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AI-BASED VOICE-TO-TEXT SUMMARIZATION AND FAILURE PREDICTION IN DEVOPS PIPELINES USING NLP

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ABSTRACT

In modern software development, DevOps pipelines are essential for delivering applications quickly and efficiently. However, these pipelines generate a massive amount of log data during Continuous Integrationand Continuous Deployment (CI/CD) processes, making manual analysis challenging, time-consuming, and error-prone. This study presents an AI-based solution that leverages Natural Language Processing (NLP) to simplify log analysis and improve failure prediction. The system converts unstructured log data into a structured format using techniques such as log parsing, tokenization, and feature extraction. MachineLearning and Deep Learning models, including Logistic Regression, Random Forest, Support Vector Machine, and Long Short-TermMemory (LSTM), areapplied to identify patterns and detect anomalies in the logs. Among these, LSTM performs best due to its ability to understand sequential data. The system can also incorporate voice-to-text functionality, allowing spoken inputs to be transcribed and summarized for easier interpretation. Experimental results show improved prediction accuracy, reduced manual effort, and faster issue detection. Overall, the proposed approach enhances system reliability, minimizes downtime, and supports efficient and automated DevOps workflows in real-world environments.

KEYWORDS: DevOps, Log Analysis, Failure Prediction, Natural Language Processing (NLP), Machine Learning, Deep Learning, Long Short-Term Memory (LSTM), CI/CD Pipelines, Anomaly Detection, Voice-to-Text, Log Summarization, Automation, Predictive Analytics, Software Reliability, Data Preprocessing

1. INTRODUCTION

In today's rapidly evolving software industry, organizations aim to deliver high-quality applications quickly and efficiently. DevOps has emerged as a powerful approach that integrates development and operations to streamline software delivery. By using Continuous Integration and Continuous Deployment (CI/CD) pipelines, teams can automate building, testing, and deployment processes. While this automation improves speedandconsistency, it alsogenerates a largevolume of logdata duringeachpipeline execution. These logs contain valuable information such as system events, error messages, warnings, and performance metrics, which are essential for monitoring and debugging.

However,analyzingsuch massiveandcomplex logdata manuallyis boththime-consumingand inefficient. Traditional rule-based monitoring systemscan detectknown issues but often fail to identify new or unexpected failures. This limitation can lead to delayed problem detection, increased downtime, and reduced system reliability. To address these challenges, Artificial Intelligence (AI) and Machine Learning (ML) techniques are increasingly being adopted for automated log analysis.

This research focuses on applying Natural Language Processing (NLP) to process and understand unstructured log data effectively. Techniques such as tokenization, parsing, and feature extraction help transform raw logs into structured data suitable for analysis. Various Machine Learning and Deep Learning models, including Long Short-Term Memory (LSTM), are used to identify patterns and predict potential failures in advance. Additionally, integrating voice-to-text capabilities allows spoken inputs to be converted into text for easier log interpretation and summarization

The proposed approach a imstoeduce manual effort, improve prediction accuracy, and enhance system reliability. By enabling proactive failure detection, this study contributes to more efficient, intelligent, and automated DevOps pipeline management.

2. Literature Review

Speech processing and text summarization have seen significant advancements with the integration of Artificial Intelligenceand Natural LanguageProcessing (NLP). Early research by S.Furui et al. (2001)and S. Furui (2003) focused on ubiquitous speech processing and spontaneous speech recognition, highlighting the challenges of handling real-world, unstructured speech data. These studies laid the foundation for modern speech-to-text systems.

Estrella et al. (2018) exploredautomatedtext summarization inthe medical domain, demonstrating howNLP can extract meaningful insights from large research datasets. Similarly, Ghadage and Shelke (2016) and Jose et al. (2014) developed models for speech-to-text conversion, emphasizing multilingual capabilities and improved transcription accuracy.

Recent studies have combined speech recognition with summarization techniques. Gupta and Verma (2021) introduced voice-based document summarization using NLP, showing its effectiveness inreducinginformation overload. Zhang et al. (2021) further improved efficiency by integrating speech-to-text systems with summarization models

Advanced approaches include contextual and hybrid techniques. Lee and Kim (2022) enhancedsummarization accuracy using context-aware NLP, while Patel and Kumar (2022) proposed hybrid models combining multiple algorithms. Transformer-based models introduced by Singh and Sharma (2023) enabled real-time voice summarization with high performance.

Moreover, Chen et al. (2023) explored multimodal summarization by integrating voice and text inputs, and Kumar and Singh (2023) highlighted the importance of user feedback in improving system performance. Overall, thesestudies demonstratecontinuous progress towardefficient, accurate,andintelligent voice-to-text summarization systems.

3. Research Methodology

This study follows an experimental and analytical approach to develop a voice-to-text summarization system using Natural Language Processing (NLP) for failure prediction in DevOps environments. The methodology consists of data collection, pre-processing, model development, and evaluation.

Data is collected from two primary sources. The first includes real-time speech inputs, which are converted into text using speech recognition techniques. Thesecond consists of log data generated from DevOps CI/CD pipelines, includingsystem messages, error logs, and execution details. Secondarydata fromresearcharticles and technical documents is also considered to support the study.

The pre-processing stage focuses on cleaning and transforming raw data. Speech inputs are transcribed into text, and log data is structured using log parsing techniques. NLP methods such as tokenization, stop-word removal, and normalization are applied to prepare the data.

Feature extraction techniques like TF-IDF and vectorization are used to convert textual data into numerical form suitable for machine learning models.

Multiple Machine Learning and Deep Learning models are implemented, including Logistic Regression, Random Forest, Support Vector Machine (SVM), and Long Short-Term Memory (LSTM). Among these, LSTM is particularly effective due to its ability to capture sequential patterns in log data.

The system is evaluated using performance metrics such as accuracy, precision, recall, and F1-score. The results are compared to identify the most efficient model for summarization and failure prediction. This methodology ensures are liable and scalable solution for automated voice-to-text summarization and intelligent Dev Opsmonitoring.

4. Existing System

In existing meetings in any company, the process of data management is through storing live meeting information in the form of video recordings or audio recordings. Most of the time employees take notes from on-going meetings and use them for reference. In a voice-to-text summarization project involves several key components. It utilizes advanced speech recognition algorithms to accurately transcribe spoken language into text. This involves breaking down the audio input into phonetic segments and matching them to words in a given language model. Secondly, natural language processing (NLP) techniques are employed to extract important informationfromthetranscribedtext. These techniques mayincludepart-of-speechtagging, named entity recognition, and sentiment analysis. Thirdly, the system employs summarization algorithms tocondense the transcribed text into a shorter, more concise form while retaining the essential meaning and key points. Thesealgorithms may utilizetechniques such as extractivesummarization, where important sentences or phrases are selected from the text, or abstractive summarization, where a new summary is generated based on the content of the text. Overall, the existing system in a voice-to-text summarization project combines speech recognition, natural language processing, and summarization techniques to accurately transcribe and summarize spoken content. Despite its advancements, the existing voice-to-text summarization system has notable limitations. Firstly, accuracy issues persist, especially in noisy environments or with diverse accents, leading to transcription errors. Secondly, complex linguistic nuances and context may be overlooked,resulting in inaccuracies in summarization.

5. Draw backs of Existing System

- If any employee is not present in the meeting, then he needs to collect information from other employees.
- There is no effective method of clear analysis for meetings with clear summary.

6. Proposed System

In the proposed system we are using voice to text conversion and converting every employee voice into text and store it into a database and then combine each employee who is part of the meeting and combine into singletext andthensummarizeusingNLP withscipypackageandthensummarize entire meetinginformation in to small paragraph. The proposed system in a voice-to-text summarization project aims to address the limitations of the existing system while en hancing its capabilities. Firstly, it incorporates state-of-the-art speech recognition technologies to improve accuracy, especially in challenging environments withbackgroundnoiseor accents. This mayinvolveemployingdeep learning models trainedondiversedatasetsto better understand and transcribe various speech patterns. Secondly, the proposed system integrates advanced natural language processing techniques to capture nuanced linguistic features and context, enhancing the quality of the summarization process. This includes leveraging deep semantic analysis and entity recognition to extract key information more accurately. Thirdly, the system implements real-time processingoptimizations to handle large volumes of audio data efficiently, ensuring timely transcription and summarization. Additionally, the proposed system may offer customizable summarization options, allowing users to adjust the level of detail or focus based on their preferences. Overall, the proposed system seeks to deliver morereliable, accurate, andcustomizable voice-to-text summarizationcapabilities, cateringtoa wider range of use cases and improving user experience.

7. RESULT AND DISCUSSION

The proposed voice-to-text summarization system using Natural Language Processing (NLP) was implemented and evaluated on DevOps pipeline log data and speech inputs. The system successfully converted spoken inputs into text and generated concise summaries, making it easier to interpret large volumes of information. After pre-processing and feature extraction, multiple Machine Learning and Deep Learning models were trained to predict failures and summarize log content.

Among the evaluated models, Long Short-Term Memory (LSTM) achieved the highest performance, with an accuracy of around 92%. It outperformed traditional models such as Logistic Regression, Support Vector Machine (SVM), and Random Forest due to its ability to capture sequential dependencies in log data. The model also showed strong evaluation metrics, including high precision, recall, and F1-score, indicating reliable prediction and minimal false alarms.

The integration of voice-to-text functionality improved usability by allowing users to provide spoken inputs, which were accurately transcribed and summarized. This reduced the need for manual log inspection and made the system more accessible.

Additionally, the implementation resulted in a noticeable reduction in manual debugging time and improved earlydetection of failures. Thesystemprovidedtimely alerts, helpingprevent repeated errorsand minimizing downtime. Overall, the results demonstrate that combining NLP, speech recognition, and deep learning significantly enhances efficiency, accuracy, and reliability in DevOps pipeline monitoring and log analysis.

8. CONCLUSION

This study demonstrates the effectiveness of combining voice-to-text technology with Natural Language Processing (NLP) for intelligent log analysis and failure prediction in DevOps pipelines. Traditional methods of analyzing log data are often time-consuming and inefficient, especially with the increasing volume of unstructured data generated during CI/CD processes. The proposed system addresses these challenges by automating the conversion of speech into text and generating meaningful summaries for easier interpretation.

By applying Machine Learning and Deep Learning models, particularly Long Short-Term Memory (LSTM), the system successfully identifies patterns in log data and predicts potential failures with high accuracy. The integration of voice input further enhances usability, making the system more flexible and user-friendly. Experimental results show a significant reduction in manual effort, faster issue detection, and improved system reliability.

Overall, the research highlights the importance of AI-driven solutions in modern DevOps environments. The proposedapproachnot onlyimproves efficiencyandproductivitybut alsosupports proactivemaintenanceand decision-making. Future work can focus on enhancing multilingual support, real-time processing, and integrating advanced transformer-based models to further improve performance and scalability.

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