving the information technology experts, and getting approval for the budget. The process was consuming more time which delayed the innovation.

Artificial intelligence technologies help the user find the right information presented in the right place to solve a specific task [48]. The technology's use helps reduce frustration by enabling the team to access the right information document. During the assembly, the artificial intelligence tool could automatically present and identify the relevant additional information and their sources, such as videos, documents, and links, depending on the keyword and topic presented. Artificial intelligence models can make specific notes and assign tasks [49]. After the meeting, artificial intelligence can monitor the assigned task, summarize the content, and monitor the deadlines, making it more important for people to access the information depending on the topics [50]. Digital associated with an informal interface enhances unified team collaboration and communication capabilities enabling workers to use voice control to send instant messages and make calls. The tool is productive since it enables team workers to create better business outcomes and reduces frustration.

11. RESULTS

This research shows that artificial intelligence can filter out barking, typing, and other noise from video calls in Microsoft Teams. The use of machine learning can help in noise cancellation as it can differentiate between speech and noise, as well as identify and filter out undesirable noises. Additionally, a training program can help create a training set with multiple representative noises. The deep learning models require a powerful training infrastructure and Microsoft Azure to give the team a wider view to developing a more improved version of the machine learning model. AI technologies can help users find the right information presented in the right place to solve a specific task. Additionally, AI can make specific notes and assign tasks after the meeting, monitor the assigned task, summarize the content, and monitor the deadlines. AI has the potential to make video calls more efficient and productive and reduce frustration.

12. RECOMMENDATIONS

This report recommends identifying the representative set that computers and people in various applications can use. The representative set consists of selective models from the subset of the original dataset whose function is to capture more important information more efficiently from the data sets. Being innovative with the office layout is an appropriate way to filter barking, typing, and noise; for example, desks and systems in groups help compartmentalize barking and noise and use sound-friendly furniture. This report finds the use of acoustic wall panels essential for noise filtering. In any building, they should use sound-absorbing walls, which effectively combat noise. Improve insulation by using materials that are effective in sound reduction. Unforgiving floor surfaces such as porcelain, ceramic, and concrete contribute to massive noise, while the carpet is the best solution for noise reduction. Also, LVT flooring is the alternative for easy maintenance and selection of design options that boost sound absorption.

13. CONCLUSIONS

Separating the signal from the noise is important to the dataset because it improves performance; for instance, overfitting affects machine learning. The algorithm can consume noise as a pattern and then generalize it; hence it is important to cancel noisy data from the signal. The occurrences of noisy data in the Microsoft team can impact meaningful information. Noisy data can lead to a decrease in classification accuracy or poor results. Many identification techniques can be

assembled, but only one can work efficiently. Polishing techniques improve classification accuracy compared to robust and filtering techniques, although they contribute to some datasets and Microsoft errors. The Microsoft team offers solution support services and verifies the computer system, facilitating the cloud-based solution and sharing the information using the computing resources. Using artificial intelligence enables solving noise, barking, and typing problems due to its efficiency and the cab's mode to detect some signals.

ACKNOWLEDGMENT

REFERENCES

[1]   Nassif, A.B., Shahin, I., Attili, I., Azzeh, M. and Shaalan, K., (2019). Speech recognition using deep neural networks: A systematic review. IEEE Access, 7, pp.19143-19165.

[2]   Duan, S., Zhang, J., Roe, P. and Towsey, M., (2014) A survey of tagging techniques for music, speech, and environmental sound. Artificial Intelligence Review, 42(4), pp.637-661.

[3]   Hubbard, M. and Bailey, M.J., (2018) Mastering Microsoft Teams. Mastering Microsoft Teams. https://doi. Org/10.1007/978-1-48423670-3.

[4]   Skelly, P., Hester, S., Ryan, T., Underwood, J., Bowden, E., Evans, T.K., Geurts, G., Lang, K., Liemohn, K., McCann, C. and Schubert Sr, M., (2014) The New Business Operating System: Combining Office 365 and the Microsoft Cloud Ecosystem to Create Business Value.

[5]   Ganesan, V. and Manoharan, S., (2015) Surround noise cancellation and speech enhancement using subband filtering and spectral subtraction. Indian Journal of Science and Technology, 8(33), p.1.

[6]   Reddy, C.K., Gopal, V., Cutler, R., Beyrami, E., Cheng, R., Dubey, H., Matusevych, S., Aichner, R., Aazami, A., Braun, S. and Rana, P., (2020) Theinterspeech 2020 deep noise suppression challenge: Datasets, subjective testing framework, and challenge results. arXiv preprint arXiv:2005.13981.

[7]   Lin, S., Ryabtsev, A., Sengupta, S., Curless, B.L., Seitz, S.M. and Kemelmacher-Shlizerman, I., (2021) Real-time high-resolution background matting. In Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition (pp. 8762-8771).

[8]   Amershi, S., Begel, A., Bird, C., DeLine, R., Gall, H., Kamar, E., Nagappan, N., Nushi, B. and Zimmermann, T., (2019) May. Software engineering for machine learning: A case study. In 2019 IEEE/ACM 41st International Conference on Software Engineering: Software Engineering in Practice (ICSE-SEIP) (pp. 291-300). IEEE.

[9]   Strake, M., Defraene, B., Fluyt, K., Tirry, W. and Fingscheidt, T., (2020) October. INTERSPEECH 2020 Deep Noise Suppression Challenge: A Fully Convolutional Recurrent Network (FCRN) for Joint Dereverberation and Denoising. In INTERSPEECH (pp. 24672471).

[10]   Panesar, A., (2019) Machine learning and AI for healthcare (pp. 1-73). Coventry, UK: Apress.

[11]   Hinton, G., Deng, L., Yu, D., Dahl, G.E., Mohamed, A.R., Jaitly, N., Senior, A., Vanhoucke, V., Nguyen, P., Sainath, T.N. and Kingsbury, B., (2012) Deep neural networks for acoustic modeling in speech recognition: The shared views of four research groups. IEEE Signal processing magazine, 29(6), pp.82-97.

[12]   Brynjolfsson, E. and Mcafee, A.N.D.R.E.W., (2017) Artificial intelligence, for real. Harvard Business Review.

[13]   Das, S., Dey, A., Pal, A. and Roy, N., (2015) Applications of artificial intelligence in machine learning: review and prospect. International Journal of Computer Applications, 115(9).

[14]   Jagadish, H.V., Gehrke, J., Labrinidis, A., Papakonstantinou, Y., Patel, J.M., Ramakrishnan, R. and Shahabi, C., (2014) Big data and its technical challenges. Communications of the ACM, 57(7), pp.86-94.

[15]   Crick, M. ed., (2016) Power, Surveillance, and Culture in YouTube's Digital Sphere. IGI Global.

[16] Noda, K., Yamaguchi, Y., Nakadai, K., Okuno, H.G. and Ogata, T., (2015) Audio-visual speech recognition using deep learning. Applied Intelligence, 42(4), pp.722-737.

[17] Rösler, P., (2018) On the End-to-End Security of Group Chats in Instant Messaging Protocols.

[18] Cutler, R., Hosseinkashi, Y., Pool, J., Filipi, S., Aichner, R., Tu, Y. and Gehrke, J., (2021) Meeting Effectiveness and Inclusiveness in Remote Collaboration. Proceedings of the ACM on Human-Computer Interaction, 5(CSCW1), pp.1-29.

[19] Boyes, H., Hallaq, B., Cunningham, J., and Watson, T., (2018) Theindustrial internet of things (IIoT): An analysis framework. Computers in industry, 101, pp.1-12.

[20] Lane, N.D., and Georgiev, P., (2015) February. Can deep learning revolutionize mobile sensing? In Proceedings of the 16th International Workshop on Mobile Computing Systems and Applications (pp. 117122).

[21] Loreto, S. and Romano, S.P., (2012) Real-time communications in the web: Issues, achievements, and ongoing standardization efforts. IEEE Internet Computing, 16(5), pp.68-73.

[22] Wang, B., Qi, Z., Ma, R., Guan, H. and Vasilakos, A.V., (2015) A survey on data center networking for cloud computing. Computer Networks, 91, pp.528-547.

[23] Choudhary, B. and Rakesh, S.K., (2016) February. An approach using agile method for software development. In 2016 International Conference on Innovation and Challenges in Cyber Security (ICICCSINBUSH) (pp. 155-158). IEEE.

[24] Attaran, M., Attaran, S. and Kirkland, D., (2019) The need for digital workplace: increasing workforce productivity in the information age. International Journal of Enterprise Information Systems (IJEIS), 15(1), pp.1-23.

[25] Géron, A., (2019) Hands-on machine learning with Scikit-Learn, Keras, and TensorFlow: Concepts, tools, and techniques to build intelligent systems. O'Reilly Media.

[26] Tidd, J. and Bessant, J.R., (2020) Managing innovation: integrating technological, market and organizational change. John Wiley & Sons.

[27] Yang, P.R., and Meals, R.A., (2014) How to establish an interactive conference and Journal Club. The Journal of hand surgery, 39(1), pp.129-133.

[28] Mutanen, T.P., Metsomaa, J., Liljander, S. and Ilmoniemi, R.J., (2018) Automatic and robust noise suppression in EEG and MEG: The SOUND algorithm. Neuroimage, 166, pp.135-151.

[29] Jha, K., Doshi, A., Patel, P., and Shah, M. (2019) A comprehensive review on automation in agriculture using artificial intelligence. Artificial Intelligence in Agriculture, 2, pp.1-12.

[30] Zhou, Z., Chen, X., Li, E., Zeng, L., Luo, K. and Zhang, J., (2019) Edge intelligence: Paving the last mile of artificial intelligence with edge computing. Proceedings of the IEEE, 107(8), pp.1738-1762.

[31] Bender, E.M. and Friedman, B., (2018) Data statements for natural language processing: Toward mitigating system bias and enabling better science. Transactions of the Association for Computational Linguistics, 6, pp.587-604.

[32] Zhang, Z., (2012) Microsoft Kinect sensor and its effect. IEEE Multimedia, 19(2), pp.4-10.

[33] Garnett, R., Huegerich, T., Chui, C. and He, W., (2005) A universal noise removal algorithm with an impulse detector. IEEE Transactions on image processing, 14(11), pp.1747-1754.

[34] Alshemali, B. and Kalita, J. (2020) Improving the reliability of deep neural networks in NLP: A review. Knowledge-Based Systems, 191, p.105210.

[35] Dörk, M., Riche, N.H., Ramos, G. and Dumais, S., (2012) Pivotpaths: Strolling through faceted information spaces. IEEE transactions on visualization and computer graphics, 18(12), pp.2709-2718.

[36] Mamoshina, P., Ojomoko, L., Yanovich, Y., Ostrovski, A., Botezatu, A., Prikhodko, P., Izumchenko, E., Aliper, A., Romantsov, K., Zhebrak, A. and Ogu, I.O., (2018) Converging blockchain and nextgeneration artificial intelligence technologies to decentralize and accelerate biomedical research and healthcare. Oncotarget, 9(5), p.5665.

[37] Fernández, A., del Río, S., López, V., Bawakid, A., del Jesus, M.J., Benítez, J.M. and Herrera, F., (2014) Big Data with Cloud Computing: an insight on the computing environment, MapReduce, and programming frameworks. Wiley Interdisciplinary Reviews: Data Mining and Knowledge Discovery, 4(5), pp.380-409.

[38] Pan, Y., Yao, T., Li, Y., Wang, Y., Ngo, C.W. and Mei, T., (2019). Transferrable prototypical networks for unsupervised domain adaptation. In Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition (pp. 2239-2247).

[39]   Rodriguez, M., Piattini, M. and Ebert, C., (2019) Software verification and validation technologies and tools. IEEE Software, 36(2), pp.13-24.

[40]   Sharma, P., Dash, B., and Ansari, M. F., (2022) Anti-phishing techniques – a review of Cyber Defense Mechanisms, IJARCCE, vol. 11, no. 7, 2022.

[41]   Indu, I., Anand, P.R. and Bhaskar, V., (2018) Identity and access management in cloud environment: Mechanisms and challenges. Engineering science and technology, an international journal, 21(4), pp.574-588.

[42]   Barona, R. and Anita, E.M., (2017) April. A survey on data breach challenges in cloud computing security: Issues and threats. In 2017 International Conference on Circuit, Power and Computing Technologies (ICCPCT) (pp. 1-8). IEEE.

[43]   Elsayed, M.A.M.A., (2018) Advancing Security Services for Cloud Applications (Doctoral dissertation, SQueen's University (Canada)).

[44]   Ansari, M. F., Dash, B., Sharma P., and Yathiraju N., (2022) The impact and limitations of Artificial Intelligence in Cybersecurity: A literature review, IJARCCE, vol. 11, no. 9, 2022.

[45]   Thomas, K., Li, F., Zand, A., Barrett, J., Ranieri, J., Invernizzi, L., Markov, Y., Comanescu, O., Eranti, V., Moscicki, A. and Margolis, D., (2017, October) Data breaches, phishing, or malware? Understanding the risks of stolen credentials. In Proceedings of the 2017 ACM SIGSAC conference on computer and communications security (pp. 1421-1434).

[46]   Attaran, M., Attaran, S. and Kirkland, D., (2019) The need for digital workplace: increasing workforce productivity in the information age. International Journal of Enterprise Information Systems (IJEIS), 15(1), pp.1-23.

[47]   Davenport, T.H., (2018). From analytics to artificial intelligence. Journal of Business Analytics, 1(2), pp.73-80.

[48]   Haenlein, M. and Kaplan, A. (2019) A brief history of artificial intelligence: On the past, present, and future of artificial intelligence. California management review, 61(4), pp.5-14.

[49]   Ferrell, J. and Kline, K., (2018) Facilitating trust and communication in virtual teams. People & Strategy, 41(2), pp.30-36.

[50]   Ferrario, A., Loi, M. and Viganò, E., (2020). In AI we trust Incrementally: a Multi-layer model of trust to analyze Human Artificial intelligence interactions. Philosophy & technology, 33(3), pp.523-539.