Real-Time Multi-Camera Dog Track and Alert System

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***Abstract*—This paper presents a system titled Real-Time Multi-Camera Dog Track and Alert, which leverages the YOLOv11m object detection algorithm to detect dogs in real-time video streams and recognize individual dogs by name. It addresses challenges in pet monitoring and behavior research. YOLO-based detection is combined with identity-aware annotation and a timing system for absence alerts. Experiments with dual video feeds show robust real-time detection and alert capabilities for dogs "Minney" and "Lucky."**

***Index Terms*—YOLO, dog monitoring, object detection, pet tracking, real-time alert.**

I. Introduction

Pet monitoring systems often focus on generic detection, limiting their usefulness when specific dog identity tracking is needed. Systems like those proposed by Singh et al. [1] use YOLO and LSTM for behavior detection, while others such as Kim and Moon [2] explore multimodal approaches using wearable devices. However, these either lack individual identification or require extra hardware.

Biometric methods like nose print recognition [3] or deep face embeddings [4] provide identity-level recognition but are impractical for continuous CCTV use. Our solution builds on YOLO's real-time strengths [5], training it to identify each dog by name through bounding box labels. Inspired by works on animal tracking [6] and unified frameworks for biometric pet IDs [7], our system also includes alert mechanisms to notify when a dog is missing.

II. Methodology

A. Dataset Creation

Video data of dogs "Minney" and "Lucky" was collected in indoor and outdoor environments. Frames were extracted and annotated using YOLO-format bounding boxes. Each dog's name was treated as a separate class.

While previous datasets (e.g., wildlife traps [6]) emphasize background diversity, we focus on visual clarity for reliable identity labeling. Turečková et al. [5] successfully trained YOLO on dog face crops; our approach generalizes this to whole-body CCTV footage.

B. Model Training

We used YOLOv11m due to its speed–accuracy trade-off. Each dog's name served as a label. Similar to work on embedding-based recognition [4], but without requiring facial alignment or high-res imagery.

C. Testing

Two different videos were run simultaneously through a custom Python pipeline. Each frame was processed for detection, name assignment, and confidence score logging.

D. Alert System

The alert mechanism is a critical component of the proposed system, designed to notify owners when a dog remains undetected for a predefined duration (one hour). The timer-based module operates as follows:

- Detection Monitoring: After the model identifies and labels a dog in a video frame, the system initializes a timer for that specific dog.
- Timer Reset Logic: If the dog reappears in subsequent frames within the hour, the timer resets to zero. This ensures that transient occlusions (e.g., temporary movement outside of the camera field of view) do not trigger false alarms.
- Alert Trigger: If the dog is continuously undetected for one hour, the timer expires, and the system sends an alert. Inspired by Singh et al. [1], we implement time-based alert tracking:
  - After detection, a timer starts per dog.
  - The timer resets when the dog reappears.
  - If missing 1 hour, a configurable alert (email/sound/log) is triggered.

III. Result

A. Detection Accuracy

Precision reached 1.0 at confidence threshold 0.913. Figure 1 shows the curve from training validation. Our model outperformed generic detectors that don't distinguish between individuals [7].

B. Real-Time Dual Video Tracking

Figure 2 shows successful labeling of two dogs from separate video streams. Label stability was maintained even with fast movement or partial occlusion.

IV. Discussion

This system shows real-time pet recognition is feasible without biometrics or wearables. Compared to Kim and Moon's wearable-camera fusion [2], our method is more deployable in average homes. While Smith and Johnson's

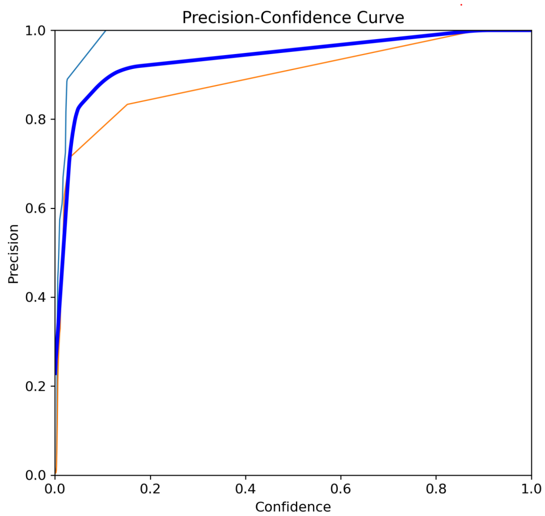

Fig. 1. Precision and confidence curve

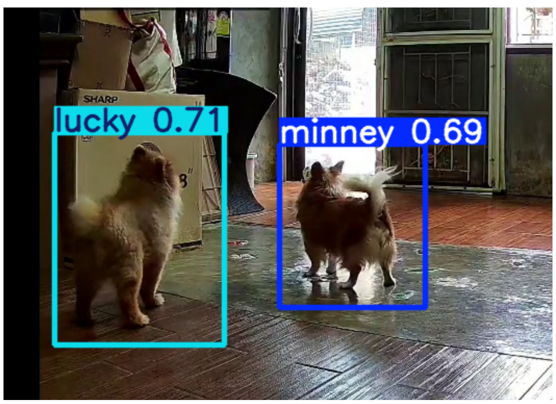

Fig. 2. Named detection output ("Minney" and "Lucky")

embeddings achieve higher precision in lab conditions [4], our YOLO model balances speed and generalizability. Future improvements could include voice-activated interaction or embedded deployment.

V. Conclusion

We propose a real-time system that detects, identifies, and monitors household dogs using YOLOv11m. Combining video input with dog identity tracking and alert generation makes this a useful tool for smart homes and shelters. Our results highlight how vision-only deep learning can fulfill practical pet surveillance tasks.

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