SKAIVISION: Transforming Automotive Dealerships with Computer Vision

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SKAIVISION

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Who is SKAIVISION?

- **Growing Startup**. 30 employees, founded in 2022
- **100% Remote Operation.** Employees are all over the US with contractors in South America.
- **Over 150 Dealerships.** Adding 20 new dealerships a month.
- **SKAIVISION Dealerships on Average …**
  - Generate 50K AI observations a day
  - Purchases 20 more vehicles a month
  - Services 50 more vehicles a month

The VISION of SKAIVISION

Scalable Computer Vision for Automotive Dealerships

- Leverage existing dealership cameras for seamless integration.
- Detect and trigger actions with advanced AI-powered algorithms.
- Cloud processing refines insights over time for smarter automation.

Why Automotive Dealerships Needs Computer Vision

$1B Lost Annually – 3 Blind Spots Drain Time and Revenue

Employee Activities

Unverified actions. Software can't confirm critical employee tasks.

Impossible for managers to monitor video feeds.

Transaction Times

Untracked transactions. No way to measure sales or service transaction times.

User input data is prone to error.

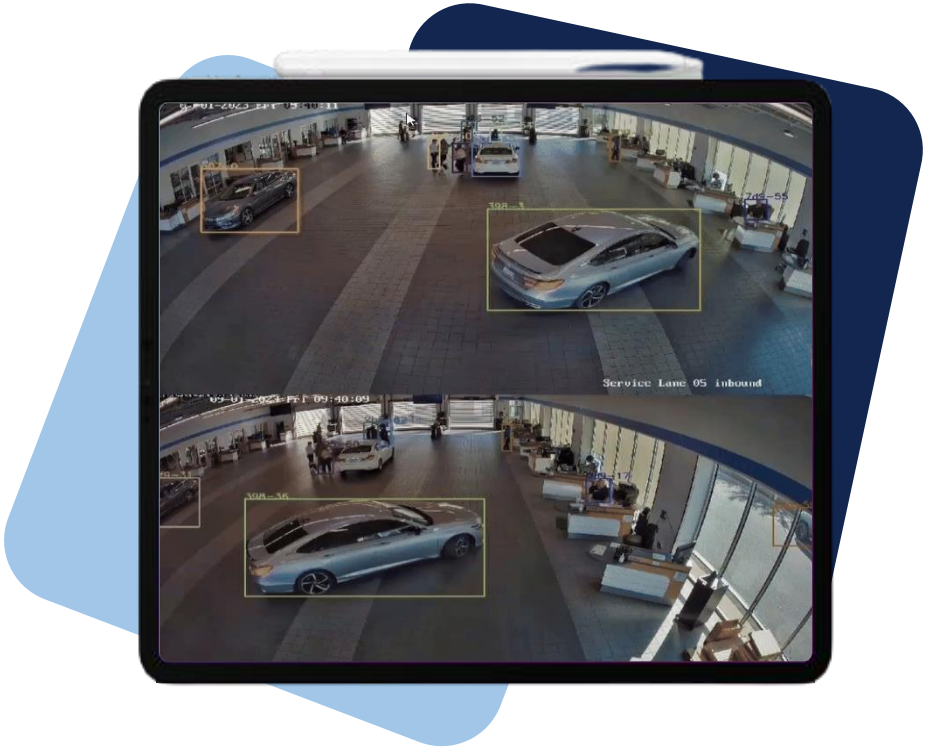
Theft & Security

Evolving threats. Organized crime is more sophisticated and outpacing security measures.

Smarter Dealership Operations

Revolutionize Efficiency with AI

- Tracks vehicles and people as they engage with dealership resources.
- Seamlessly integrates with operations, reducing human error.
- Monitors activities, triggering alerts for missed or met thresholds.
- Optimizes equipment use with real-time utilization alerts.



Computer Vision AI Today

Currently much like pre-1914 auto manufacturing—custom-built for each use case.

- Ford revolutionized manufacturing with standardized parts and the assembly line.
- SKAIVISION applies the same principle, creating scalable, standardized AI solutions.

How SKAIVISION Delivers Scalable AI

Approach

- **Frame-by-frame analysis.** Identifies people, vehicles, and objects using custom-trained AI models.
- **Smart tracking.** Uses distributed memory to track movements across all networked cameras.
- **Context-aware AI.** Calculates relationships and distances between tracked entities.
- **Action detection.** Identifies key events and triggers cloud-based AI notifications.

Examples

- **Stalled vehicle.** No movement detected for 5+ minutes.
- **Customer engagement.** Employee within 2 meters of a customer for over 2 minutes.

Real-World Application: Enhancing CX

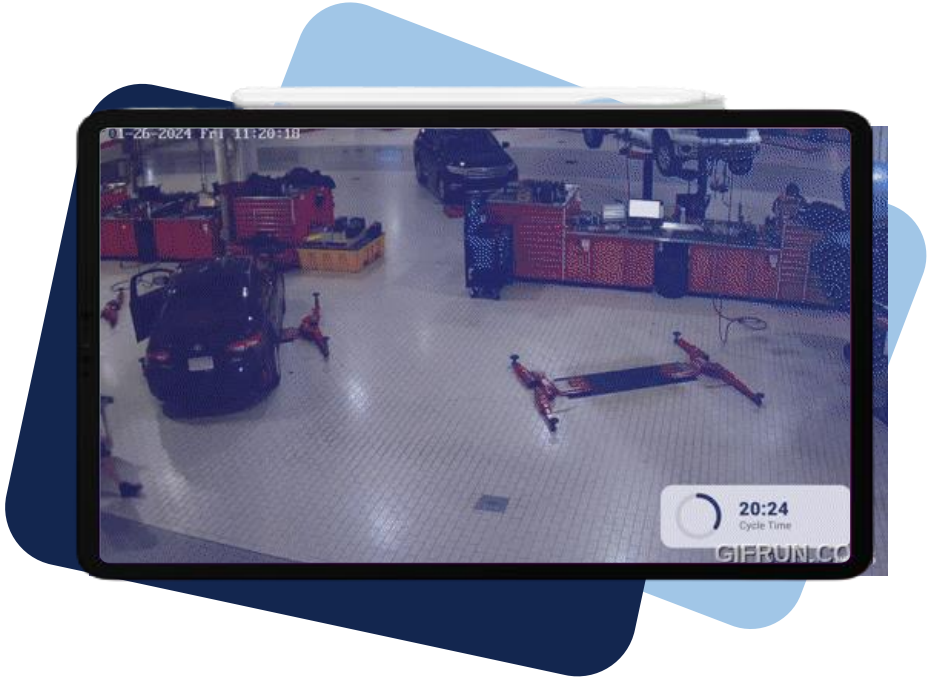
Is Your Customer Waiting Unattended?

- Customers receive a unique ID when entering service areas.
- A timer tracks time spent without employee interaction.
- Instantly alerts staff to ensure prompt service.

Real-World Application: Enhancing CX

How Long Does a Service Really Take?

- Vehicles are identified upon arrival, and service time is tracked.
- Timer runs while the vehicle is in service.
- Idle time is logged when a vehicle is in the bay but unattended.



Real-World Application: Enhancing CX

Keep Customers Updated on Service Progress.

- Vehicles are tracked at key points throughout their visit.
- Real-time updates provide customers with their vehicle’s status.
- Ensure transparency and improve the service experience.

Real-World Application: Enhancing CX

Optimize Electric Charging Station Usage.

- Know when stalls are idle or in use.
- Track vehicle presence and stall occupancy in real-time.
- Receive instant alerts or detailed usage reports for efficiency monitoring.

Challenges

Applying computer vision to automotive dealerships is challenging.

- **Site Inconsistencies** – No two dealerships are the same.
- **Hardware Limitations** – Varying camera setups and tech stacks.
- **AI Complexity** – Industry-specific challenges require custom solutions.

Common Site Challenges

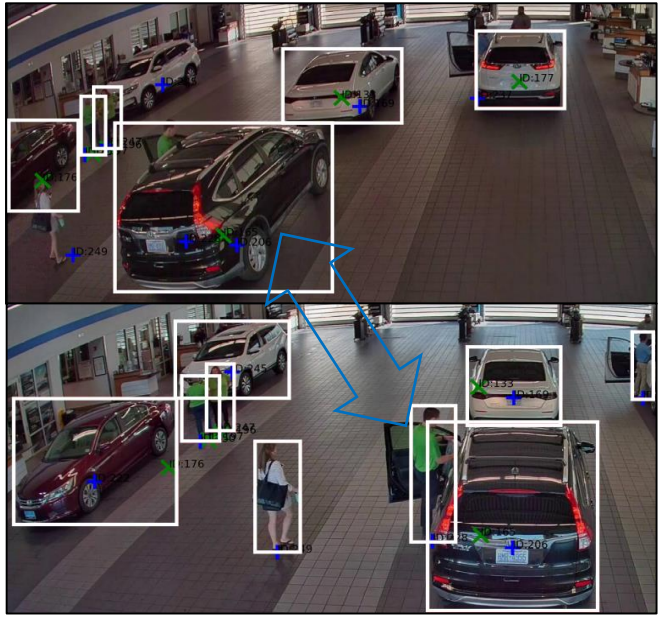
- **Inconsistent Layouts.** AI engine is designed to adapt to any dealership environment. As new layouts are introduced, more generalization is needed.
- **Occlusion Issues.** Trackers/models continuously improve to handle obstructions like cars, columns, and furniture, reducing false alerts.
- **Glare Interference.** Camera selection considers time-of-day glare to ensure consistent visibility.
- **Bandwidth Constraints.** Networks must support AI-driven data processing for optimal performance.

Common Site Challenges

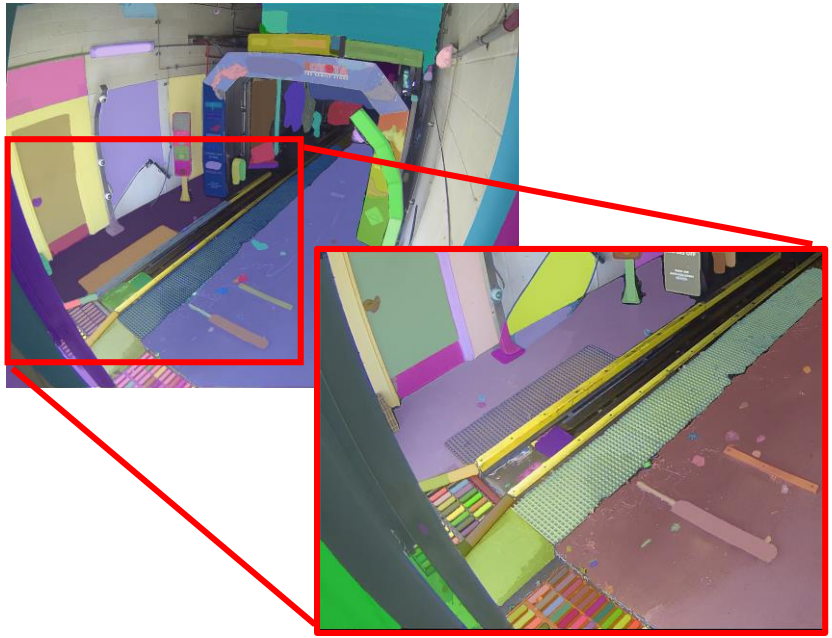
- **IT Restrictions.** Strict dealership network protocols can limit server interactions.
- **Camera Downtime.** Hardware and network issues may take cameras offline.
- **Traffic Flow Variability.** People and vehicles don’t always follow expected routes (e.g., using exits as entrances).
- **Lighting Conditions.** Poor lighting can impact AI accuracy, requiring adaptable models.

Common Site Challenges

Overlapping Camera Auto-Calibration: Unknown camera position/orientation



Camera view altered: Needs auto-detection of altered views



Common Hardware Challenges

- **Inconsistent Camera Features.** Variations in connection type, resolution, compression, zoom, lens type, and filters require adaptable video processing.
- **Unstable Mounting.** Cameras that move or vibrate can shift regions of interest, requiring continuous recalibration.
- **Indoor vs. Outdoor Requirements.** Different environments demand specialized cameras, adding complexity to system setup.

Common Hardware Challenges

Navigating Failures & Limitations.

- **Root Cause Analysis.** Investigate hardware issues to quickly diagnose and resolve failures.
- **Hardware Problems.** Some new hardware arrives faulty (e.g., Intel Raptor Lake, Nvidia 4090 power connectors, Nvidia 50 series missing Raster Output Units).
- **Longevity & Performance.** Preventing burn-in with temperature monitoring, dynamic optimization, and usage scheduling to extend hardware lifespan.

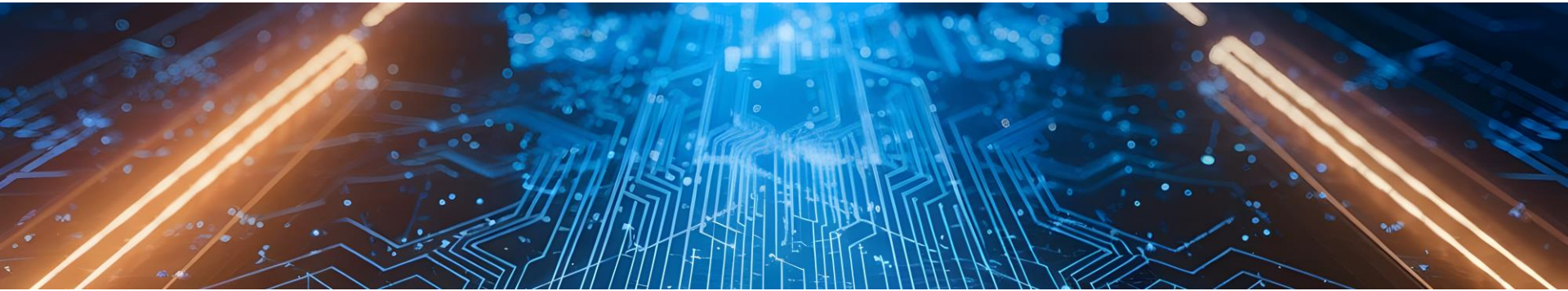
Common AI Challenges

Adapting AI for Dealership Applications.

- **Dataset Scarcity** – Public datasets lack the diverse camera angles and configurations found in our domain, requiring specialized data collection.
- **Limited State-of-the-Art Support** – Existing AI models are trained on general datasets, making them less effective in our unique environment.
- **Camera Networking Variability** – Our AI is built to handle dropped frames, artifacts, and inconsistent frame rates for reliable performance.

Common AI Challenges

- **Adaptive Scaling.** The system must adjust to hardware limitations, optimizing performance without compromising output quality.
- **Near Real-Time Processing.** Continuous optimization and device prioritization are required for smooth operation across all site cameras running near real-time.
- **Intelligent Recovery.** Must detect delays (frame dropping, slow network, etc..) and catch up without data loss, maintaining accuracy and reliability.



Challenges in Object Detection & Tracking

Shared Challenges Across Models

- **Generalized Solutions.** Most models are optimized for broad use, not domain-specific needs.
- **Public Dataset Limitations.** Issues include mislabeling (e.g., a partial arm detected as a person), inconsistent tracking setups, and mismatched traffic assumptions.
- **Performance Gap.** High-performing models like ByteTrack & BotSORT score 90% on MOT data but drop to 65% in our domain.
- **Class-Agnostic Tracking.** Requires separate trackers for different object types, increasing complexity.
- **Runtime Constraints.** Some models are too large or slow for near real-time processing.

Solutions & Improvements

Custom Data Collection & Processing

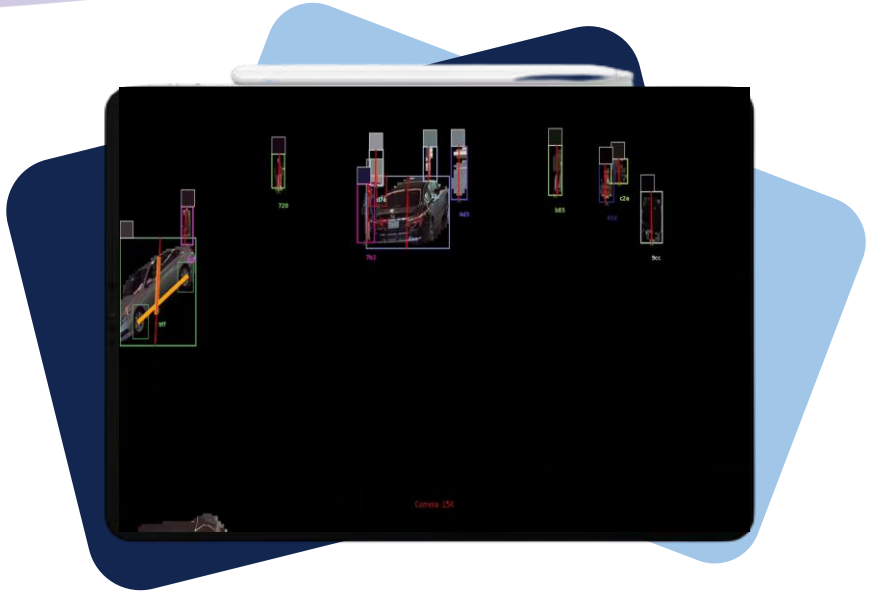
- Intelligent data collection targets failure cases in object detection.

Tracking & Evaluation Enhancements

- **Feedback Loop.** A "Thumbs Down" system logs failures to generate test points.
- **Automated Testing Pipeline.** Built on MOT evaluation for continuous improvement.

Tracking Across Non-Overlapping Cameras

- **2D and 3D Feature Extraction**
  - Segmentation to remove background
  - Skeletonization to estimate object/world rotation
  - Predominant color, which varies by lighting
  - Object scale across world plane
- **Pseudo-random Traffic Expectations**
  - Human/vehicle patterns often diverge
  - Temporal heuristics guide comparisons
  - Unexpected objects can corrupt traffic flow
- **Correcting Camera Distortion Real-Time**

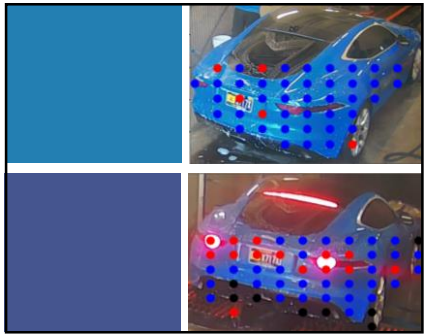


Tracking Across Non-Overlapping Cameras

Challenges in Object Matching

- Highly varying object rotation and pose complicate associations.
- Subtle differences complicate filtering bad matches.
- ***Can you spot correct vs. incorrect match?***

Color Variations



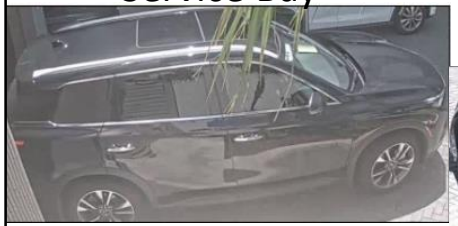
Correct Match

Service Bay

Carwash Entrance

Incorrect Match

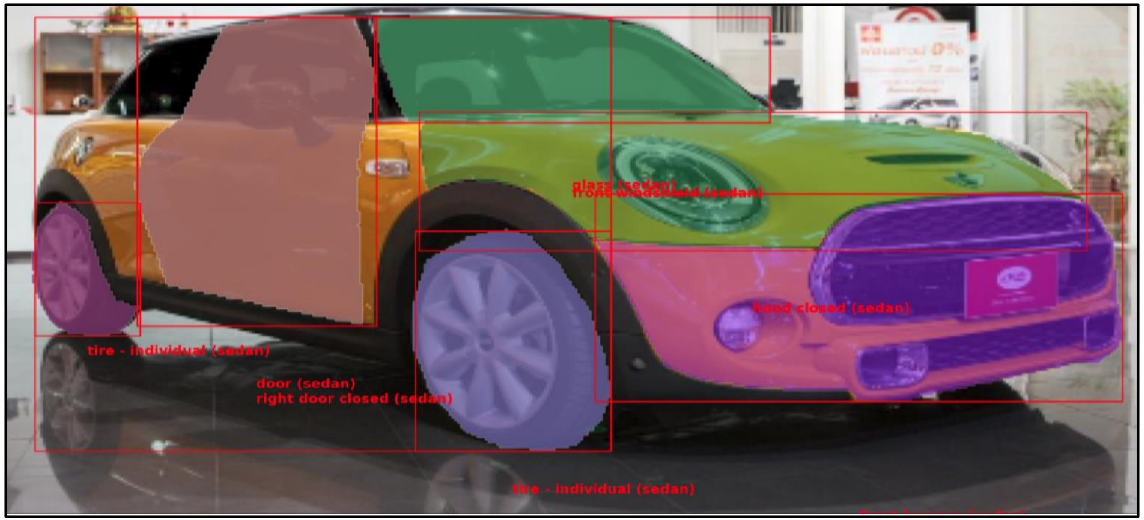
Service Bay

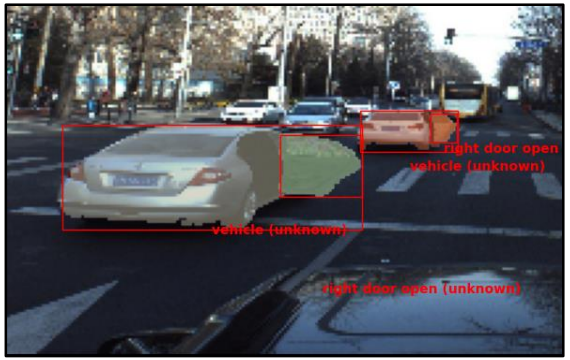


Carwash Entrance

Tracking Across Non-Overlapping Cameras

- Vehicle parts segmentation reinforces robust track matching.
- Enables individual component and ensemble matching.
- Open/closed part states informs transition behaviors.





How Did We Do It?

Our Approach

- Embed an AI server at the dealership, choose which fits your organization's needs:
  - 4U Rack Mounted Server
    - NVIDIA A5000 24GB
    - 40 RTSP streaming cameras per server at SD resolution
  - Stand-alone compact form factor AI box
    - NVIDIA 3050 / 4060 8GB
    - 15 RTSP streaming cameras per server at SD resolution

In Summary

- **Vision AI Solves Real Problems**
  Computer vision can identify delays, inefficiencies, and missed opportunities in dealership operations.
- **Edge Processing is Critical**
  On-premise AI hardware allows for real-time insights without overwhelming dealership bandwidth.
- **Standardized AI for Unique Environments**
  SKAIVISION builds reusable AI frameworks that adapt to the diverse layouts and challenges of dealerships.
- **Custom Data Fuels Better Detection**
  Proprietary datasets and tailored evaluation pipelines improve accuracy beyond public models.
- **Scalability Without Compromise**
  A single AI box can power dozens of cameras—delivering consistent insights across a growing network.

Resources

Website

https://skaivision.com

Blog

https://skaivision.com/blog

LinkedIn

https://www.linkedin.com/in/jasonrfayling/

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Questions?

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