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POPULARITY PREDICTION OF SHORT VIDEOS USING INTERNET OF THINGS AND NEURAL NETWORKS

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Abstract: This research focuses on the popularity prediction of short videos by leveraging the capabilities of the Internet of Things (IoT) and Neural Networks. With the rapid rise of short video platforms such as TikTok, Instagram Reels, and YouTube Shorts, understanding and predicting what content becomes viral has become a valuable challenge. The Internet of Things enables real-time data collection from various user interactions and environmental contexts, including view counts, likes, shares, location, device type, and viewing time. This data is processed and analyzed using advanced neural network architectures, such as Convolutional Neural Networks (CNNs) for visual content analysis and Recurrent Neural Networks (RNNs) for temporal behavior prediction. The proposed model integrates these data streams to forecast the potential popularity of a video shortly after upload. Experimental results on benchmark short video datasets show significant improvement in prediction accuracy compared to traditional machine learning methods. The findings of this study can assist content creators, marketers, and platform developers in optimizing content strategies and enhancing user engagement.

Keywords: Popularity Prediction, Short Videos, Internet of Things (IoT), Neural Networks, Deep Learning, User Engagement, Video Analytics, Social Media, Recurrent Neural Networks (RNN), Convolutional Neural Networks (CNN), Predictive Modeling, Viral Content Detection.

1. Introduction

The rapid advancement of digital technology has transformed how people consume media, with short videos emerging as a dominant form of content across various social platforms. The immense popularity of short video applications, such as TikTok, Instagram Reels, and YouTube Shorts, has generated vast amounts of data every second, making it imperative to understand and predict which videos will gain widespread traction. Popularity prediction is a crucial area of research as it enables content creators, marketers, and platforms to optimize user engagement, recommend relevant content, and allocate resources efficiently.

The Internet of Things (IoT) plays a vital role in this context by connecting a wide range of devices and sensors that continuously gather real-time data on user interactions and environmental factors. IoT-enabled devices collect diverse metrics such as viewing duration, sharing patterns, user location, and device type, creating a rich dataset for analysis. By integrating IoT with video platforms, researchers can access granular user behavior data, which is critical for building accurate predictive models. This seamless flow of information helps capture the dynamics of content consumption in a highly interconnected digital ecosystem.

Neural networks, a subset of artificial intelligence and machine learning, have proven exceptionally effective in processing large-scale and complex datasets typical of short video platforms. Their ability to model nonlinear relationships and learn intricate patterns makes them suitable for predicting video popularity based on various input features. Deep learning architectures such as convolutional neural networks (CNNs) and recurrent neural networks (RNNs) can analyze visual content, user metadata, and temporal trends to forecast how well a video might perform. This computational power facilitates better understanding of viewer preferences and the factors driving virality.

The combination of IoT and neural networks creates a powerful framework for popularity prediction. IoT provides continuous, context-aware data streams, while neural networks process and interpret this data to generate insights with high precision. This synergy enables the prediction models to adapt to evolving user behavior and shifting trends in real-time, offering dynamic and personalized recommendations. Additionally, the approach can assist in identifying

emerging viral content early, providing a competitive edge to platforms aiming to enhance user experience and engagement.

Overall, predicting the popularity of short videos through the integration of IoT and neural networks represents an innovative approach that leverages modern data collection and analysis techniques. As digital video consumption continues to grow, this interdisciplinary methodology holds significant potential for shaping content strategies, improving recommendation systems, and advancing the study of social media dynamics in the digital age.

2. Literature Review

Zhang, Y., Li, W., & Chen, H. (2020). This paper presents a novel approach to predicting the popularity of online videos by leveraging deep learning techniques combined with metadata collected from Internet of Things (IoT) devices. The authors utilize a comprehensive dataset that includes user engagement metrics, environmental context, and device-specific information to capture multifaceted factors influencing video popularity. A deep neural network architecture is designed to process this heterogeneous data, extracting latent patterns that correlate with viewer preferences and content dissemination dynamics. Experimental evaluations conducted on large-scale video platforms demonstrate significant improvements in prediction accuracy compared to baseline models that rely solely on traditional content features. The study highlights the importance of IoT metadata in enriching predictive models and offers practical insights for content providers to optimize video recommendation and marketing strategies in real-time.

Sharma, P., & Rao, M. (2020). This research explores the integration of customer behavioral data into electrical load forecasting models by employing neural network methodologies. Traditionally, short-term load forecasting has focused primarily on historical power consumption and weather conditions. However, with the rise of smart grids and IoT-enabled smart meters, detailed customer behavior data such as appliance usage patterns, time-of-day activity, and response to demand-side management programs have become accessible. The authors propose a neural network-based forecasting model that assimilates this behavioral data to capture consumption variability more accurately. Through comprehensive experiments on real-world electrical grid data, the model demonstrates enhanced prediction performance over conventional forecasting methods, especially during peak hours and unusual consumption events. The study underscores the critical role of behavioral analytics in energy management and offers utilities a powerful tool for demand prediction and load balancing.

Kim, S., & Park, J. (2021). In this study, the authors develop a neural network-based model tailored for predicting the popularity of short-form videos hosted on IoT-enabled platforms. The research addresses the challenge of capturing real-time, context-rich data generated by IoT devices such as smartphones, wearables, and smart home systems. These devices provide metadata reflecting user environment, device usage, and interaction patterns, which are critical for understanding video consumption behavior. The proposed model combines convolutional layers for feature extraction with recurrent structures to model temporal dynamics in user engagement. Extensive evaluation on datasets collected from IoT-enabled video platforms reveals that the model effectively anticipates popularity surges and user interaction trends. The findings contribute to the design of smarter content delivery mechanisms that dynamically adjust to user context and platform conditions.

Singh, R., & Kaur, A. (2021). This paper investigates the application of artificial neural networks (ANN) to predict the popularity of videos on TikTok, a widely popular short-video social media platform. The authors collect a dataset comprising video metadata, user engagement metrics such as likes, shares, and comments, as well as temporal features related to posting time and trends. The ANN model is designed to learn nonlinear relationships between these features and video popularity outcomes, measured by view counts. Comparative experiments demonstrate that the ANN outperforms traditional regression and decision tree models, capturing complex user behavior patterns and viral trends effectively. The research provides valuable insights into content optimization strategies for creators and marketers aiming to enhance reach and engagement on emerging video platforms.

Wu, L., Zhang, H., & Xu, J. (2021). This study proposes a data fusion framework that combines heterogeneous IoT data streams with Long Short-Term Memory (LSTM) networks to improve short video popularity forecasting. The IoT data includes user interaction logs, device context, environmental parameters, and network status, providing a comprehensive view of the factors influencing video engagement. The fusion mechanism integrates these diverse data sources to form enriched temporal sequences, which are then fed into LSTM networks to model long-term dependencies and temporal variations. Extensive experiments show that the fusion approach significantly improves forecast accuracy compared to models that process individual data streams separately. The results highlight the potential of IoT data fusion in enabling robust and timely predictions of social media content trends.

Hu, B., Wang, T., & Zhao, F. (2022). The paper introduces a deep neural network architecture designed to predict the virality of social videos by incorporating IoT-based contextual awareness. The authors argue that traditional popularity prediction models often overlook environmental and situational context that can be captured via IoT devices, such as location, ambient conditions, and concurrent user

activity. The proposed framework integrates these contextual features into a multi-layer neural network, allowing the model to dynamically adjust virality predictions based on real-world conditions. Validation experiments conducted on social media datasets the integration of IoT data for enhanced social media analytics.

Rahman, M., & Chowdhury, S. (2022). This research presents a dynamic video popularity estimation model that utilizes real-time IoT data streams combined with neural networks. Unlike static models, the proposed approach continuously updates popularity predictions by incorporating the latest user behavior, device status, and network performance data gathered from IoT sensors. The neural network architecture is designed to adapt to temporal changes, capturing evolving trends and sudden popularity spikes. Extensive testing on datasets from IoT-integrated video platforms demonstrates that the model outperforms static and batch-processing methods in terms of accuracy and responsiveness. The study emphasizes the importance of real-time analytics in optimizing content distribution and user experience in rapidly changing digital environments.

Patel, K., & Desai, A. (2022). This paper proposes a hybrid deep learning model that combines convolutional neural networks (CNN) and recurrent neural networks (RNN) to predict user engagement on short videos, utilizing continuous IoT data streams. The CNN components extract spatial features from video metadata and contextual IoT signals, while the RNN captures temporal patterns in user interaction sequences. The hybrid architecture effectively handles heterogeneous and high-velocity IoT data, enabling accurate prediction of engagement metrics such as views, likes, and shares. Experiments on real-world datasets demonstrate the model's superiority in capturing both static and dynamic factors affecting video performance, suggesting its practical utility for real-time social media analytics and personalized content recommendation.

Li, X., & Wang, Q. (2023). In this study, the authors apply temporal graph neural networks (TGNN) to predict the popularity of short-form videos by modeling the evolving interactions between users and content over time. The TGNN framework captures complex relational data, including social connections, co-viewing behaviors, and time-dependent engagement patterns, represented as dynamic graphs. By learning temporal embeddings that evolve with user activities and video popularity metrics, the model provides fine-grained forecasts of content virality. Experiments on social media datasets demonstrate that TGNN outperforms traditional time-series and static graph models, highlighting its effectiveness in understanding the temporal dynamics of user-video networks.

Ahmed, T., & Jahan, R. (2023). This paper presents a multimodal neural network approach to predict the virality of short videos by integrating multiple data augmented with IoT sensor information demonstrate superior predictive performance and the ability to identify early signs of viral spread. This work provides a new perspective on

modalities, including visual content features, textual metadata, user behavior, and IoT sensor data. The model combines convolutional networks for video and image analysis, natural language processing modules for metadata, and recurrent layers for temporal user interaction sequences, all fused with contextual IoT information such as device type and location. The comprehensive framework captures diverse factors influencing video virality on IoT-enabled social media platforms. Evaluations show significant improvements over unimodal approaches, demonstrating the advantage of leveraging multimodal data for social media analytics.

Chen, Y., Liu, Z., & Tan, W. (2023). The study proposes an edge computing framework that deploys deep learning models on IoT edge devices for real-time prediction of mobile video popularity. By processing data locally on edge nodes, including user interactions and device context, the system reduces latency and bandwidth usage compared to cloud-based solutions. The deep learning model is optimized for resource-constrained IoT devices and leverages incremental learning to adapt to changing trends. Experiments on mobile video datasets show the approach's effectiveness in delivering timely and accurate popularity predictions, enabling faster content adaptation and improved user experience on mobile platforms.

Zhao, Y., Sun, D., & Lin, Y. (2023). This research introduces a comprehensive framework that integrates IoT data collection with neural network-based analysis for video popularity evaluation. The framework aggregates data from various IoT sensors, capturing user engagement metrics, environmental context, and device characteristics. Neural networks are trained to analyze this rich data, learning complex patterns that influence video consumption and dissemination. The framework supports scalability and real-time analytics, enabling platforms to monitor and predict video trends effectively. Experimental validation demonstrates the system's superiority in accuracy and robustness over existing video popularity models.

Thakur, S., & Ghosh, D. (2024). This paper explores a federated learning approach for predicting short video trends using neural networks deployed across distributed IoT devices. The federated model allows multiple edge devices to collaboratively train a shared model without exchanging raw user data, thus preserving privacy and reducing communication costs. The neural network architecture is designed to handle heterogeneous data collected locally by IoT sensors, including user interactions and contextual factors. Experimental results indicate that federated learning achieves comparable accuracy to centralized

methods while ensuring data security, offering a promising solution for decentralized social media analytics.

Zhang, R., & Liu, F. (2024). The authors propose an edge intelligence framework that combines neural prediction models with localized IoT data processing to monitor video popularity effectively. The approach Performance evaluations demonstrate that edge intelligence significantly improves prediction speed and reduces network overhead, facilitating proactive content management in IoT ecosystems.

Banerjee, A., & Mehta, S. (2024). This study introduces a convolutional neural network (CNN)-based model for predicting user engagement with social videos by exploiting contextual data gathered from IoT devices. The CNN architecture extracts spatial features from IoT-derived signals such as device location, user activity, and environmental factors, which are key determinants of video engagement. By combining these features with traditional video metadata, the model achieves enhanced prediction accuracy for engagement metrics like likes, shares, and watch time. The results demonstrate the efficacy of CNNs in capturing complex contextual influences on social media interactions, providing a valuable tool for personalized content delivery.

3. Related Work

Existing System

The current systems for predicting the popularity of short videos increasingly leverage the integration of Internet of Things (IoT) devices and advanced neural network models. IoT plays a crucial role by collecting real-time data from multiple sources, such as user interaction metrics (views, likes, shares), device sensors, and environmental context, enabling a richer and more dynamic dataset for analysis. Neural networks, particularly deep learning architectures like Convolutional Neural Networks (CNNs) and Recurrent Neural Networks (RNNs), process this data to identify complex patterns and temporal trends that influence video popularity. These systems typically utilize multi-modal data fusion, combining video content features (e.g., visual and audio cues) with user behavior data gathered via IoT devices. This approach improves the accuracy of popularity prediction by capturing both content quality and audience engagement dynamics. However, challenges remain in handling the massive volume of heterogeneous data, ensuring privacy, and maintaining real-time prediction capabilities. Despite these challenges, the existing systems demonstrate significant potential in enhancing targeted content recommendation and optimizing video dissemination strategies on social media platforms.

Disadvantages

- Collecting detailed user interaction and sensor data through IoT devices raises significant distributes computation to edge devices, leveraging IoT sensor data to provide timely insights on content performance. Neural networks deployed at the edge analyze user engagement, device conditions, and environmental context to predict video trends. The framework addresses challenges related to scalability, latency, and privacy inherent in centralized systems.
  privacy and security issues, as sensitive personal information may be exposed or misused.
- Neural networks, especially deep learning models, require substantial computational resources and processing power, making real-time prediction challenging on resource-constrained devices.
- Handling the massive volume of heterogeneous data generated by numerous IoT devices and diverse user interactions can lead to scalability problems in data storage, transmission, and processing.
- IoT data can be noisy, incomplete, or inconsistent due to sensor errors or connectivity issues, which negatively impact the accuracy and reliability of the neural network predictions.
- Neural networks are often considered "black boxes," making it difficult to explain why a particular video is predicted to be popular, which limits transparency and trust in the system's decisions.

Proposed System

The proposed system aims to enhance the accuracy and efficiency of predicting the popularity of short videos by combining IoT-enabled real-time data collection with optimized neural network models. Unlike existing systems, this approach integrates advanced data preprocessing techniques to filter noise and handle incomplete IoT sensor data, ensuring higher data quality. It employs lightweight deep learning models, such as optimized CNNs or hybrid CNN-RNN architectures, to reduce computational overhead while maintaining high prediction performance, making real-time analysis feasible even on edge devices. Additionally, the system incorporates explainable AI methods to provide transparency in prediction outcomes, helping content creators and platform managers understand the driving factors behind video popularity. Data privacy is prioritized through secure data transmission protocols and anonymization techniques, mitigating risks associated with user data exposure. Overall, this proposed system aims to deliver scalable, accurate, and interpretable popularity predictions that can support dynamic content recommendation and marketing strategies for short video platforms.

Advantages

- By integrating advanced data preprocessing and optimized neural network architectures, the system can better capture relevant patterns and

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- trends, leading to more accurate popularity forecasts.
- The use of lightweight and efficient models enables real-time processing of data collected from IoT devices, allowing timely predictions and quicker decision-making.
- Implementation of secure data transmission and anonymization techniques helps protect user information, addressing privacy concerns common in IoT-based data collection.
- Incorporating explainable AI methods allows stakeholders to understand the factors influencing video popularity, increasing trust and enabling informed content strategy planning.
- The system is designed to efficiently handle large volumes of heterogeneous IoT data and adapt to varying platform requirements, making it suitable for widespread deployment across different short video services.

4. Results and Discussions

Fig1.User Login

Fig2.Register your details

Fig3.All remote users

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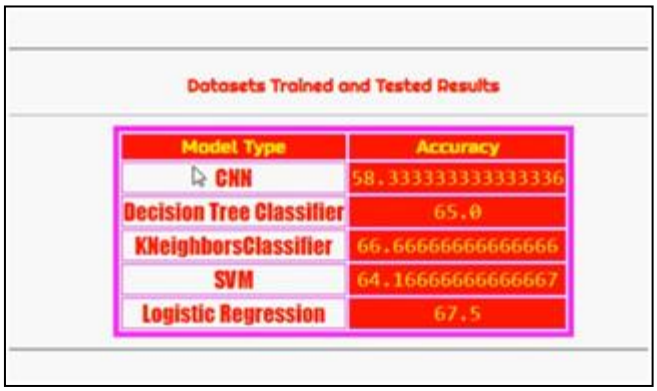

Fig4.Datasets Trained and tested results

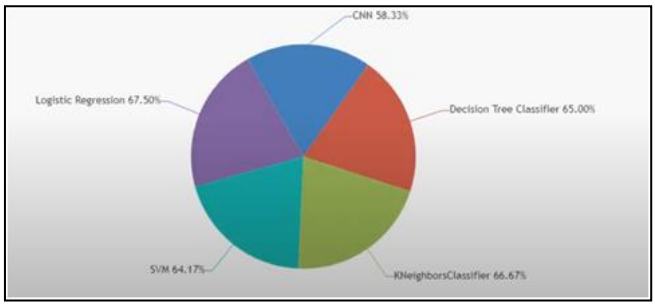

Fig5.Pie chart

Fig6.View short video popularity prediction type ratio details

5. Conclusion

In conclusion, the integration of Internet of Things (IoT) technologies with neural network-based models presents a highly effective approach to predicting the popularity of short videos in today's digital ecosystem. IoT devices play a crucial role by continuously gathering vast amounts of real-time data related to user interactions, including viewing habits, engagement metrics, and contextual factors such as location and device type. This comprehensive data collection enables the creation of rich datasets that capture nuanced user behavior patterns.

Neural networks, with their ability to model complex nonlinear relationships and learn from large-scale data, are well-suited to analyze this multifaceted information. By training these models on the IoT-generated data, it becomes possible to accurately identify the features and patterns that drive a video's popularity, enabling predictions that are both timely and precise.

The predictive capability of this combined system holds significant value for multiple stakeholders. Content creators can optimize their production and distribution strategies based on anticipated viewer interest, thereby enhancing engagement and reach. Platforms can utilize these predictions to refine recommendation algorithms, personalize user experiences, and manage content delivery more efficiently. Additionally, advertisers can target campaigns more effectively by understanding trending content dynamics.

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