



Article

Vibescape: Real-Time Emotion-Based Music Recommendation Using Multimodal Analysis

P. Velavan¹, K. Senthamilselvan², T. Shynu³, S. Suman Rajest⁴, R. Regin⁵, M. Mohamed Sameer Ali⁶

1. Department of Computer Science and Engineering, Dhaanish Ahmed College of Engineering, Chennai, Tamil Nadu, India
2. Department of Electronics and Communication Engineering, Dhaanish Ahmed College of Engineering, Chennai, Tamil Nadu, India
3. Dhaanish Ahmed College of Engineering, Padappai, Chennai, Tamil Nadu, India
4. Dhaanish Ahmed College of Engineering, Chennai, Tamil Nadu, India
5. Assistant Professor, Department of Computer Science and Engineering, SRM Institute of Science and Technology, Ramapuram, India
6. Dhaanish Ahmed College of Engineering, Chennai, Tamil Nadu, India.

*Correspondence : velavan@dhaanishchennai.in, regin12006@yahoo.co.in

Abstract: Vibescape is a novel emotion-based music recommender system that aims to provide a personalised and immersive music streaming experience. This system employs cutting-edge emotion detection technology to analyse the user's emotions in real time and suggest songs that fit their current mood. Vibescape combines popular music platforms such as Spotify, SoundCloud and YouTube to allow users to stream music from their preferred sources seamlessly. The app also provides personalised playlists that match the user's mood and listening habits. Vibescape's intuitive and user-friendly interface customises the overall music streaming experience according to the emotional journey of the listener. Vibescape uses advanced algorithms to analyse emotional signals from facial expressions, voice, or text inputs to accurately identify moods. In addition to recommendations based on emotion, the system also adapts to long-term listening patterns, fine-tuning its recommendations to make a more personalised experience over time. Its integration with multiple music sources means the platform can provide a huge library of songs for different tastes and moods. Vibescape is a new way to link emotions and music, turning passive listening into an emotionally resonant and dynamic experience.

Keywords: Emotion-Based; Music Recommender System; Emotion Detection; Customized Playlists; Dynamic Experience; User-Friendly; Music Streaming; Popular Music Platforms

Citation: Velavan, P, Senthamilselvan, K, Shynu, T, Rajest, S. S, Regin, R & Sameer Ali, M. M. Vibescape: Real-Time Emotion-Based Music Recommendation Using Multimodal Analysis. Central Asian Journal of Mathematical Theory and Computer Sciences 2026, 7(3), 33-47

Received: 10th Mar 2026
Revised: 21st Apr 2026
Accepted: 08th May 2026
Published: 02nd June 2026



Copyright: © 2026 by the authors. Submitted for open access publication under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>)

1. Introduction

The Vibescape project is an innovative step forward in the field of intelligent music recommendation systems, and is designed to change the way users interact with digital music platforms [36]. Music streaming has become an integral part of our daily lives in recent years with millions of users relying on platforms to discover, organise and enjoy music. However, despite the sophistication of current recommendation algorithms, there is still a large gap to truly personalised experiences that match users' real-time emotional states [31]. Vibescape addresses this limitation by offering an emotion-aware music recommendation system that adapts to the user's mood, thus providing a more immersive and meaningful listening experience [50]. The core idea of Vibescape is to analyse the

emotions of users in real time with advanced emotion detection techniques [45]. These methods use multimodal data including facial expressions, tone of voice and text sentiment to accurately identify the current emotional state of the user.

The system uses deep learning models, specifically Convolutional Neural Networks and Natural Language Processing algorithms, to process these inputs and classify emotions into categories such as happiness, sadness, anger, relaxation or excitement [39]. This classification is used as a basis for providing personalised music recommendations matching the user's emotional state at that very moment. One of the unique features of Vibescape is the ability to combine multiple popular music streaming platforms into one unified interface [49]. Add that to integration with Spotify, SoundCloud, and YouTube, and users are guaranteed a huge and varied music library without having to switch between apps [33]. This seamless integration improves user convenience and provides the recommendation engine with a broader pool of songs, improving the quality and relevance of its recommendations [56]. The system recommends not only individual tracks but also creates personalised playlists that change with the user's mood and preferences, providing a tailored listening experience that adapts over time [43]. The motivation behind the development of Vibescape is the limitations of existing music streaming systems.

Traditional recommendation algorithms mainly depend on historical data including listening history, user preferences, genre choices and popularity trends. Approaches such as collaborative filtering and content-based filtering have been successful in identifying patterns and recommending relevant content. However, they do not capture the dynamic nature of human emotions [28]. This often leaves users manually searching for music that fits their current mood, creating a disjointed and less enjoyable experience. Vibescape seeks to address this gap by delivering real-time emotion-based recommendations that align with the user's current feelings. Moreover, Vibescape is not limited to short-term emotional detection, but also includes adaptive learning mechanisms to study long-term listening patterns [35]. The system is constantly tracking how users interact with the music, what songs they play, skip, like, or add to playlists and uses that information to improve its recommendation model. Over time, this enables Vibescape to better know individual preferences and offer more accurate and more personalised suggestions [40]. The real-time emotion analysis coupled with long-term behavioural learning creates a robust recommendation system that addresses immediate and evolving user preferences.

The design of Vibescape aims to encompass a wide range of features that contribute to the success of next-generation music recommender systems [46]. Besides emotion detection and cross-platform integration, the system also focuses on the user experience, with a more intuitive and user-friendly interface. The design is simple and user-friendly so that users can easily interact with the application [53]. The integration of features such as real-time emotion feedback, dynamic playlist generation and seamless music streaming into a coherent environment enhances the overall usability [32]. Vibescape balances powerful functionality with ease of use by focusing on both technological innovation and user-centric design. Another important element of Vibescape is its possible influence on the connection between music and emotions [42]. Music has long been known to be a powerful way to express and regulate emotions, and it influences mood, behaviour and psychological well-being. Vibescape provides users a way to interact with music in a more meaningful and therapeutic manner by matching music recommendations to emotional states [55]. For example, the system can suggest soothing music when the user is stressed, happy music when the user is sad, or upbeat music when the user is tired.

This customised approach increases entertainment value and also helps emotional well-being and mental health support. Today's music streaming services, by contrast, operate within a more static framework [37]. They provide curated playlists, genre-based recommendations, trending music suggestions, etc. But these are generally pre-defined without any real-time adaptability [48]. If mood-based playlists exist, they're usually fairly generic and don't consider individual differences or changes in mood states. Moreover, the lack of cross-platform integration forces users to rely on multiple apps for different music libraries creating a disjointed experience [29]. Vibescape addresses these

issues by providing a dynamic, unified and emotion-aware solution that links the user intent to the system response. From a technical perspective, Vibescape uses sophisticated machine learning techniques for accurate emotion detection and recommendation generation [51]. Facial emotion recognition systems analyse visual cues such as facial landmarks and expressions. Speech analysis algorithms analyse vocal features such as tone, pitch, and intensity.

Text-based sentiment analysis is analysing the emotional context of users' input coming from chats or typed input. These multimodal inputs are merged to generate a rich emotional profile, which is then mapped to suitable music recommendations using state-of-the-art recommendation algorithms [41]. The combination of information from various sources makes the system's predictions more reliable and accurate. Additionally, the system is scalable and flexible to grow with an increasing number of users and to adapt to changing technology trends. Cloud-based infrastructure enables real-time data processing and storage, ensuring efficient performance and a smooth user experience [34]. The modular architecture of Vibescape allows for the integration of new features and services, such as compatibility with wearable devices or advanced biometric sensors, adding further capabilities. Such flexibility makes Vibescape a future-proof platform, ready to adapt to the upcoming trends in artificial intelligence and digital entertainment [47].

The development of Vibescape also takes into account ethical and privacy issues concerning emotion detection technologies. The system is based on sensitive user information such as facial images and voice recording, so it has strong security levels to ensure the user privacy [38]. We use encryption of data, secure authentication and transparent data usage policies to ensure that user information is dealt with responsibly. Furthermore, users are given the option to customise the degree of interaction with the system by managing their data sharing preferences. Vibescape is committed to the responsible use of technology and to building trust by paying close attention to ethical considerations [44]. To conclude, Vibescape is a major advancement in the development of music recommendation systems combining emotion detection with personalised content delivery [54]. It surpasses the limitations of traditional platforms by providing real-time, emotion-based recommendations that cater to short-term and long-term user preferences [30]. Vibescape is a comprehensive and captivating music streaming experience that combines the convenience of multiple music services, sophisticated machine learning techniques, and user-friendly design [52]. The system associates emotions with music, making the passive experience of listening to music interactive and emotionally engaging, and changing the way users interact with music in the digital world.

Review of Literature

Spotify is one of the most influential music streaming services out there and it uses complex algorithm-based recommendation systems to customise the experience for each user [21]. It uses sophisticated methods such as collaborative filtering, which examines user listening habits, preferences, and patterns to create personalised playlists like "Discover Weekly" and "Release Radar." These playlists are created by looking at individual listening histories, identifying similarities between users with similar tastes, and considering the popularity of songs in certain genres [27]. By doing so, Spotify has managed to build a very addictive platform that exposes people to new music that fits in with existing tastes. It has many advantages, but the recommendation system of Spotify lacks real-time emotion detection which is a major limitation in the context of dynamic user experience [2]. The platform has playlists by mood like "Feel Good," "Chill Vibes," or "Workout Hits," but these are largely static, pre-curated collections that do not respond to the user's immediate emotional state. This leads to the need for users to often manually search for songs that match their current mood, indicating a gap in real-time emotional personalisation [23]. Music is inherently tied to human emotions, and the inability to dynamically respond to changing emotional states reduces the effectiveness of such recommendation systems in providing truly immersive experiences.

This gap is even more evident when we think about the increasing expectations of users in the digital age [10]. Today's users require highly personalised, context-aware services that are able to respond immediately to their needs and preferences [14]. Traditional recommender systems are efficient in analysing historical data, but they do not have the capability to interpret real time emotional cues obtained from facial expressions, voice modulation or textual inputs. This hampers such systems from offering recommendations in line with the current emotional state of the users, and limits their ability to improve user engagement and satisfaction [7]. Another limitation of current music streaming platforms is their reliance on static and pre-defined data models. These systems are mainly based on the past user data such as the history of played tracks, liked songs, and playlist interactions [26]. This method gives a baseline understanding of user preferences but fails to account for the dynamic nature of human emotions and situational contexts [20]. For instance, a user who usually listens to upbeat music might desire calm and soothing songs when stressed or tired. However, traditional systems may still recommend high energy songs based on past behaviour, resulting in a mismatch between user expectations and system output.

In addition to the lack of emotional adaptability, many of the existing platforms also have non-intuitive user interfaces that can hinder smooth navigation. New music discovery, playlist creation, and preference management are often multi-step processes that can be cumbersome and time consuming [16]. The complexity can be a barrier for users to get immersed in the platform, especially when they want quick and easy access to music that fits their mood. An intuitive and easy-to-use interface is required to make the platform more accessible and user-friendly. In addition, the lack of effective integration between multiple music platforms is another challenge [5]. For example, users can listen to the different music libraries provided by different streaming services such as Spotify, YouTube, and SoundCloud. But these platforms are separate and users have to switch between apps to browse the different content. It also interferes with the overall listening experience and reduces convenience. Bringing together the different platforms in one single interface can greatly improve the usability and provide users with a more seamless, all encompassing music streaming experience. One single system is the answer.

Existing music streaming systems also have serious performance and scalability challenges [9]. As the number of users on these platforms increases, they have to handle more and more concurrent requests. Heavy traffic can result in delayed responses, interruptions during playback, and occasional outages. Such issues can have negative impacts on user satisfaction and retention [13]. In addition, the integration of various streaming services introduces another layer of complexity in scalability, requiring efficient data synchronisation and resource allocation to maintain consistent performance across diverse platforms [22]. Another significant issue in the current systems is related to the security and data management [1]. Music streaming services collect vast amounts of private user data, including personal data, listening habits and payment information. It is critical to ensure the security and privacy of this information [25]. However, vulnerabilities to cyber-attacks and lack of data protection mechanisms can put users at potential risk. In addition, inefficient processes for data organization and retrieval may lead to delays in delivering personalised recommendations, further degrading the user experience [19]. Moreover, the absence of effective data anonymisation techniques raises concerns on the misuse of user data, especially when dealing with sensitive information such as emotional states.

Vibescape, unlike these limitations, suggests a new way of music streaming that combines real time emotion detection with personalised recommendation systems [11]. Vibescape employs cutting-edge technologies such as computer vision, natural language processing and speech analysis to precisely analyse the emotional states of users and offer music suggestions that match their current mood. This dynamic approach helps to make sure that the suggestions provided to the users are relevant and meaningful, improving their overall listening experience [4]. Vibescape also tackles the problem of platform fragmentation by bringing together different music streaming services under one interface. This allows users to enjoy a wide range of music content without toggling

between applications [17]. The ability of the system to create personalised playlists based on real time emotional states and long-term preferences adds up to the personalisation, making it a powerful tool for delivering an immersive music experience.

On the performance front, Vibescape is built to scale well with high volumes of user interactions [15]. The system is configured with scalable cloud-based architectures and optimised algorithms to deliver fast response times and playback smoothness even under heavy load conditions. This attention to performance and scalability allows Vibescape to provide a reliable and consistent user experience [6]. Security and data management are also priorities of the Vibescape system. Advanced techniques and secure data storage mechanisms are used for data encryption to prevent unauthorised access of user information. Moreover, data anonymisation and privacy preserving techniques are applied to guarantee responsible and ethical treatment of users' emotional data [12]. These measures are useful in building trust and confidence in users, which is vital for the broad acceptance of such systems.

To summarise, current music streaming services such as Spotify have made significant progress in the area of personalised recommendations, but they still fall short when it comes to the dynamic and emotional dimensions of user experience [8]. The absence of real-time emotion detection, dependence on static data models, limited platform integration, and issues with performance, scalability, and security indicate the need for more sophisticated solutions [3]. Vibescape fills these gaps by integrating emotion detection and intelligent recommendation systems to provide a seamless, personalised and emotionally engaging music streaming experience [18]. Bridging the divide between human feelings and music choice, Vibescape signifies a revolutionary leap forward in the development of digital music platforms, opening the door to more natural and flexible user experiences down the road [24].

2. Materials and Methods

The Vibescape Emotion-Based Music Recommender System proposes a methodology that aims to provide a personalised and adaptive music streaming experience, using emotion recognition and intelligent music classification techniques [60]. The system is trained on a complete dataset of music, which is the main dataset used to train and test the system. This dataset contains a mixture of music tracks with different emotional tags such as happy sad calm and energetic. Such labels are important for the system to be able to understand and classify the music according to its emotional properties [68]. This dataset is used for sampling relevant training samples to build the recommendation model. These samples are normalised to ensure consistency and eliminate scale differences, which could adversely impact the model's performance [64]. Normalisation standardises input data so the system can efficiently and accurately process audio features. This step is done on both the training and testing datasets, so as to maintain system consistency (Figure 1) [75].

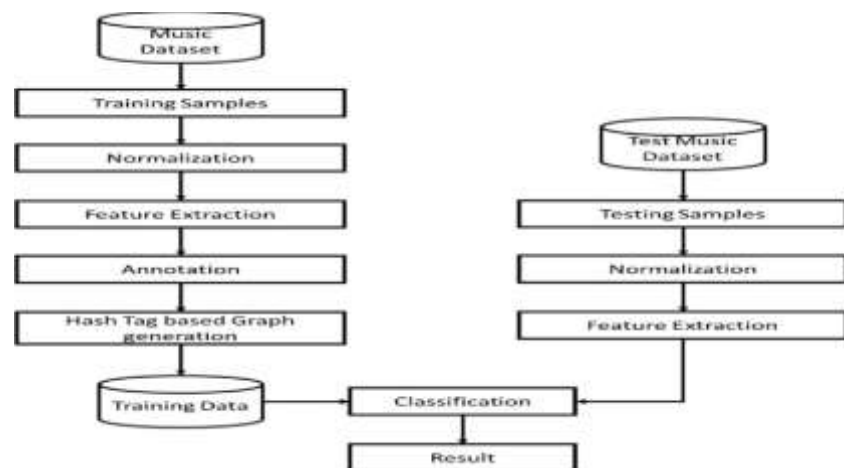


Figure 1. Block Diagram

After normalisation, the system conducts feature extraction, which is an important stage in the analysis of the intrinsic properties of music. A structured representation of each music track is generated by extracting a set of audio features such as rhythm, tempo, pitch, timbre and spectral characteristics [59]. These features constitute the basis for the mapping of the songs to different emotional states. The system improves the capability of performing precise emotion-based classification through conversion of raw audio signals into meaningful data [71]. After the features extraction, the training data is annotated with emotions annotations. The annotation process maps each music track to an emotion label, producing a labelled dataset that can be used for supervised learning [65]. The annotation step is important to allow the model to learn the relationship between audio features and emotional outcomes, so it can predict the emotional tone of new, unseen music tracks.

Furthermore, a mechanism for hashtag-based graph generation is implemented to enhance the intelligence of the system. The relational graph built by this module visualises the relationships between different emotional tags and music features [63]. The system can then better understand the relationships between emotions and the transitions from emotion to another and how they can be mapped to music recommendations [69]. This graph-based approach enhances the flexibility and adaptability of the recommendation engine. The processed and annotated data is then stored as structured training data which is then used for the classification model [57]. The core of the Vibescape system is the classification module, which employs machine learning algorithms to analyse input features and give suitable emotional tags to music tracks [74]. The classification model associates the detected emotional state of the user, identified through input modalities such as facial expressions, voice signals or textual data with the matching music features from the dataset.

In parallel, the performance of the system is evaluated using a separate test music dataset. The testing samples are normalised and the features are extracted in the same way as during the training phase [67]. Then the trained model is used to predict the emotional labels of these test samples, which can be used for assessing the accuracy and reliability. This evaluation step is important to prove the effectiveness of the recommendation system [72]. Finally, the output of the classification process decides which music tracks are most appropriate for the user's current emotional state. Based on these results, Vibescape generates personalised playlists that fit the mood of the user and provides a smooth and interactive listening experience [61]. We propose a methodology that combines real-time emotion detection and advanced machine learning techniques to achieve a dynamic, user-centric approach to music recommendation, bridging the gap between human emotions and digital music consumption [77].

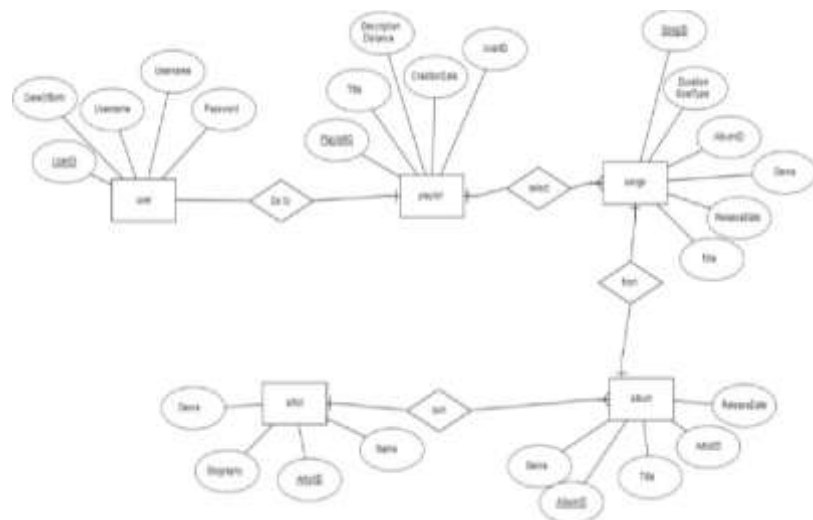


Figure 2. ER Diagram

The Vibescape Emotion-Based Music Recommender System adopts a structured methodology to guarantee seamless and personalised music recommendations based on user emotions. The system starts with the initialisation of the application which loads the user interface that allows users to login or create a new account. Once logged in to the platform, users are greeted with an interface that offers to create playlists, select songs, and stream music from integrated platforms such as Spotify, SoundCloud and YouTube [62]. When a user is initialised, a new account is created and important user information such as the username, password, and date of birth are securely stored and a unique UserID is assigned to track the user's actions within the system. Users will be able to create their own playlist according to their preference. Each Playlist will have their own PlaylistID and will be associated to the respective user. The system stores important information such as playlist title, description and creation date [70]. After this the user can choose songs from a large music library. Each song has information such as SongID, title, genre, duration and album.

When a song gets added to a playlist, we associate it with the user and with the playlist [66]. Furthermore, the system stores detailed information of artists and albums. Artists are described by an ArtistID and attributes such as name, genre, and biography [76]. Albums are associated through AlbumID and have attributes such as release date and genre. The system also improves personalisation by analysing user playlists to identify trends in listening behaviour and emotional preferences, producing music suggestions [58]. One of the key features of Vibescape is the emotion detection and classification module that uses real-time facial expression analysis to detect the user's emotional state. This detected emotion is mapped to appropriate songs in the database. This enables the system to create instantaneous mood playlists [73]. Finally, the system maintains a record of all user interactions, such as playlist creation, song selection, and recommendation history, to enable efficient data retrieval and to enhance future recommendations, thus providing an ever-adapting and personalised music experience.

3. Results and Discussion

The ER diagram of the Vibescape Emotion-Based Music Recommender System provides a complete structural overview of the interactions among various entities to enable a personalised and emotion-driven music experience. The system is designed to maintain a well-organised database of music related information, while tracking user preferences, emotional states and listening behaviour at its core [83]. This system has a very important entity that is the User entity. It contains basic information about the user such as UserID, username, password and date of birth. Each individual has their own attributes. These attributes are unique and allow secure access to the system. Demographic information such as date of birth also allows the system to potentially tailor recommendations based on age-related preferences or trends. Users can engage with the service on a deep level, make and curate playlists, pick tracks, and react to recommendations [92]. This entity is the basis from which all other interactions are built up, because any action in the system can be traced back to a specific user. Playlist entity: This is linked to the User entity and describes organised groupings of songs by users.

Playlist has attributes like title, description and creation date. It is identified uniquely by PlaylistID. These attributes are both functional and descriptive, allowing users to organise their music by moods, events, or personal themes. The User and Playlist relationship is one-to-many, in which one user can create many playlists but a playlist can only have one user. This design allows you to have ownership and personalisation while keeping a clear structure in the database [79]. Playlists are one of the core features of the Vibescape system, as they allow users to save and listen again to their favourite songs, but also provide the system an organised way to present emotion-based recommendations. The Songs entity describes individual music tracks available in the system, and it is a core component of the recommendation engine. Each song has properties like SongID, title, genre, duration, album information etc [88]. These attributes enable accurate classification and filtering, which is useful for matching songs with specific emotional states.

The genre attribute can be used to match songs to user preferences and the duration attribute can be used to optimise playlist length and listening sessions. The system provides a lot of flexibility to songs, since they can be included in multiple playlists and belong to multiple users [87]. This many-to-many relationship between Songs and Playlists is typically handled with a junction table to efficiently store and retrieve the data. It stores rich meta data for each song, which improves the system's ability to give accurate and meaningful recommendations. Another dimension to the system is added by the Artist entity . It represents the creators of the music [91]. It has attributes like ArtistID, name, genre and biography which give identification and descriptive information. The biography is in place, then the system can offer contextual information to the users, which improves their overall experience.

Artist and Album have a one to many relationship, as an artist can release multiple albums. This structure reflects the reality of music production and ensures that the database reflects the hierarchy of musical content [96]. By leveraging data about artists, the system can recommend songs that match the tastes of the user in specific artists or genres, enhancing the relevance of the recommendations. The Album entity is a connection between artists and tracks, allowing the grouping of tracks into logical collections. Attributes such as AlbumID, title, release date and genre define each album [80]. The relationship between Album and Songs is also one-to-many, where one album can have many songs, but each song has one album. This relationship is important for maintaining integrity of music data, and for features like album-based browsing and recommendations. Albums are connected to artists and songs creating a rich network of relations which helps to access data faster and improves the user experience. Albums also provide an additional dimension for recommendation, because users may prefer listening to full albums rather than individual tracks.

The Vibescape Emotion Music Recommender System is based on a methodology that enables the integration of emotion detection, user preferences and music streaming [82]. The process starts with the initialisation of the application, loading of the graphical user interface. It is the primary interface through which the user interacts with the system. It provides a friendly environment and includes options for the user to receive recommendations based on their mood, to manage their playlists and to integrate with popular music streaming platforms. Interface design is very important as it needs to be user-friendly and responsive to give a good experience for the user. When the application is launched, the system engages the emotion detection module, a key feature of Vibescape [89]. The system uses the user's camera to capture the facial expressions in real-time and analyse them to understand the user's emotional state. This process uses advanced computer vision and machine learning techniques so that the system can recognise emotions like happiness, sadness, anger, surprise and neutrality.

The accuracy of emotion detection is important because it directly impacts the quality of music recommendations. Through the continuous tracking of the user's facial expressions, the system can adapt to the changes in mood, providing a dynamic and adaptive experience. Besides automatic emotion detection, the system allows users to manually input their music preferences. This means picking a streaming platform of choice and setting parameters such as genre or mood intensity [84]. This is important because it gives users a certain degree of control over the recommendation process, thus assuring that the system is aligned with their personal tastes. The user input is validated against the platforms that are supported, to avoid errors and increase the reliability of the system. Vibescape strikes a balance between personalisation based on user input and personalisation based on emotion detection. Once the emotional state and preferences of the user have been determined, the system then begins to match songs that match the detected mood [93]. This is done by analysing song metadata, like track name, artist, album, genre and duration.

This is precisely what the recommendation algorithm is for. It should be able to translate emotions into corresponding music tracks [98]. For example, a happy mood might be associated with upbeat, lively songs, while a sad mood could be connected to slower, more reflective tracks. It may also look at historic data, like songs it has played

before or feedback from users, to fine-tune its recommendations. Once the right songs are found, the system constructs personalised playlists that match the user's current emotional state. Each of these playlists is then presented to the user, with details about each track such as name, artist and album [78]. One of the main features of Vibescape is the possibility to create and display playlists, which allows users to interact with the recommendations in a structured and convenient way. Users can choose to save these playlists for future use or play them immediately as they prefer. This flexibility increases user satisfaction and promotes further interaction with the system. Vibescape's streaming features are seamlessly integrated with other popular platforms such as Spotify, SoundCloud and YouTube. When a user clicks on a song or playlist, the system automatically streams or redirects the content to the platform of choice [90]. You get access to a large library of music with this integration, but still have the personalised experience of Vibescape.

The system also collects data on the user's activity, such as which songs they listen to and for how long, which is saved for later analysis [94]. This data is invaluable for increasing the accuracy of recommendations over time. One of the unique features of the Vibescape system is its ability to update recommendations on the fly as the user's emotional state changes. The emotion detection module keeps running and when it detects a change in mood the playlist is updated. For example, if a user's mood shifts from sad to happy, the system will adjust its recommendations to include more upbeat tracks [85]. This real-time adaptability is what differentiates Vibescape from traditional music recommendation systems, which typically depend on static preferences or historical data. The system's personalisation capabilities are significantly enhanced by user feedback. Vibescape collects feedback on suggested songs and playlists, so users can express how much they like or dislike them. The feedback is used to train the recommendation algorithm to give better recommendations that match the user's preferences. The system learns over time and improves in providing a highly customised music experience.

Also, the storage of emotional data and listening history helps the process, allowing the system to learn and evolve with every session. The ER diagram also has additional entities and relationships, which help in tracking user interaction and play history [86]. The attributes of the Track (which is same as the Songs entity) are track ID, track name, duration etc. This entity is related to the Album entity via the "Contains" relationship, implying that each album has multiple tracks and each track belongs to only one album [97]. This hierarchy is required to organise music data and to support various features of the system.

The "Played" and "WasPlayedAt" relationships are especially important to capture playback history. These relationships map tracks to time stamps . It records when the song was played . This is information that is used to analyse listening patterns and identify trends in how users are behaving [95]. For example, the system might learn that certain songs are often played while in certain emotional states, and use that knowledge to make better recommendations in the future. Vibescape also tracks your playback history in detail, and uses it to create a personalised music experience that's aware of the context. In summary, the ER diagram and methodology of Vibescape Emotion-Based Music Recommender System together form a strong and effective platform for music discovery and enjoyment [81]. The explicit relationships between entities ensure data integrity and enable complex interactions, and the systematic methodology allows for the seamless integration of emotion detection, user preferences, and streaming services. Vibescape combines cutting-edge technologies with intuitive design to provide a novel and immersive music recommendation experience that responds to the user's emotions and preferences on the fly, while also learning and evolving through feedback and data analysis.

4. Conclusion

Vibescape Emotion Music Recommender System is an innovative and highly personalised approach to music streaming that leverages facial emotion detection and real-time music recommendations. The system provides users a seamless experience that

dynamically adapts to their emotional state and curates playlists that match their moods. Vibescape is compatible with many streaming platforms including Spotify, SoundCloud and YouTube to make it easier for users to find their favourite music without having to switch between various apps. The system has an intuitive graphical user interface (GUI), which is essential for improving the overall user experience, allowing users to navigate easily, explore playlists and stream music with ease. The use of facial recognition technology makes music recommendations even more personalised, and adds a new dimension of interaction based on emotion, which is not found in traditional music recommender systems. Furthermore, the modular design of Vibescape facilitates future scalability, for example, by implementing improved emotion detection algorithms, adding more streaming services, or features such as user authentication and feedback systems. With an emphasis on technological innovation and user experience, Vibescape is positioned to meet the demands of modern music listeners who prefer personalised, mood-based playlists.

REFERENCES

- [1] H. AbdulKader, E. ElAbd, and W. Ead, "Protecting online social networks profiles by hiding sensitive data attributes," *Procedia Computer Science*, vol. 82, pp. 20–27, 2016.
- [2] E. Fattoh, F. Kamal Alsheref, W. M. Ead, and A. M. Youssef, "Semantic sentiment classification for COVID-19 tweets using universal sentence encoder," *Computational Intelligence and Neuroscience*, vol. 2022, pp. 1–8, 2022.
- [3] D. K. Sharma and R. Tripathi, "4 Intuitionistic fuzzy trigonometric distance and similarity measure and their properties," in *Soft Computing*, De Gruyter, Berlin, Germany, pp. 53–66, 2020.
- [4] D. K. Sharma, B. Singh, M. Anam, R. Regin, D. Athikesavan, and M. Kalyan Chakravarthi, "Applications of two separate methods to deal with a small dataset and a high risk of generalization," in *2021 2nd International Conference on Smart Electronics and Communication (ICOSEC)*, Trichy, India, 2021.
- [5] D. K. Sharma, B. Singh, M. Anam, K. O. Villalba-Condori, A. K. Gupta, and G. K. Ali, "Slotting learning rate in deep neural networks to build stronger models," in *2021 2nd International Conference on Smart Electronics and Communication (ICOSEC)*, Trichy, India, 2021.
- [6] K. Kaliyaperumal, A. Rahim, D. K. Sharma, R. Regin, S. Vashisht, and K. Phasinam, "Rainfall prediction using deep mining strategy for detection," in *2021 2nd International Conference on Smart Electronics and Communication (ICOSEC)*, Trichy, India, 2021.
- [7] Nallathambi, R. Ramar, D. A. Pustokhin, I. V. Pustokhina, D. K. Sharma, and S. Sengan, "Prediction of influencing atmospheric conditions for explosion Avoidance in fireworks manufacturing Industry-A network approach," *Environ. Pollut.*, vol. 304, no. 7, p. 119182, 2022.
- [8] H. Sharma and D. K. Sharma, "A Study of Trend Growth Rate of Confirmed Cases, Death Cases and Recovery Cases of Covid-19 in Union Territories of India," *Turkish Journal of Computer and Mathematics Education*, vol. 13, no. 2, pp. 569–582, 2022.
- [9] L. Karn et al., "Designing a Deep Learning-based financial decision support system for fintech to support corporate customer's credit extension," *Malays. J. Comput. Sci.*, vol.36, no.s1, pp. 116–131, 2022.
- [10] L. Karn et al., "B-lstm-Nb based composite sequence Learning model for detecting fraudulent financial activities," *Malays. J. Comput. Sci.*, vol.32, no.s1, pp. 30–49, 2022.
- [11] P. P. Dwivedi and D. K. Sharma, "Application of Shannon entropy and CoCoSo methods in selection of the most appropriate engineering sustainability components," *Cleaner Materials*, vol. 5, no. 9, p. 100118, 2022.
- [12] Kumar, S. Singh, K. Srivastava, A. Sharma, and D. K. Sharma, "Performance and stability enhancement of mixed dimensional bilayer inverted perovskite (BA2PbI4/MAPbI3) solar cell using drift-diffusion model," *Sustain. Chem. Pharm.*, vol. 29, no. 10, p. 100807, 2022.
- [13] Kumar, S. Singh, M. K. A. Mohammed, and D. K. Sharma, "Accelerated innovation in developing high-performance metal halide perovskite solar cell using machine learning," *Int. J. Mod. Phys. B*, vol. 37, no. 07, p.12, 2023.
- [14] Senapati and B. S. Rawal, "Adopting a deep learning split-protocol based predictive maintenance management system for industrial manufacturing operations," in *Lecture Notes in Computer Science*, Singapore: Springer Nature Singapore, pp. 22–39, 2023.

- [15] Senapati and B. S. Rawal, "Quantum communication with RLP quantum resistant cryptography in industrial manufacturing," *Cyber Security and Applications*, vol. 1, no. 12, p. 100019, 2023.
- [16] Senapati et al., "Wrist crack classification using deep learning and X-ray imaging," in *Proceedings of the Second International Conference on Advances in Computing Research (ACR'24)*, Cham: Springer Nature Switzerland, pp. 60–69, 2024.
- [17] B. Naeem et al., "Heart disease detection using feature extraction and artificial neural networks: A sensor-based approach," *IEEE Access*, vol. 12, no.3, pp. 37349–37362, 2024.
- [18] R. Tsarev et al., "Automatic generation of an algebraic expression for a Boolean function in the basis \wedge, \vee, \neg ," in *Data Analytics in System Engineering*, Cham: Springer International Publishing, Switzerland, pp. 128–136, 2024.
- [19] R. Tsarev, B. Senapati, S. H. Alshahrani, A. Mirzagitova, S. Irgasheva, and J. Ascencio, "Evaluating the effectiveness of flipped classrooms using linear regression," in *Data Analytics in System Engineering*, Cham: Springer International Publishing, Switzerland, pp. 418–427, 2024.
- [20] M. A. Yassin et al., "Advancing SDGs : Predicting Future Shifts in Saudi Arabia ' s Terrestrial Water Storage Using Multi-Step-Ahead Machine Learning Based on GRACE Data," 2024.
- [21] M. A. Yassin, A. G. Usman, S. I. Abba, D. U. Ozsahin, and I. H. Aljundi, "Intelligent learning algorithms integrated with feature engineering for sustainable groundwater salinization modelling: Eastern Province of Saudi Arabia," *Results Eng.*, vol. 20, p. 101434, 2023.
- [22] S. I. Abba, A. G. Usman, and S. IŞIK, "Simulation for response surface in the HPLC optimization method development using artificial intelligence models: A data-driven approach," *Chemom. Intell. Lab. Syst.*, vol. 201, no. April, 2020.
- [23] G. Usman et al., "Environmental modelling of CO concentration using AI-based approach supported with filters feature extraction: A direct and inverse chemometrics-based simulation," *Sustain. Chem. Environ.*, vol. 2, p. 100011, 2023.
- [24] Gbadamosi et al., "New-generation machine learning models as prediction tools for modeling interfacial tension of hydrogen-brine system," *Int. J. Hydrogen Energy*, vol. 50, pp. 1326–1337, 2024.
- [25] Abdulazeez, S. I. Abba, J. Usman, A. G. Usman, and I. H. Aljundi, "Recovery of Brine Resources Through Crown-Passivated Graphene, Silicene, and Boron Nitride Nanosheets Based on Machine-Learning Structural Predictions," *ACS Appl. Nano Mater.*, 2023.
- [26] S. Alotaibi et al., "Sustainable Green Building Awareness: A Case Study of Kano Integrated with a Representative Comparison of Saudi Arabian Green Construction," *Buildings*, vol. 13, no. 9, 2023.
- [27] S. I. Abba et al., "Integrated Modeling of Hybrid Nanofiltration/Reverse Osmosis Desalination Plant Using Deep Learning-Based Crow Search Optimization Algorithm," *Water (Switzerland)*, vol. 15, no. 19, 2023.
- [28] S. I. Abba, J. Usman, and I. Abdulazeez, "Enhancing Li + recovery in brine mining : integrating next-gen emotional AI and explainable ML to predict adsorption energy in crown ether-based hierarchical nanomaterials," pp. 15129–15142, 2024.
- [29] J. Usman, S. I. Abba, N. Baig, N. Abu-Zahra, S. W. Hasan, and I. H. Aljundi, "Design and Machine Learning Prediction of In Situ Grown PDA-Stabilized MOF (UiO-66-NH₂) Membrane for Low-Pressure Separation of Emulsified Oily Wastewater," *ACS Appl. Mater. Interfaces*, Mar. 2024.
- [30] P. P. Anand, U. K. Kanike, P. Paramasivan, S. S. Rajest, R. Regin, and S. S. Priscila, "Embracing Industry 5.0: Pioneering Next-Generation Technology for a Flourishing Human Experience and Societal Advancement," *FMDB Transactions on Sustainable Social Sciences Letters*, vol.1, no. 1, pp. 43–55, 2023.
- [31] G. Gnanaguru, S. S. Priscila, M. Sakthivanitha, S. Radhakrishnan, S. S. Rajest, and S. Singh, "Thorough analysis of deep learning methods for diagnosis of COVID-19 CT images," in *Advances in Medical Technologies and Clinical Practice*, IGI Global, pp. 46–65, 2024.
- [32] G. Gowthami and S. S. Priscila, "Tuna swarm optimisation-based feature selection and deep multimodal-sequential-hierarchical progressive network for network intrusion detection approach," *Int. J. Crit. Comput.-based Syst.*, vol. 10, no. 4, pp. 355–374, 2023.
- [33] J. Obaid, S. Suman Rajest, S. Silvia Priscila, T. Shynu, and S. A. Etyem, "Dense convolution neural network for lung cancer classification and staging of the diseases using NSCLC images," in *Proceedings of Data Analytics and Management*, Singapore; Singapore: Springer Nature, pp. 361–372, 2023.
- [34] S. S. Priscila and A. Jayanthiladevi, "A study on different hybrid deep learning approaches to forecast air pollution concentration of particulate matter," in *2023 9th International Conference on Advanced Computing and Communication Systems (ICACCS)*, Coimbatore, India, 2023.

- [35] S. S. Priscila, S. S. Rajest, R. Regin, and T. Shynu, "Classification of Satellite Photographs Utilizing the K-Nearest Neighbor Algorithm," *Central Asian Journal of Mathematical Theory and Computer Sciences*, vol. 4, no. 6, pp. 53–71, 2023.
- [36] S. S. Priscila and S. S. Rajest, "An Improved Virtual Queue Algorithm to Manipulate the Congestion in High-Speed Network," *Central Asian Journal of Medical and Natural Science*, vol. 3, no. 6, pp. 343–360, 2022.
- [37] S. S. Priscila, S. S. Rajest, S. N. Tadiboina, R. Regin, and S. András, "Analysis of Machine Learning and Deep Learning Methods for Superstore Sales Prediction," *FMDB Transactions on Sustainable Computer Letters*, vol. 1, no. 1, pp. 1–11, 2023.
- [38] R. Regin, Shynu, S. R. George, M. Bhattacharya, D. Datta, and S. S. Priscila, "Development of predictive model of diabetic using supervised machine learning classification algorithm of ensemble voting," *Int. J. Bioinform. Res. Appl.*, vol. 19, no. 3, 2023.
- [39] S. Silvia Priscila, S. Rajest, R. Regin, T. Shynu, and R. Steffi, "Classification of Satellite Photographs Utilizing the K-Nearest Neighbor Algorithm," *Central Asian Journal of Mathematical Theory and Computer Sciences*, vol. 4, no. 6, pp. 53–71, 2023.
- [40] S. S. Rajest, S. Silvia Priscila, R. Regin, T. Shynu, and R. Steffi, "Application of Machine Learning to the Process of Crop Selection Based on Land Dataset," *International Journal on Orange Technologies*, vol. 5, no. 6, pp. 91–112, 2023.
- [41] T. Shynu, A. J. Singh, B. Rajest, S. S. Regin, and R. Priscila, "Sustainable intelligent outbreak with self-directed learning system and feature extraction approach in technology," *International Journal of Intelligent Engineering Informatics*, vol. 10, no. 6, pp.484-503, 2022.
- [42] S. S. Priscila, D. Celin Pappa, M. S. Banu, E. S. Soji, A. T. A. Christus, and V. S. Kumar, "Technological frontier on hybrid deep learning paradigm for global air quality intelligence," in *Cross-Industry AI Applications*, IGI Global, pp. 144–162, 2024.
- [43] S. S. Priscila, E. S. Soji, N. Hossó, P. Paramasivan, and S. Suman Rajest, "Digital Realms and Mental Health: Examining the Influence of Online Learning Systems on Students," *FMDB Transactions on Sustainable Techno Learning*, vol. 1, no. 3, pp. 156–164, 2023.
- [44] S. R. S. Steffi, R. Rajest, T. Shynu, and S. S. Priscila, "Analysis of an Interview Based on Emotion Detection Using Convolutional Neural Networks," *Central Asian Journal of Theoretical and Applied Science*, vol. 4, no. 6, pp. 78–102, 2023.
- [45] J. Cao, G. Bhuvanewari, T. Arumugam, and A. B. R, "The digital edge: Examining the relationship between digital competency and language learning outcomes," *Frontiers in Psychology*, vol. 14, Jun. 2023.
- [46] J. Rehman, M. Kashif, and T. Arumugam, "From the land of Gama: Event attachment scale (EAS) development exploring fans' attachment and their intentions to spectate at traditional gaming events," *International Journal of Event and Festival Management*, vol. 14, no. 3, pp. 363–379, Jun. 2023.
- [47] K. U. Kiran and T. Arumugam, "Role of programmatic advertising on effective digital promotion strategy: A conceptual framework," *Journal of Physics: Conference Series*, vol. 1716, p. 012032, Dec. 2020.
- [48] M. A. Sanjeev, A. Thangaraja, and P. K. S. Kumar, "Multidimensional scale of perceived social support: Validity and reliability in the Indian context," *International Journal of Management Practice*, vol. 14, no. 4, p. 472, 2021.
- [49] M. A. Sanjeev, S. Khademizadeh, T. Arumugam, and D. K. Tripathi, "Generation Z and intention to use the digital library: Does personality matter?," *The Electronic Library*, vol. 40, no. 1/2, pp. 18–37, Dec. 2021.
- [50] S. Gupta, N. Pande, T. Arumugam, and M. A. Sanjeev, "Reputational impact of COVID-19 pandemic management on World Health Organization among Indian public health professionals," *Journal of Public Affairs*, Oct. 2022.
- [51] S. Hameed, S. Madhavan, and T. Arumugam, "Is consumer behaviour varying towards low and high involvement products even sports celebrity endorsed?," *International Journal of Scientific & Technology Research*, vol. 9, no. 3, Mar. 2020. [Online]. Available: <https://www.ijstr.org/final-print/mar2020/Is-Consumer-Behaviour-Varying-Towards-Low-And-High-Involvement-Products-Even-Sports-Celebrity-Endorsed.pdf>
- [52] S. Verma, N. Garg, and T. Arumugam, "Being ethically resilient during COVID-19: A cross-sectional study of Indian supply chain companies," *The International Journal of Logistics Management*, Aug. 2022.
- [53] T. Arumugam, B. L. Lavanya, V. Karthik, K. Velusamy, U. K. Kommuri, and D. Panneerselvam, "Portraying women in advertisements: An analogy between past and present," *The American Journal of Economics and Sociology*, vol. 81, no. 1, pp. 207–223, Jan. 2022.

- [54] T. Arumugam, B. Subramaniam, B. Jayakrishnan, V. Asi, M. Reddy, and Ranganathan, "Financial reengineering perspectives of Government of India with respect to time series effect and performance of sovereign gold bond," Accessed: Aug. 06, 2024. [Online]. Available: <https://www.ijstr.org/final-print/mar2020/Financial-Reengineering-Perspectives-Of-Government-Of-India-With-Respect-To-Time-Series-Effect-And-Performance-Of-Sovereign-Gold-Bond.pdf>
- [55] T. Arumugam, K. M. Ashifa, V. Vinayagalakshmi, U. Kiran, and S. Ramya, "Big Data in Driving Greener Social Welfare and Sustainable Environmental Management," *Advances in Business Information Systems and Analytics Book Series*, pp. 328–343, Dec. 2023.
- [56] T. Arumugam, M. A. Sanjeev, R. K. Mathai, S. R. Boselin Prabhu, R. Balamourougane, and T. Jarin, "An empirical verification of the proposed distributor marketing intelligence system model," *International Journal of Business Information Systems*, vol. 45, no. 4, pp. 454–473, Jan. 2024.
- [57] T. Arumugam, R. Arun, R. Anitha, P. L. Swerna, R. Aruna, and V. Kadiresan, "Advancing and methodizing artificial intelligence (AI) and socially responsible efforts in real estate marketing," *Advances in Business Information Systems and Analytics Book Series*, pp. 48–59, Dec. 2023.
- [58] T. Arumugam, R. Arun, S. Natarajan, K. K. Thoti, P. Shanthi, and U. K. Kommuri, "Unlocking the Power of Artificial Intelligence and Machine Learning in Transforming Marketing as We Know It," *Advances in Business Information Systems and Analytics Book Series*, pp. 60–74, Dec. 2023.
- [59] T. Arumugam, R. Mathai, K. Balasubramanian, Renuga K., M. Rafiq, and V. Kalyani, "The mediating effect of customer intimacy on electronic word of mouth (eWOM) in social networking sites on buying intention," *Zenodo (CERN European Organization for Nuclear Research)*, Sep. 2021.
- [60] T. Arumugam, S. Sethu, V. Kalyani, S. S. Hameed, and P. Divakar, "Representing women entrepreneurs in Tamil movies," *The American Journal of Economics and Sociology*, vol. 81, no. 1, pp. 115–125, Jan. 2022.
- [61] T. Arumugam, S. Shahul Hameed, and M. A. Sanjeev, "Buyer behaviour modelling of rural online purchase intention using logistic regression," *International Journal of Management and Enterprise Development*, vol. 22, no. 2, pp. 139–139, Jan.
- [62] T. Arumugam, "An evolution of distributors' marketing intelligence system (DMIS) among FMCG distributors: A conceptual frame work," *International Journal of Multidisciplinary Education and Research*, vol. 1, no. 5, pp. 11–13, Jul. 2016.
- [63] U. K. Kommuri and T. Arumugam, "Greenwashing Unveiled: How It Impacts Stakeholder Perception as well as Sustainability Realities," *Shanlax International Journal of Arts Science and Humanities*, vol. 11, no. S3-Feb, pp. 96–101, Feb. 2024.
- [64] V. Kadiresan, T. Arumugam, M. Selamat, and B. Parasuraman, "Pull factors, career anchor and turnover of academicians in Malaysian higher education," *Journal of International Business and Economics*, vol. 16, no. 4, pp. 59–80, Oct. 2016.
- [65] V. Kadiresan, T. Arumugam, N. Jayabalan, A. R. H. Binti, and C. Ramendran SPR, "HR practices and employee retention. Leader-Member Exchange (LMX) as a mediator," *International Journal of Engineering and Advanced Technology*, vol. 8, no. 6S3, pp. 618–622, Nov. 2019.
- [66] G. A. Ogunmola, M. E. Lourens, A. Chaudhary, V. Tripathi, F. Effendy, and D. K. Sharma, "A holistic and state of the art of understanding the linkages of smart-city healthcare technologies," in *2022 3rd International Conference on Smart Electronics and Communication (ICOSEC)*, Trichy, India, 2022.
- [67] P. Sindhuja, A. Kousalya, N. R. R. Paul, B. Pant, P. Kumar, and D. K. Sharma, "A Novel Technique for Ensembled Learning based on Convolution Neural Network," in *2022 International Conference on Edge Computing and Applications (ICECAA)*, IEEE, Tamil Nadu, India, pp. 1087–1091, 2022.
- [68] R. B. M. Saleh, S. Venkatasubramanian, N. R. R. Paul, F. I. Maulana, F. Effendy, and D. K. Sharma, "Real-time monitoring system in IoT for achieving sustainability in the agricultural field," in *2022 International Conference on Edge Computing and Applications (ICECAA)*, Tamil Nadu, India, 2022.
- [69] Srinivasa, D. Baliga, N. Devi, D. Verma, P. P. Selvam, and D. K. Sharma, "Identifying lung nodules on MRR connected feature streams for tumor segmentation," in *2022 4th International Conference on Inventive Research in Computing Applications (ICIRCA)*, Tamil Nadu, India, 2022.
- [70] Goswami, A. Das, K. I. Ogaili, V. K. Verma, V. Singh, and D. K. Sharma, "Device to device communication in 5G network using device-centric resource allocation algorithm," in *2022 4th International Conference on Inventive Research in Computing Applications (ICIRCA)*, Tamil Nadu, India, 2022.

- [71] M. Yuvarasu, A. Balaram, S. Chandramohan, and D. K. Sharma, "A Performance Analysis of an Enhanced Graded Precision Localization Algorithm for Wireless Sensor Networks," *Cybernetics and Systems*, pp. 1–16, 2023, Press.
- [72] P. P. Dwivedi and D. K. Sharma, "Evaluation and ranking of battery electric vehicles by Shannon's entropy and TOPSIS methods," *Math. Comput. Simul.*, vol. 212, no.10, pp. 457–474, 2023.
- [73] P. P. Dwivedi and D. K. Sharma, "Assessment of Appropriate Renewable Energy Resources for India using Entropy and WASPAS Techniques," *Renewable Energy Research and Applications*, vol. 5, no. 1, pp. 51–61, 2024.
- [74] P. P. Dwivedi and D. K. Sharma, "Selection of combat aircraft by using Shannon entropy and VIKOR method," *Def. Sci. J.*, vol. 73, no. 4, pp. 411–419, 2023.
- [75] W. M. Ead, W. F. Abdel-Wahed, and H. Abdul-Kader, "Adaptive fuzzy classification-rule algorithm in detection malicious web sites from suspicious URLs," *International Arab Journal of e-Technology*, vol. 3, pp. 1–9, 2013.
- [76] M. A. Abdelazim, M. M. Nasr, and W. M. Ead, "A survey on classification analysis for cancer genomics: Limitations and novel opportunity in the era of cancer classification and target therapies," *Annals of Tropical Medicine and Public Health*, vol. 23, no. 24, 2020.
- [77] F. K. Alsheref, I. E. Fattoh, and W. M. Ead, "Automated prediction of employee attrition using ensemble model based on machine learning algorithms," *Computational Intelligence and Neuroscience*, vol. 2022, pp. 1–9, 2022.
- [78] Kumar, J., & Rani, V., "Investigating the dynamics of FinTech adoption: an empirical study from the perspective of mobile banking", *Journal of Economic and Administrative Sciences*, April 2024.
- [79] Kumar, J., Rani, G., Rani, M., & Rani, V, "Do green banking practices improve the sustainability performance of banking institutions? The mediating role of green finance", *Social Responsibility Journal*, July 2024.
- [80] Kumar, J., Rani, M., Rani, G., & Rani, V, "Human-machine dialogues unveiled: an in-depth exploration of individual attitudes and adoption patterns toward AI-powered ChatGPT systems", *Digital Policy, Regulation and Governance*, 26(4), 435-449, April 2024.
- [81] Kumar, J., Rani, V., Rani, G., & Rani, M. (2024). Understanding purchase behaviour towards green housing among millennials: the mediating role of purchase intention. *International Journal of Housing Markets and Analysis*, April 2024.
- [82] Kumar, J., & Rani, V. (2024). Financial innovation and gender dynamics: a comparative study of male and female FinTech adoption in emerging economies. *International Journal of Accounting & Information Management*, August 2024.
- [83] Kumar, J., Rani, G., Rani, M. and Rani, V. (2024). Blockchain technology adoption and its impact on SME performance: insights for entrepreneurs and policymakers. *Journal of Enterprising Communities: People and Places in the Global Economy*, Vol. ahead-of-print No. ahead-of-print, August 2024.
- [84] Kumar, J., & Rani, V., "What do we know about cryptocurrency investment? An empirical study of its adoption among Indian retail investors," *The Bottom Line*, February 2024, Vol. 37 No. 1, pp. 27-44.
- [85] Rani, V., & Kumar, J., "Gender differences in FinTech adoption: What do we know, and what do we need to know?", *Journal of Modelling in Management*.
- [86] Senapati and B. S. Rawal, "Adopting a deep learning split-protocol based predictive maintenance management system for industrial manufacturing operations," in *Big Data Intelligence and Computing. DataCom 2022*, C. Hsu, M. Xu, H. Cao, H. Baghban, and A. B. M. Shawkat Ali, Eds., *Lecture Notes in Computer Science*, vol. 13864. Singapore: Springer, 2023, pp. 25–38.
- [87] Senapati and B. S. Rawal, "Quantum communication with RLP quantum resistant cryptography in industrial manufacturing," *Cyber Security and Applications*, vol. 1, 2023, Art. no. 100019.
- [88] Senapati et al., "Wrist crack classification using deep learning and X-ray imaging," in *Proceedings of the Second International Conference on Advances in Computing Research (ACR'24)*, K. Daimi and A. Al Sadoon, Eds., *Lecture Notes in Networks and Systems*, vol. 956. Cham: Springer, 2024, pp. 72–85.
- [89] Muthulakshmi, J. Tamilselvi, and S. S. Hameed, "Moderating effects of challenges on self-efficacy and satisfaction of women street vendors," *Int. J. Electron. Finance*, vol. 13, no. 3, pp. 386–402, 2024.
- [90] T. Arumugam, S. S. Hameed, J. M. Ehya, V. Kadiresan, and R. Krishnaraj, "Impact of Artificial Intelligence on Customer Journey Mapping and Experience Design," in *Optimizing Intelligent Systems for Cross-Industry Application*, pp. 121–136, IGI Global, 2024.
- [91] V. Kadiresan, S. S. Hameed, and B. Subramaniam, "Empathizing the Effect of Mobile Coupon Promotions on Social Shopping Behaviour," *FMDB Trans. Sustain. Hum. Soc.*, vol. 1, no. 1, pp. 30–38, 2024.

-
- [92] T. Arumugam, S. Hameed, J. M. Ehya, R. Krishnaraj, and S. Subbulakshmi, "Empowering Distributors by Leveraging Consumer Tenacity With Advanced Marketing Intelligence Systems and Intelligent Process Automation," in *Advancements in Intelligent Process Automation*, pp. 459–480, IGI Global, 2025.
- [93] S. Chundru, "Harnessing AI's Potential: Transforming Metadata Management with Machine Learning for Enhanced Data Access and Control," *International Journal of Advances in Engineering Research*, vol. 27, no. 2, pp. 39-49, 2024.
- [94] S. Chundru, "Beyond Rules-Based Systems: AI-Powered Solutions for Ensuring Data Trustworthiness," *International Transactions in Artificial Intelligence*, vol. 7, no. 7, p. 17, 2023.
- [95] Pothu, A. R., "Celery Trap: A Browser and Email-Based Extension for Proactive Phishing, Spearphishing, and Web Threat Detection," SSRN, Oct. 10, 2024. [Online]. Available: <https://ssrn.com/abstract=4983399>.
- [96] M. A. Raj, M. A. Thinesh, S. S. M. Varmann, A. R. Pothu, and P. Paramasivan, "Ensemble-Based Phishing Website Detection Using Extra Trees Classifier," *AVE Trends In Intelligent Computing Systems*, vol. 1, no. 3, pp. 142 – 156, 2024.
- [97] Agussalim, Rusli, A. Rasjid, M. Nur, T. Erawan, Iwan, and Zaenab, "Caffeine in student learning activities," *J. Drug Alcohol Res.*, vol. 12, no. 9, Ashdin Publishing, 2023.
- [98] Agussalim, S. N. Fajriah, A. Adam, M. Asikin, T. Podding, and Zaenab, "Stimulant drink of the long driver lorry in Sulawesi Island, Indonesia," *J. Drug Alcohol Res.*, vol. 13, no. 3, Ashdin Publishing, 2024.