SPOTLIGHT
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Fleet managers cannot rely on telematics-based fleet management solutions alone to effectively address their organizations' fleet management expectations. Therefore, leading providers are pivoting toward cameras and computer vision–based approaches to align with the evolving needs of fleet managers.

Computer Vision: The Essential Component to Unlock the Ambitious Expectations of Today's Vehicle Fleets

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Introduction

No longer a secret, the expectations and job requirements of fleet managers (or greater fleet management teams) continue to expand. These vital team members, who already are being challenged to drive further optimization along traditional metrics to improve productivity and safety, are now increasingly being asked to utilize fleet technologies to deliver additional organizational flexibility, insight, intelligence, and control. For instance, today's fleet managers may be responsible for defining, measuring, and delivering improvements that include:

- **Cost savings.** Managers must understand and identify where there is potential waste caused by drivers, routing, and matching processes, or even vehicle purchasing and life-cycle management.
- **Vehicle utilization and spend management.** Prior to the availability of modern fleet management systems, organizations were challenged to effectively understand the relationship between drivers, work orders and routes, and vehicle usage.
- **Environmental and sustainability impact.** The importance of visibility into the operation and effectiveness of a carbon-heavy vehicle fleet has increased as C-level executives and boards announce aggressive environmental, social, and governance (ESG) pledges and goals.
- **Worker retention.** Driver and frontline personnel worker shortages are catalysts for instability and increased costs; fleet managers are tasked with understanding and implementing worker retention measures.
- **Compliance and reporting.** The level and frequency of expected reporting granularity and tracking continue to increase; these reports feed into driver, organizational, and regulatory evaluations and are key inputs with third parties (e.g., insurers) to improve costs and operational efficiency.

Unfortunately, fleet managers who continue to utilize only traditional telematics-based fleet management solutions will struggle to easily support and scale these new conditions of their job. Fleet management technologies by themselves are not

AT A GLANCE

KEY TAKEAWAYS

- Telematics-based fleet management solutions can no longer meet the needs of today's fleet managers.
- Augmenting a telematics-based fleet management approach with cameras and computer vision (CV) provides the proper foundation to support current and future requirements.
- CV contributes important benefits to fleet management solutions including real-time alerting and event accuracy, current and future use case expansion, driver facial identification, and video forensics.

flawed, but they lack the specificity, accuracy, and capability breadth necessary to deliver across the additional dimensions highlighted previously. In particular, most telematics-based fleet management solutions fall short in the following areas:

- **Alerting.** Available sensor data information, onboard/on-device computation, and data analytic approach limitations introduce latency for the triggering of a vehicle and/or driver event. Fleets require near instantaneous, millisecond latency to identify an event. This extremely low latency allows a driver the greatest latitude to respond/take action.
- **Intelligence use cases and metadata.** Telematics-based solutions are limited in terms of what types of data they can capture and truly understand. Further, without the ability to have access to a multidimensional input source (e.g., from a camera), these solutions cannot support the continuous improvement of features and capabilities.
- **Driver and user identification.** Telematics-based solutions often rely on passive methods (e.g., driver log-in portals or vehicle associations) to map a driver or a user to a given vehicle. This creates an opportunity for variable identity uncertainty that reduces the effectiveness of measuring and monitoring driving and workplace behavior and events.
- **Use case tuning and false events.** Telematics-based solutions leverage data captured via on-device and/or vehicle sensors. These data sources often provide a very good approximation of vehicle and driving events, but they lack the specificity needed to deliver sufficient accuracy levels for eliminating false positives and negatives. Further, fleet organizations using these systems are often tiptoeing the line between correlation and causation, which makes it incredibly difficult to understand the root cause of an issue (and thus develop and implement a proper fix).

Fortunately, the fleet management technology and provider ecosystems have been investing in R&D to sufficiently evolve their solutions to address these telematics-based shortcomings and better align with the expanded responsibility of today's fleet managers. Most significantly, these next-generation fleet solutions include the integration of driver-facing and front-facing cameras, along with computer vision (CV) software operating at the edge, to supplement and or augment their telematics-based foundation to better support a broader range of use cases and deliver real-time feedback.

Industry and Domain Definitions

- **AI inferencing:** The process by which a computer-generated AI model makes a prediction based on a provided input or set of inputs
- **Continuous integration and continuous delivery (CI/CD):** A framework to develop, validate, and deploy, by which an organization seeks to deliver ongoing, rolling future capability and feature updates
- **Computer vision:** The field of study seeking to enable and improve the way computers can interpret and understand images, videos, and sensor data (e.g., radar, lidar) using AI and machine learning (ML) techniques
- **Computer vision model:** A purposely trained AI-based recipe designed to derive intelligence from a visual or visualized data (e.g., images, videos, lidar) input
- **Deep learning:** A subset of machine learning that looks to build AI models like that of the human brain (Deep learning approaches leverage a neural network-based approach and hierarchy to model development and AI inferencing.)
- **Edge computing:** Running software or compute workloads on a given device of interest (In many cases, this workload leverages the onboard computation and storage available on an integrated capture device [e.g., camera] to minimize latency, autonomy, and data transmission challenges/limitations.)

- **Machine learning:** A subset of AI that leverages extensive training data sets and models to understand how best to perform a given task
- **Object classification:** A class of CV AI models focused on understanding the inclusion or exclusion of a class of particular objects within a given image or video

Building the Case for CV

Computer vision, much like any other emerging and AI-based technology, has received considerable hype. However, CV isn't really a new technology, as it began as an academic research endeavor in the 1960s. Yet only recently (i.e., within the past 10 years) have the right critical factors come together to be able to drive the recent use and commercialization of CV. These factors, which are essential to the development and deployment of CV across a range of convenience and mission-critical use cases, include:

- **Readily available training data.** CV models, much like any AI-based models, require large amounts of available and relevant data (i.e., images and videos). This was an industry bottleneck until vast libraries of images were made available on the internet.
- **Advancements in computation and storage.** CV models require vast arrays of computing and storage to be able to store and process millions of training images. Until the advent of cloud computing and advanced GPUs, which speed up AI workloads through parallelization, models were limited in terms of their ability to have sufficient depth and structure to meet a use case's business requirements.
- **Support for deployment anywhere.** Organizational use cases differ in terms of the need for autonomy, latency, and/or redundancy. Recent industry advancements in data orchestration, middleware, and baseline support for democratizing workflows across the cloud, edge, and on device enable the development of flexible CV architectures that meet the needs of a given use case.
- **Emergence of deep learning techniques.** Deep learning, which is a subset of AI and machine learning, takes an almost biological approach to designing and building CV models. These techniques, which began to grow in popularity in the early 2010s, take advantage of many of the advancements highlighted in this section and have demonstrated a stepwise improvement in CV and AI inference accuracy, including surpassing the effectiveness of humans in key CV tasks like object classification and localization.
- **Maturity of commercial tooling and platforms.** As CV model accuracy and performance continue to improve, there have been strong, consistent R&D investments in the hardware, software, and services needed to broaden the applicability of CV across new verticals and use cases. These investments by both emerging and established technology vendors are critical to reducing the level of effort required to use CV (and AI more generally); ensuring greater IT strategy, compatibility, and footprint support; and helping with any regulatory compliance requirements.
- **Pervasive communications infrastructures and architectures.** Communications infrastructure and architectures that allow for persistent data connections and support for the sharing of high-speed, low-latency data over a wireless, cellular footprint have expanded where providers can pursue, build, and deploy CV use cases. This includes supporting high-reliability mobility use cases that cannot subsist alone on a local area network (LAN) or Wi-Fi connection.

And as the CV ecosystem continues to see strong, consistent investment, IDC has seen exponential growth in the use of CV to amplify or improve existing visual use cases as well as to support the creation of brand-new use cases. IDC views CV as no longer a fringe technology. Organizations are integrating and relying on CV to enable high-value tasks including medical imaging and diagnosis, health and safety monitoring, human and robotic coordination, and even autonomous driving.

Thus it's no wonder that leading fleet management solution providers have long looked to the promise of CV to help better align with current and future customer needs as well as to address legacy telematics-based shortcomings. These providers have established that cameras paired with CV will be the primary, critical sensor and will be deeply integrated into their solution's application logic, data analytics, and future R&D plans. This CV-centered strategic approach is already having a profound impact on not only the rate of innovation for these providers but also the level of business value that is being delivered to their fleet customers.

In IDC's analysis of the benefits of moving to a CV-centered fleet management approach, we focus on the following improvements and efficiencies as most critical for customers:

- **CV enables fleet providers to deliver a higher level of service.** Fleet systems are only as good as the data that they can provide, and CV-based solutions can leverage high-fidelity cameras and complex CV models to determine events and alerts. Leading providers are investing heavily in model training and validation to be able to ensure that these models have extremely high levels of accuracy to minimize both false positives and negatives and deliver only true events when operating in the real world. Further, providers are auditing event data (including reviewing captured event footage) from the field to understand opportunities to further improve the accuracy of their CV models.
- **CV provides a platform for future use case expansion.** Cameras equipped with CV should not be viewed as a limited, single-purpose sensor. Instead, the visual tasks that CV can perform are constantly improving as the underlying technology and model life-cycle capabilities improve. Leading fleet providers adopting CV can bring these innovations and improvements in CV capabilities to their customers over time. In this way, these fleet providers can leverage existing communications infrastructure, edge hardware, software, and workflows to extend the value they can provide to customers. This is a huge benefit for customers as their solution will continue to learn and deliver value with future R&D. Of course, there are limitations to this future expandability (e.g., compute, storage, camera resolution), but for the most part, use case expansion holds true.
- **CV delivers business value for customers, even those with small fleets.** The frequency, range, proactivity, and accuracy of events and alerts that can be generated by a CV-based fleet solution ensure that fleets both large and small can capture insights and value. In this way, organizations do not have to wait for large, fleetwide deployments to better understand their usage, behavior, and operations. This is a considerable improvement over telematics-based solutions, as organizations can more effectively align fleet management spending with unique, localized insights and ROI.
- **CV offers greater transparency.** CV models and feedback mechanisms provide organizations with customizable video and image evidence and logs of alerts and events. This evidence can be critical to providing irrefutable proof of a given condition as well as reinforcing the calculation and measurement of fleet and driver performance. Further, these evidence logs and snippets can be effectively used as part of an organization's operations and governance approach, including the establishment of KPIs and metrics that can be utilized with supporting organizations as part of a greater digital transformation initiative.

- **CV definitively identifies drivers and users.** A big challenge for fleet managers and workers is confirming the linkages between an event and a worker/driver. CV-based solutions can leverage facial recognition and identification to automatically link a driver to events. In this way, there are complete assurances that the gathered information and insights apply to the correct employee when monitoring safety events or driver compliance requirements.
- **CV facilitates positive change through alerts, coaching, and feedback.** Improved use case detection accuracy, greater depth of use cases, and driver identification capabilities create the right environment for fleet managers to coach and improve driver behavior. Further, CV-enabled devices and platform software can deliver a combination of coaching videos and real-time alerts to positively identify and reinforce events. By providing organizations with a high level of consistency and accuracy as well as irrefutable evidence of events, CV builds a strong level of trust in the fleet system that can be used to identify problem areas and facilitate positive organizational and driver change.
- **CV enables the sharing of data insights to engage ecosystem constituents.** CV-based solutions help organizations expand the metrics that can be used for measuring the impact and effectiveness of their fleets. These data insights not only are valuable to fleet-related stakeholders but also can be shared with other stakeholders (e.g., customers, partners, and other business units) to reinforce how and where fleet effectiveness is impacting their greater business. For instance, customers can utilize historical and real-time fleet performance data with insurers to adjust and rightsize their premiums.

Leading fleet management providers have not ignored the outsize impact of building around computer vision. The combination of the benefits delivered by CV-based solutions enables customers to drive further improvements in fleet effectiveness, operations, costs, and safety that are not possible with telematics-based solutions. As customers think through their fleet strategies, they will see the greatest return by working with a provider that understands the potential benefits of utilizing CV.

Considering Motive

Founded in 2013, Motive, formerly KeepTruckin, is a leading provider of global fleet management services. Motive's vision is to design and build technology that connects and automates physical operations that will transform the safety, productivity, and profitability of the physical economy. The company pursues this mission via its AI-powered applications that address customer use cases around fleet tracking and telematics, safety, compliance, sustainability, physical security, and workforce and spend management. Motive currently has more than 120,000 active customers and targets customers from trucking and logistics, construction, oil and gas, food and beverage, delivery, field service, passenger transit, and agricultural industries.

Motive's product strategy centers around designing and deploying purpose-built hardware, platforms, and applications (i.e., including mobile) to connect a customer's vehicles, equipment, and physical assets. This approach puts Motive in a strong position to support the scalability needed for future feature and capability growth while maintaining a robust security and data privacy foundation. Further, Motive's ability to design around a single, integrated platform for customers streamlines how users can engage, customize, view, track, query, and manage their fleet environments in real time.

Motive has demonstrated itself as a technology-first company and has been one of the leading providers in adapting and integrating key technology growth areas of cloud and edge computing, IoT, AI, CV, and advanced data analytics into its products and services. It takes pride in fully understanding customer challenges and delivering complete solutions that address these pain points.

Motive is focused on remaining an ecosystem innovator for the use and adoption of CV in fleet management. It has designed, developed, and deployed an integrated camera-based IoT device that brings the power of CV to fleet management. Further, Motive's approach to CV is an area that helps differentiate the company from its competitors.

Specifically, this differentiation includes:

- **End-to-end product view.** Motive's consideration and understanding of all aspects of the hardware, software, and service development and life cycle enabled the company to be an early adopter of and innovator with CV. Further, Motive's team was able to identify where and how CV could deliver the greatest improvement and designed around that. The Motive team develops and maintains novel and patented algorithms designed to enable the rapid development of models.
- **Investments in CV and AI experts.** Motive maintains one of the largest dedicated teams of experts to support its CV and AI initiatives. This includes an in-house safety team that reviews all AI events and behaviors across its extensive customer footprint to ensure the highest level of accuracy and effectiveness. These experts are instrumental in the selection of strategic partners (e.g., Ambarella) that maximize the success of CV initiatives including enabling the fine-tuning needed to deliver the best performance.
- **High-accuracy CV model validation thresholds.** The Motive team holds itself to the highest standards when deciding when to commercialize a CV model-enabled alert. It sees this utmost rigor as critical to eliminating false positives and negatives and establishing customer trust. Further, the Motive team has implemented a CI/CD framework to improve model performance over time, and it utilizes over-the-air (OTA) updates to seamlessly update customer hardware and software.
- **Customer satisfaction as foundational.** Motive constantly looks for opportunities to add new functionality and use cases to its solutions. It achieves this goal while collaborating with its customers to ensure the proper alignment, feedback, and prioritization between future innovation, investment requirements, and potential business value. Motive proactively engages with its customers and sees them as critical to its current and future success.

Challenges

IDC expects strong growth for fleet management providers as customers look to take advantage of the benefits of today's CV-based solutions. However, in the near term, Motive faces the following challenges while in pursuit of this market growth:

- **Proprietary hardware.** IDC understands the rationale and benefits of building around a fully integrated, proprietary hardware strategy. However, such a stance limits the ability of new customers or existing customers operating a mixed fleet, who have already invested in (potentially) supportable hardware, to migrate or switch their service without purchasing new hardware. Motive should consider opportunities to validate third-party hardware (even if the full feature and capability set may not be available) to reduce this challenge for customers.
- **Off-road fleet targeting.** IDC expects that traditional on-road vehicle fleets will remain a sweet spot for Motive; however, there is ample opportunity as customers seek to develop a similar level of understanding about the use and operation of their off-road vehicle fleets (e.g., yellow iron/construction vehicles, forklifts,). Although Motive supports off-road telematics capabilities via OEM integrations with Caterpillar, John Deere, Komatsu, and Volvo, IDC sees this segment as less of a focus. As Motive looks to better address this segment, IDC expects that the company will benefit from a new customer engagement and entry point as well as deliver incremental value through the unified visibility of a greater range of off- and on-road assets and operators.

Conclusion

Telematics-based fleet management solutions are not able to effectively address the expanded role and expectations of today's fleet management organizations. Instead, leading fleet management providers have invested in cameras and CV capabilities to address these telematics-based shortcomings and deliver outsize business value for customers. CV-based fleet management solutions are superior to legacy solutions because of their ability to support increased real-time alerting and event accuracy, current and future use case expansion, driver facial identification, and video forensics and playback capabilities as well as offer ecosystem benefits (e.g., insurance premium reductions).

Fleet management organizations without a solution or those with a legacy telematics-based fleet solution should investigate the ecosystem of CV-based solution providers to fully understand how CV-based solutions can deliver increasing business value.

About the Analyst

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Matt Arcaro, Research Director, is responsible for IDC's worldwide computer vision (CV) and AI technologies and tools research. Mr. Arcaro works within IDC's software market research and advisory practice and directly reports to IDC's greater AI- and ML-focused team.

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More About Motive

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