

360 view CCTV Management System

Technical Proposal



Introducing, an integrated management and control system for CCTV, designed to enhance operational efficiency through a more centralized and intuitive approach.

**Equipped with
Artificial Intelligence (AI)
technology, our system
optimizes supervision and
surveillance capabilities.**



How our system works:

Our system operates through three main stages: *Acquiring*, *Organizing*, and *Output*.

01.

ACQUIRING

At this stage, the system collects raw data in the form of video footage from the connected CCTV camera network.

02.

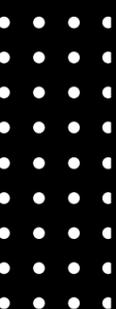
ORGANIZING

The acquired data is then processed and categorized using AI technology. The integrated AI does more than just transmit information from edge devices—it is capable of detecting, identifying, and conducting self-training autonomously, ensuring higher accuracy in analysis.

03.

OUTPUT

In the final stage, the system delivers refined output that has undergone multiple processing steps, rather than simply forwarding raw input from edge devices. Users also benefit from AI-driven automation features such as auto object tracking, auto object sorting, and object justification, improving surveillance efficiency.



ACQUIRING

ORGANIZING

OUTPUT

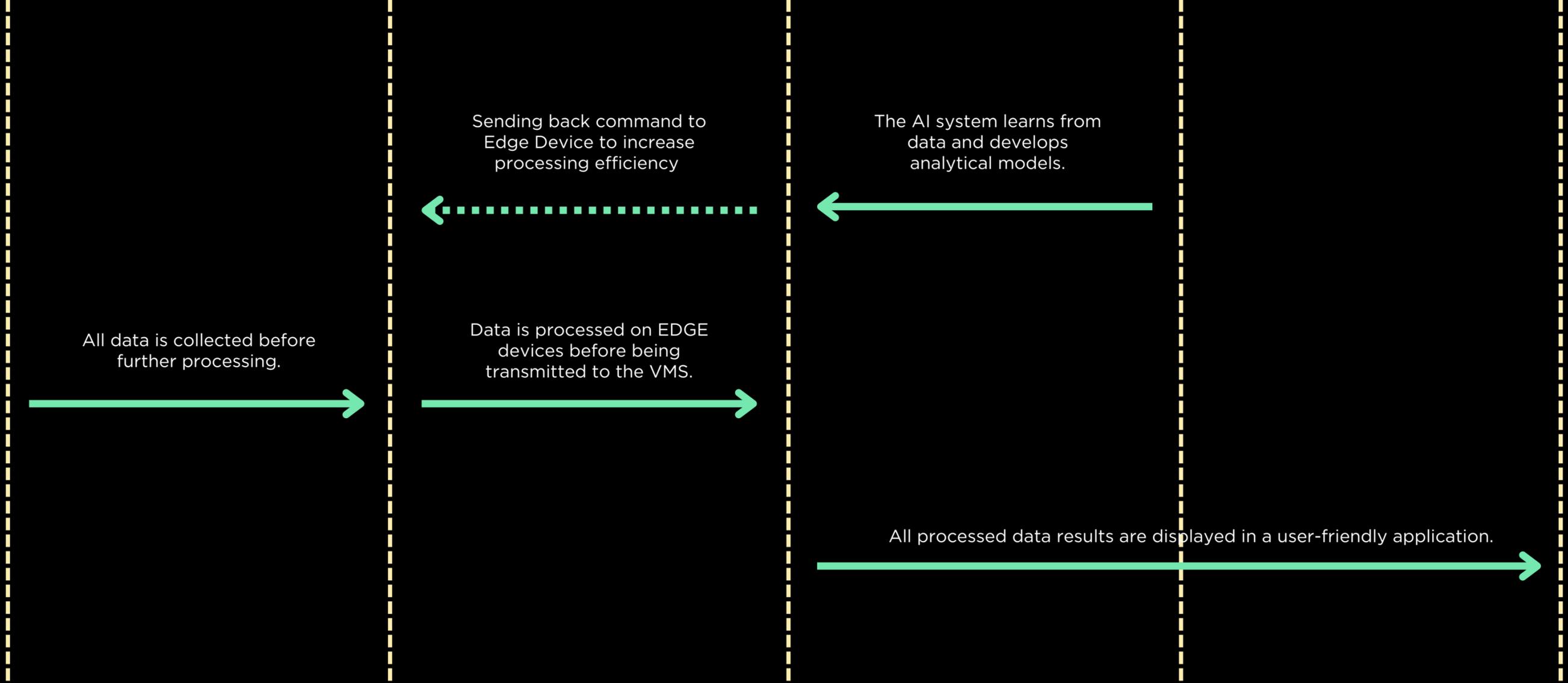
CCTV/Video

Edge Device

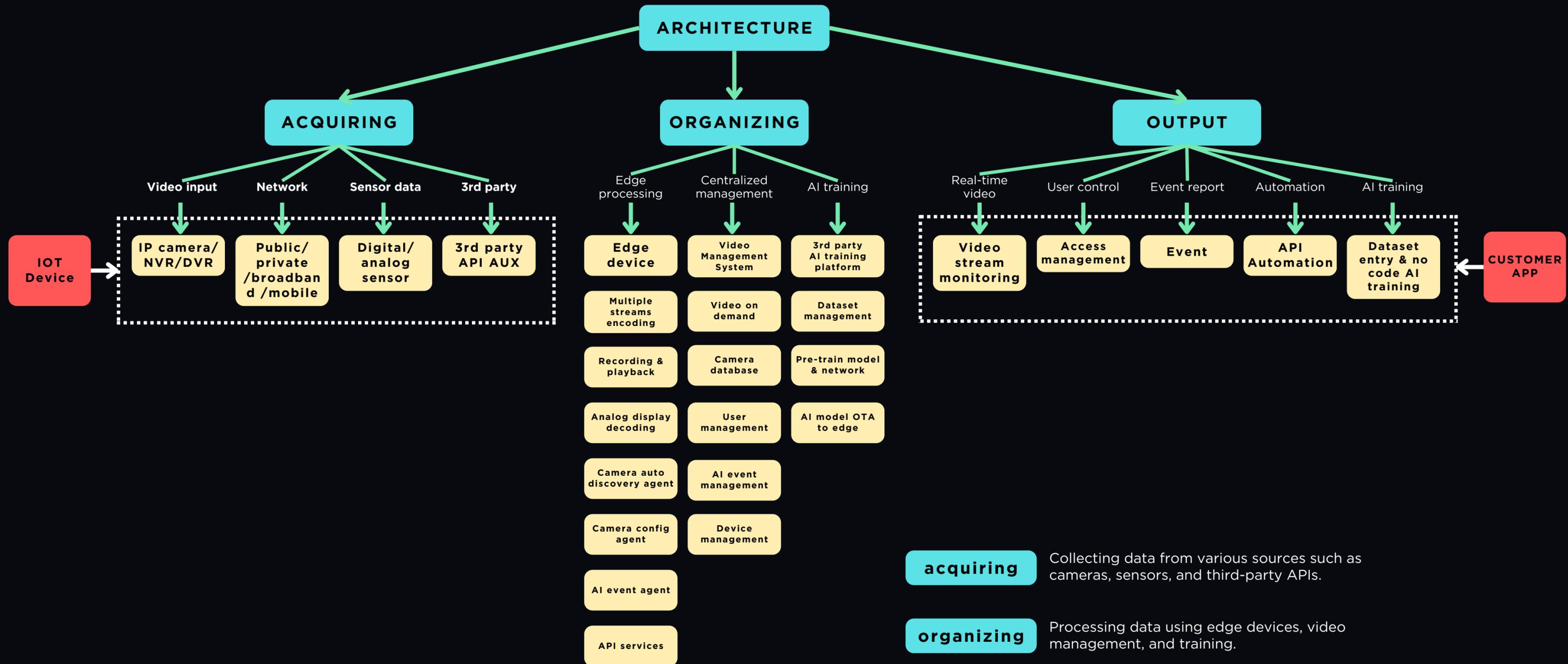
Video Management System

AI Training Platform

Customer Application



Our complete technical architecture



- acquiring** Collecting data from various sources such as cameras, sensors, and third-party APIs.
- organizing** Processing data using edge devices, video management, and training.
- output** Providing results in the form of video monitoring, access management, event reporting, and AI training (customer application).

Our main features

Our system offers 10 key features designed to simplify user operations and enhance system efficiency.

Viewing And Managing Stream



Device Monitoring And Management



Viewing Event Data



Browse Through Events



Training Process



Annotation



Testing Model



Analyze Model



Playback



Adding Cameras To Training Platform



Viewing And Managing Stream

The Stream Management feature allows users to dynamically add or remove active video streams for real-time monitoring. This functionality provides flexible stream control, enabling users to focus on relevant surveillance feeds based on operational needs.

Functionalities:



Add Stream

- Users can select a CCTV location from the available list.
- The chosen stream is added to the monitoring interface for real-time viewing.



Remove Stream

- Users can disable or remove an active stream from the monitoring dashboard.
- Ensures efficient resource management and declutters the interface.

Viewing Event Data

This feature allows users to track specific detected parameters, recognize patterns, and support data-driven decision-making. With flexible data filtering options, users can focus on specific time periods to gain deeper insights and make informed decisions.

Features:

Customizable Chart Representation



- Users can select different chart types (e.g., bar chart, pie chart, line graph) to visualize helmet usage statistics.
- Provides flexibility in data presentation for better insights.

Date Range Selection



- Users can filter and display data based on a specific date range (day, month, year).
- Ensures focused analysis for a selected time period.

Data Comparison



- Displays the total count of detected objects based on specified criteria.
- Identifies patterns and changes in trends over time.

Interactive Data Exploration



- Users can hover over data points to view detailed statistics.
- Enables zooming and filtering for in-depth analysis.

Training Process

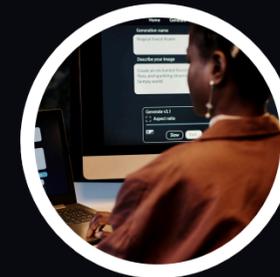
This feature ensures streamlined training management, allowing users to monitor progress, adjust parameters if needed, and select the best-performing model for further evaluation or deployment.

Functionalities:



Select Project and Start Training

- Allows users to choose a project from the project list.
- Initiates the training process based on the selected project's dataset and configurations.



Training Control

- Displays real-time training status, including:
- Progress Percentage: Indicates the overall completion rate.
- Epoch Progress: Shows the current epoch and total epochs configured.
- Model Size: Tracks the storage footprint of the trained model.



Training Output & Performance Metrics

- Realtime Loss Tracking & Best Epoch Metrics Graphic
- Provides real-time visualization of training and validation loss.
- Highlights key performance indicators at each epoch.
- Best Epoch Performance
- Identifies the best-performing epoch based on validation loss and accuracy.
- Ensures the most optimized model checkpoint is retained for deployment.

Testing Model

This structured approach ensures a comprehensive evaluation of the model's ability to detect and classify specific objects, optimizing performance for deployment across various monitoring and data analysis systems.

This testing process involves:



Object Detection, Classification & Tracking

- Utilizes real-time or recorded video footage to analyze objects within an environment.
- Classifies detected objects into multiple categories based on image recognition models.
- Implements bounding box detection to identify and track objects within the video feed.
- Ensures consistent tracking across multiple frames to minimize false positives and false negatives.

Playback

This feature ensures seamless access to past recordings, enabling users to efficiently analyze surveillance footage for investigations and incident reviews.

Functionalities:



Timestamp-Based History Log

- Displays playback history in a chronological format.
- Allows users to quickly identify and access specific time-stamped events.



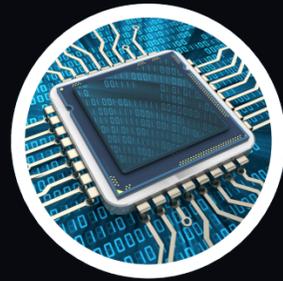
Event-Based Playback Navigation

- Users can search and filter playback records based on time intervals.

Device Monitoring and Management

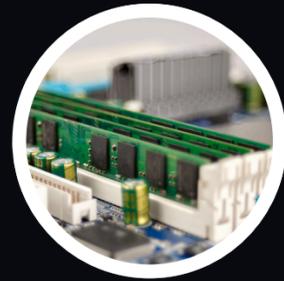
The Device Monitoring and Management feature provides real-time tracking and control over system resources and operational status. This ensures optimal performance, early detection of potential issues, and efficient resource utilization.

The monitored parameters includes:



CPU Usage

- Displays real-time CPU load and utilization percentages.
- Helps identify performance bottlenecks and optimize processing efficiency.



Memory Usage

- Tracks the system's RAM consumption and available memory.
- Prevents potential slowdowns due to excessive memory allocation.



Media Server Status (On/Off)

- Monitors the operational status of the media server.
- Ensures continuous streaming and data processing.



Recorder Status (On/Off)

- Indicates whether the recording system is active or inactive.
- Prevents data loss by ensuring proper recording functionality.



Interface Speed

- Measures network interface speed and connectivity performance.
- Detects potential bandwidth limitations affecting data transmission.



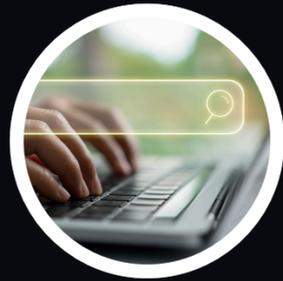
Storage Monitoring

- Tracks available and used disk space for recordings and system files.
- Provides alerts for low storage capacity to prevent system failures.

Browse Through Events

The CCTV Monitoring System enables users to browse, categorize, and analyze events detected through a video analytics-based system, ensuring efficient event analysis, allowing users to quickly retrieve, assess, and respond to critical incidents with data-driven decision-making.

Functionalities:



Event Browsing & Categorization

- Users can navigate through detected events in an organized manner.
- Events are categorized based on predefined criteria for easier analysis.



Metadata-Based Search & Filtering

- Supports search queries based on:
 - Event Time
 - Camera Location
 - Activity Type
 - Object or Individual Identification

Annotation

This feature enhances system accuracy by enabling real-time validation and correction, ensuring more reliable results in helmet detection and traffic safety monitoring.

Functionalities:



Manual Annotation & Correction

- Allows users to manually reclassify incorrect detections, such as:
- Riders wearing helmets mistakenly classified as "No Helmet."
- Riders without helmets incorrectly detected as "Helmet Worn."



Data Accuracy Enhancement

- Saves corrected entries to improve the dataset used for future model training.



Model Improvement & Retraining

- Integrates with the training pipeline to update and retrain the model based on corrected labels.
- Reduces false positives and false negatives in subsequent detections.

Analyze Model

The Model Training Report provides a comprehensive analysis of the training process, covering key aspects such as model configuration, input data details, performance evaluation, and graphical insights into the model's effectiveness.

The report includes the following sections:

Model Training Summary



- Overview of the training process, including the model architecture, training duration, number of epochs, and optimization strategy.
- Details on hyperparameters such as learning rate, batch size, and regularization techniques.

Model Input Details



- Dataset specifications, including training, validation, and test set distributions.
- Data augmentation techniques and preprocessing steps applied before training.

Model Performance Metrics



- Key evaluation metrics such as accuracy, precision, recall, F1-score, and loss values.
- Summary of overall model performance across different datasets.

Best Model Performance



- Identification of the best-performing model based on validation loss and accuracy.
- Snapshot of weight checkpoints and saved model configurations.

Realtime Loss Tracking



- Dynamic visualization of the training and validation loss over epochs.
- Early stopping criteria and convergence analysis.

Image Performance Metrics



- Confusion Matrix (Normalized): Provides an intuitive representation of classification performance.
- Labels Correlation Heatmap: Displays relationships between different class labels.
- Precision-Recall Curve: Illustrates the trade-off between precision and recall at various thresholds.
- Recall Curve: Depicts recall performance across different confidence levels.
- Precision Curve: Visualizes how precision varies across the dataset.
- F1 Score Curve: Highlights the balance between precision and recall throughout the evaluation process.

Adding Cameras to Training Platform

This feature allows users to configure and integrate cameras for data collection and model training. This process involves setting up essential parameters to ensure optimal dataset acquisition and model performance.

Configuration Inputs:

Label List



- Defines the classification or annotation categories for the collected images.
- Enables structured labeling to improve model training accuracy.

Image Cycle



- Specifies the number of image collection cycles per camera or dataset.
- Controls how frequently images are captured for training.

Image Train Ratio



- Determines the allocation of images for training versus validation/testing.
- Ensures a balanced dataset for effective model generalization.

Accuracy Target



- Sets the desired accuracy threshold for model training.
- Helps in monitoring model improvements and convergence criteria.

Project Thumbnail



- Assigns a representative image for the project.
- Enhances project organization and visual identification.

Initial Model



- Selects the base model to be used for training.
- Can be a pre-trained model or a newly initialized one.

Acquire Dataset



- Enables automatic image acquisition from configured camera sources.
- Ensures seamless data flow into the training pipeline.

Camera Collector List



- Displays available cameras for data collection.
- Allows users to select and manage cameras for the training process.