

**Project Team #: 20CSM\_B06**

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**Project Name:**

Video Metadata Generation and Classification using Deep Learning Techniques.

**Abstract:**

The project aims to enhance the efficiency of video metadata generation for ISRO mission and program documentaries by automating the labor-intensive process. The existing approach employs a hybrid model of CNN and LSTM, but it faces challenges related to overfitting and high computational cost. To address these issues, the proposed solution focuses on improving the accuracy of video classification through *meticulous fine-tuning and hyperparameter optimization*. The system's primary objective is to effectively *categorize videos into diverse genres*, such as launch programs, interviews, educational content, outdoor shots, public events, traffic, and more. By *generating metadata like Title, Description, Timestamps, Duration, Tags, and Keywords*, the system aims to analyze video content efficiently and extract pertinent information. This metadata will facilitate easy classification and retrieval, ultimately enhancing the accessibility and utility of ISRO's extensive collection of video documentaries.

<b>Title</b>	Video Metadata Generation and Classification using Deep Learning Techniques
<b>Client</b>	Department of Space, Indian Space Research Organisation (ISRO).
<b>Objective</b>	<p>The main objective of the proposed solution is to streamline and automate the labor-intensive process of video metadata generation for ISRO mission and program documentaries. The system aims to improve the accuracy of video classification by carefully fine-tuning and optimizing hyperparameters. By generating metadata like Title, Description, Timestamps, Duration, Tags, and Keywords, the solution seeks to efficiently analyze video content and extract pertinent information. This will enable the system to effectively categorize videos into diverse genres, including launch programs, interviews, educational content, outdoor shots, public events, traffic, and more. The ultimate goal is to enhance the accessibility and utility of ISRO's extensive collection of video documentaries, making it easier for users to classify, search, and retrieve relevant videos based on their content and characteristics.</p>
<b>Users</b>	<ol style="list-style-type: none"> <li>1. Employees of the Department of Space.</li> <li>2. Video Archivists and Curators.</li> <li>3. Researchers and Analysts.</li> <li>4. Educators and Trainers.</li> </ol>
<b>Functional Requirements</b>	<ol style="list-style-type: none"> <li>1. <i>User Authentication and Account Management:</i> <ol style="list-style-type: none"> <li>a. This requirement ensures secure user registration, login, and password reset functionalities.</li> <li>b. It includes user authentication mechanisms like email verification and password encryption to safeguard user data.</li> <li>c. User authentication is critical for data privacy and access control, ensuring that only authorized personnel can use the application and manage videos.</li> </ol> </li> <li>2. <i>Video Upload and Management:</i> <ol style="list-style-type: none"> <li>a. This functionality allows users to upload videos related to ISRO missions and programs.</li> <li>b. It involves efficient storage and retrieval mechanisms to manage the increasing volume of uploaded videos.</li> <li>c. Video management ensures that users can easily organize and access their uploaded videos, including features like viewing, editing, and deleting videos.</li> </ol> </li> <li>3. <i>Video Classification:</i> <ol style="list-style-type: none"> <li>a. The video classification feature allows users to categorize uploaded videos into relevant genres or</li> </ol> </li> </ol>

	<p>categories, such as mission type, program theme, or event type.</p> <ul style="list-style-type: none"> <li>b. Proper video classification enhances video organization and retrieval, enabling users to find specific videos quickly based on their categories.</li> </ul> <p>4. <i>Video Search:</i></p> <ul style="list-style-type: none"> <li>a. The search functionality enables users to find videos by entering relevant keywords or video titles in the search bar.</li> <li>b. Video search streamlines the process of locating specific videos among the vast collection, saving time and improving user experience.</li> </ul> <p>5. <i>Video Statistics and Dashboard:</i></p> <ul style="list-style-type: none"> <li>a. Providing a dashboard with video statistics allows users to view insights into the performance and usage of their uploaded and classified videos.</li> <li>b. Video statistics, such as view counts, genre distribution, and user engagement metrics, help users gauge the popularity and impact of their videos.</li> </ul> <p>6. <i>User Roles and Permissions:</i></p> <ul style="list-style-type: none"> <li>a. Implementing different user roles (e.g., admin, moderator, regular user) ensures varying levels of access and control over application features and data.</li> <li>b. User roles and permissions are crucial for data security and preventing unauthorized access to sensitive functionalities.</li> </ul> <p>7. <i>Video Sharing and Collaboration:</i></p> <ul style="list-style-type: none"> <li>a. Enabling users to share videos with other authorized users fosters collaboration and knowledge sharing within the organization.</li> <li>b. Video sharing promotes teamwork and enables efficient dissemination of information among different teams and stakeholders.</li> </ul> <p>8. <i>Video Playback and Streaming:</i></p> <ul style="list-style-type: none"> <li>a. Providing smooth video playback and streaming capabilities ensures a seamless viewing experience for users.</li> <li>b. Reliable video playback and streaming support enhance user satisfaction and accessibility of video content across various devices and network conditions.</li> </ul>
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<b>Non-functional Requirements</b>	<ol style="list-style-type: none"> <li>1. <i>Security and Privacy:</i> <ol style="list-style-type: none"> <li>a. This requirement focuses on ensuring the application's security to protect sensitive user data and prevent unauthorized access to videos and user accounts.</li> <li>b. Robust encryption mechanisms, secure authentication, and role-based access control should be implemented to safeguard user information and video content.</li> </ol> </li> <li>2. <i>Scalability:</i> <ol style="list-style-type: none"> <li>a. The application should be able to handle a large number of users and video uploads without compromising performance.</li> <li>b. Designing the application with scalability in mind ensures that it can accommodate growing user bases and increased video content.</li> </ol> </li> <li>3. <i>Reliability and Availability:</i> <ol style="list-style-type: none"> <li>a. The application must be reliable, minimizing downtime and ensuring that users can access their videos and perform tasks consistently.</li> <li>b. Implementing redundant systems, load balancing, and automated backups can enhance the application's availability and reliability.</li> </ol> </li> <li>4. <i>Performance:</i> <ol style="list-style-type: none"> <li>a. The application should deliver fast response times for video uploads, classification, and searches, providing users with a smooth and responsive experience.</li> <li>b. Optimizing database queries, caching frequently accessed data, and leveraging efficient algorithms contribute to improved application performance.</li> </ol> </li> <li>5. <i>User Experience (UX):</i> <ol style="list-style-type: none"> <li>a. The application's user interface should be intuitive, user-friendly, and visually appealing to enhance the overall user experience.</li> <li>b. Conducting usability testing and gathering user feedback during development can lead to an application that meets user expectations and preferences.</li> </ol> </li> <li>6. <i>Compatibility and Cross-Platform Support:</i> <ol style="list-style-type: none"> <li>a. The application should function seamlessly across different devices, operating systems, and web browsers.</li> </ol> </li> </ol>
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	<p>b. Ensuring compatibility with various platforms extends the application's reach and accessibility to a wider audience.</p> <p>7. <i>Data Backup and Recovery:</i></p> <ol style="list-style-type: none"> <li>Regular and automated data backups are essential to prevent data loss in case of hardware failures or other unforeseen incidents.</li> <li>Implementing reliable data backup and recovery mechanisms provides data integrity and minimizes the impact of potential disasters.</li> </ol> <p>8. <i>Regulatory Compliance:</i></p> <ol style="list-style-type: none"> <li>The application should adhere to relevant regulations and data protection laws to ensure legal compliance.</li> <li>Complying with data privacy regulations and any specific industry standards strengthens user trust and protects the organization from legal issues.</li> </ol>
<b>Software and Hardware Requirements</b>	<p><b>Software Requirements:</b></p> <ol style="list-style-type: none"> <li><i>Integrated Development Environment (IDE):</i> <ul style="list-style-type: none"> <li>Visual Studio Code.</li> </ul> </li> <li><i>Front-end Technologies:</i> <ul style="list-style-type: none"> <li>HTML, CSS, and JavaScript.</li> <li>React.js.</li> </ul> </li> <li><i>Back-end Technologies:</i> <ul style="list-style-type: none"> <li>Node.js.</li> <li>Express.js.</li> <li>Django.</li> </ul> </li> <li><i>Databases:</i> <ul style="list-style-type: none"> <li>MySQL.</li> <li>MongoDB.</li> </ul> </li> <li><i>User Authentication:</i> <ul style="list-style-type: none"> <li>Passport.js.</li> </ul> </li> <li><i>Video Processing and Metadata Extraction:</i> <ul style="list-style-type: none"> <li>FFmpeg</li> </ul> </li> <li><i>Video Classification:</i> <ul style="list-style-type: none"> <li>TensorFlow.js</li> </ul> </li> <li><i>Deep Learning Framework:</i> <ul style="list-style-type: none"> <li>TensorFlow or PyTorch for implementing CNN and LSTM models</li> </ul> </li> <li><i>Cloud Storage:</i> <ul style="list-style-type: none"> <li>Amazon S3</li> </ul> </li> <li><i>Content Delivery Network (CDN):</i> <ul style="list-style-type: none"> <li>Amazon CloudFront</li> </ul> </li> </ol> <p><b>Hardware Requirements:</b></p> <ol style="list-style-type: none"> <li><i>Development Machine:</i></li> </ol>

	<ul style="list-style-type: none"> <li>• Processor: A modern multicore processor (e.g., Intel Core i7 or AMD Ryzen 7) with a clock speed of at least 3.0 GHz or higher.</li> <li>• RAM: 16GB to 32GB of RAM.</li> <li>• Storage: An SSD (Solid State Drive) with at least 500GB of storage space.</li> <li>• Graphic Card: A dedicated graphics card (e.g., NVIDIA GeForce GTX or RTX series) with at least 4GB of VRAM.</li> <li>• Operating System: Windows 10, macOS, or a popular Linux distribution (e.g., Ubuntu, CentOS).</li> </ul>
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PROJECT GUIDE

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