



# LET'S BUILD SMARTER, SAFER SPACES WITH AI

Powered by NVIDIA Metropolis and NVIDIA EGX

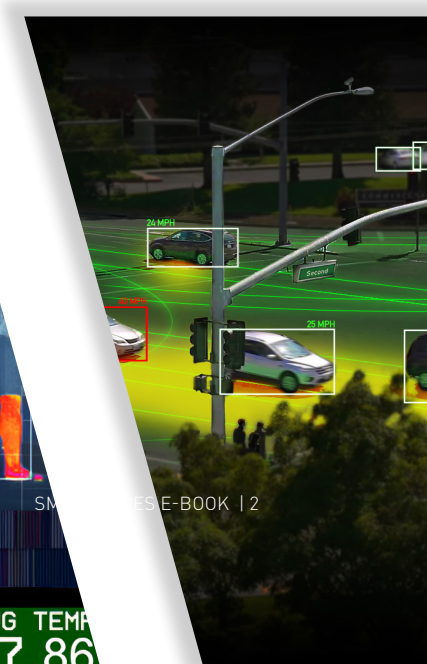
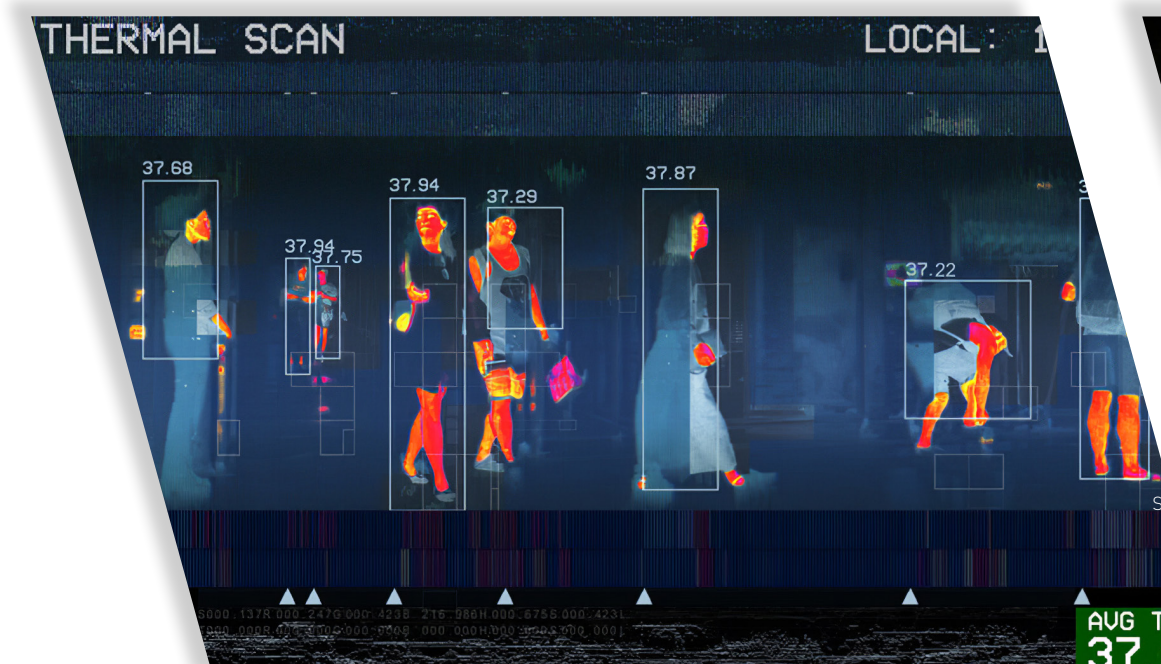
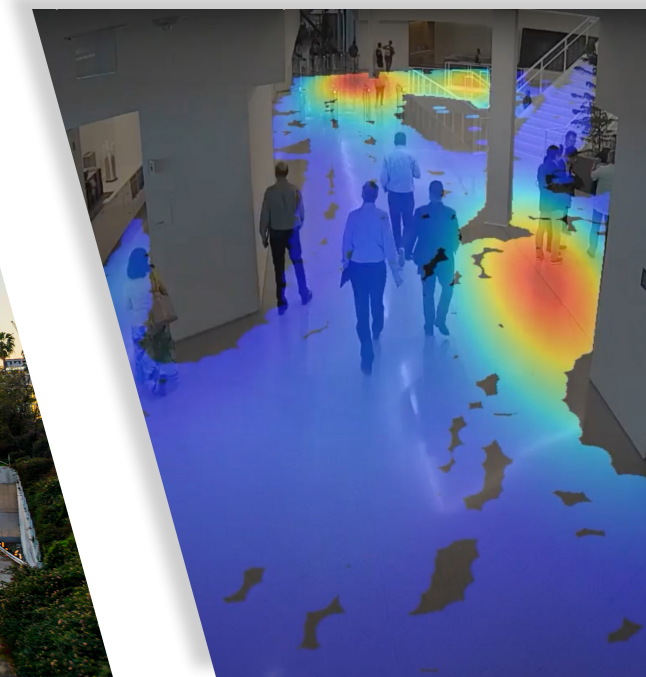




The need to automate and improve operational efficiency and safety in our physical spaces has never been greater. Approximately 1 billion video cameras—the ultimate Internet of Things (IoT) sensors—have been deployed throughout the world’s cities and spaces to help us live better and safer. Optimizing AI-enabled video analytics is critical for frictionless retail, streamlined inventory management, traffic engineering in smart cities, optical inspection on factory floors, patient care in healthcare facilities, and more.

## NVIDIA Metropolis: Powering the World’s Smartest Spaces

In the pages that follow, we’ll explore real-world examples of how AI enabled video analytics based on the NVIDIA Metropolis application framework running on the **NVIDIA EGX™ platform** solve complex operational and safety problems across a broad range of industries. **NVIDIA Metropolis and its extensive partner ecosystem** help to bring powerful AI-based video analytics applications to market faster.



# TRAFFIC MANAGEMENT

## NOTRAFFIC

### Driving smoother, more sustainable traffic for 4.5 million drivers.

Arizona's Maricopa County Department of Transportation (MCDOT) had a serious congestion issue—managing the nation's 14th most traffic-heavy region. NoTraffic, an NVIDIA Metropolis partner, gave them the answers they needed with an AI-based traffic management platform that optimizes flow based on real-time utilization and demand.

AI sensor units are installed at each intersection, providing road-user detection and classification using a fusion of machine vision and radar. The sensors use the NVIDIA Jetson edge AI devices and NVIDIA Metropolis AI framework to process video of the intersection traffic. NoTraffic's units detect and classify road users, including cars, buses, trucks, bicycles, pedestrians, and even emergency vehicles in any lighting or weather conditions.

The processed data is then used to optimize traffic-light management with edge-based computing, saving bandwidth and lowering latency. City engineers can view the data using custom dashboards for real-time data analysis that enables capabilities such as collision prediction and prioritizing certain road users.

MCDOT realized significant efficiency improvements, with more to come. An estimated 22,607 metric tons of greenhouse gases could be avoided annually—like taking 4,915 vehicles off the roads. Over \$50 million could be saved annually through costs prevented (vehicle wear and tear, fuel savings, and maintenance). And an estimated 3,957 months of vehicle delay time could be eliminated each year.



Image courtesy of NoTraffic

# TRANSIT HUB MANAGEMENT

ASSAIA

## Improving airline efficiency for 46.5 million passengers—powered by AI.

When a commercial flight lands and taxis to the gate, the choreographed dance of cleaning, restocking, and servicing a plane begins, known as the 'turnaround'. Accomplishing this faster means less wasted time with an aircraft sitting on the tarmac, less waiting around for customers, and more profits for the airline. London Gatwick Airport (LGW), the busiest single-runway airport in the world, tapped into the power of AI to make every second count.

Assaia is a Zurich-based startup that uses image recognition algorithms to process video and offer predictive analysis to better manage turnaround operations. LGW was the first airport in the world to implement Assaia's Turnaround Control, installing 28 cameras at 14 stands. Video streams from the cameras are analyzed on-premise using NVIDIA Jetson AGX Xavier™ modules, giving the airport full visibility of all turnaround activities in real time. The system uses AI algorithms to turn the video streams into structured data, including timestamps for turnaround events and safety-related data. Airport staff and vendors can then use this data to increase on-time-performance, enhance safety, and decrease costs.

LGW can now get more passengers onto more flights each day with lower operational costs, an accelerated move towards sustainability, and a safer environment for airport workers and airline crews and passengers.



Image courtesy of ASSAIA

SMART CITIES E-BOOK 14

# PARKING OPERATIONS

DATAFROMSKY

## Optimizing the daily commute through more intelligent parking.

For many commuters, the daily journey involves driving to the train station, parking, then catching the train. Sounds easy enough, but a lack of parking spots where they're most needed often leads to frustration and wasted time, and can even cause missed trains. The new Køge Nord Station, near the Danish capital of Copenhagen, took on this challenge using the power of AI.

An innovative new solution from NVIDIA Metropolis partner DataFromSky uses cameras to monitor parking lots for occupancy, enable mobile payments, and even navigate drivers to empty parking spots. Camera streams are analyzed in real-time by a server powered by the **NVIDIA EGX platform** and NVIDIA T4 GPUs using an algorithm trained to detect whether individual parking spaces are free or occupied. A browser-based interface also makes system administration easy, and mobile apps connect drivers with payment, navigation services, and notifications when their allotted parking time is about to expire. The system can even interface with local law enforcement agencies to share license plate numbers and other information should a crime occur in the lot.

Køge Nord Station can now offer commuters the ideal parking solution. Each camera monitors up to 400 parking spots, converting video streams into valuable insights in real-time using the NVIDIA DeepStream SDK. The system delivers new data and capabilities while being much cheaper and easier to implement than in-ground sensors. AI helps the station run more smoothly and save money while making every commute a little less painful.

Image courtesy of DataFromSky



# HOSPITAL OPERATIONS

ARTISIGHT

## Creating a safer environment—and bottom line—for today's hospitals.

Keeping today's hospitals running smoothly and safely is more challenging than ever before.

NVIDIA Metropolis partner, Artisight, uses AI to improve productivity in the operating room and help hospitals improve their efficiency. Their applications generate HIPAA-compliant data from video cameras and wireless devices installed strategically around the facility, providing insights on workflows and patient locations to optimize how care is provided.

Artisight had a network of 2000 cameras and other sensors deployed across Northwestern's ten hospitals running on the NVIDIA EGX platform. Then the pandemic hit, and the hospital asked for help screening people coming in for COVID-19. Artisight installed additional thermal cameras linked to its network at 104 entrances across the health system network, using AI to detect roughly 50 cases of fever among the 20,000 people coming through the doors each day. Compared to conventional temperature probes, the camera system has shortened waiting lines and reduced the staff needed at each door by 75%.

Today, they've since deployed across 37 hospitals and ambulatory surgery centers, using computer vision and conversational AI to improve operating rooms efficiency, increase patients' satisfaction, and strengthen the hospitals' bottom line. As a result, nurses are going into rooms less—thereby reducing overall exposure—and consumption of protective gear is down. It's all about safety and efficiency—powered by AI.



# WORKPLACE SAFETY

HELIN

## Making dangerous job sites safer—even at sea.

Oil rigs are some of the most dangerous job sites in the world. But Dutch safety company Helin Data is making offshore rigs safer—and more efficient—with AI.

Helin's application uses a network of cameras and sensors feeding into AI-powered video analytics algorithms based on the NVIDIA Metropolis stack. The system locates rig workers in unsafe spots and alerts them before an accident occurs. It also lets clients examine how they work and determine if portions of jobs can be done with tools and machinery, instead of additional human workers. That's an opportunity to be more efficient and safer, given one less person potentially standing in an unsafe position.

Oil rigs don't have internet access, so Helin had to design its system to handle all of its data capture and processing using on-site hardware. The NVIDIA Jetson edge AI platform powers the solution, which offers unbeatable performance and energy efficiency in a tiny form factor.

Today, the model pinpoints people's locations within 18 inches and sends an alert that can run a complete sequence in under 250 milliseconds if someone is in an unsafe area. Real-time analytics at the edge is critical to make this happen. Every real alarm can save a life and every false alarm serves as an opportunity to refine the model.



image courtesy of Helin

# CAMPUS MANAGEMENT

## ICETANA

### Discovering new insights to keep campuses safe during the COVID-19 shutdown.

Mount Royal University in Calgary, Alberta, Canada had been using icetana's public safety system for about a year when the COVID-19 pandemic took hold. The system applies real-time GPU-accelerated AI analysis to more than 250 campus cameras, differentiates routine motion from unusual activity, and sends real-time notifications to operations teams.

When campus access was restricted for COVID-19 safety reasons, the AI system adapted to the reduced movement of students and staff. As it turned out, not all unusual activity on campus involved humans. icetana's system reported a mysterious anomaly along a hallway inside one of Mount Royal's residential buildings. Control room staff were able to review the video feed and spot a dark patch forming on the carpet. When a guard went to investigate, he found a major water leak. Without icetana's AI video analytics, the leak would have gone on undetected, as that part of campus had become vacant during the shutdown. Instead, campus staff were able to contain the damage and cost of the leak almost instantaneously.

icetana's application uses the power of the NVIDIA EGX platform to analyze real-time video footage and create immediate alerts for any abnormal activity, alleviating the need to have staff constantly monitoring every camera.

Since installing the system, Mount Royal operations have reported an average of four actionable events each week that would have gone unnoticed and unreported. This is a great example of AI solving operations and safety problems in a single application.



# AIRPORT SAFETY

IPSOTEK

## Managing the growing pains of Indonesia's largest airport.

Jakarta's Soekarno-hatta International Airport (CGK) was facing a growing challenge. With three terminals serving more than 66 million passengers a year, and another 44 million anticipated by 2024, it was crucial for the airport to accurately identify and manage incidents as quickly and efficiently as possible to minimize disruptions to passengers and airside operations.

Beginning in 2015, Ipsotek set to work deploying an AI-powered solution to analyze video camera streams for a number of operational use cases throughout the terminals and is powered by the NVIDIA EGX platform. The capabilities deployed included exit lane monitoring, passenger counting, baggage handling violations, perimeter protection, abandoned baggage, and loitering. It also lets operators track abandoned vehicles—one of the highest threats at any airport. The AI-enabled application can detect when a driver abandons a vehicle, triggering a real-time alarm and auto-tracking the driver using pan-tilt-zoom (PTZ) cameras.

Ipsotek's application generates real-time and archived data for valuable business and health and safety insights. This includes people-counting over time, crowd density with heatmaps, occupancy levels and distribution, social distancing, and face-mask detection. It all makes for a smoother, safer environment for both workers and travelers.



Image courtesy of Ipsotek

# CROWD SAFETY

AWIROS

## Keeping a big crowd safe—10 million people big.

Medaram Jathara is the biggest tribal festival in Asia, drawing nearly 10 million devotees to Telangana, a state in southern India, every year. Managing a crowd this size takes more than extraordinary planning and coordination. It takes powerful technology.

The state authority responsible for event safety used the Awiros Crowd Estimation application to measure crowd density at several locations during the 2020 festival. This first-of-its-kind tool uses AI to estimate crowd densities in real time using video cameras, letting authorities detect crowd size and track variations in area-specific density over time. This gives them a head-start on taking preventive measures and avoiding dangerous situations such as stampedes.

The application was deployed on cameras positioned at several key entry-exit points of the festival site, as well as on a drone camera that provided an aerial view of the venue. Video feeds were analyzed in real time using the NVIDIA DeepStream SDK and powered by the NVIDIA EGX platform. Each GPU-enabled system analyzed video streams from several live cameras simultaneously, keeping the system footprint to a minimum and greatly reducing cost.

Officials were alerted when the crowd density in a region crossed a specific safety threshold or when the rate of change in crowd density changed rapidly and could act quickly—keeping attendees safe and the festival running smoothly.



# RETAIL OPERATIONS

AiFi

## Fast, easy, stress-free shopping—no cashier required.

Great news for anyone who loves shopping but hates lines. The convenience and speed of checkout-free shopping is becoming increasingly accessible in more places—from airports, to gas stations, and even to the Indy 500 auto race track—thanks to AiFi’s AI-powered automated retail solutions. And there are many more sites on the way.

AiFi uses a combination of AI, edge computing, and IoT fusion technology to create an autonomous retail environment. Shoppers tap a (contactless) debit card or compatible wearable device at the door to gain entry, get the products they want, and simply leave. The items are automatically registered—using AI-enabled video analytics powered by the NVIDIA EGX platform—and paid for, with receipts transmitted wirelessly to shoppers.

The “Nanostores” run on the O.A.S.I.S. Autonomous Store Platform, which includes seamless multi-camera, multi-person tracking, real-time product recognition, and live inventory tracking to deliver an ultra-fast, checkout-free shopping experience. The platform also provides shopper-behavior analytics and sales and brands analytics, and supports flexible payment options.

Full autonomy allows Nanostores to operate around the clock, 365 days a year, with no additional overhead. They can also be deployed, moved, and redeployed in a new location with minimal downtime or cost, making them perfect for pop-up stores, festivals, sporting events, and college campuses. In addition to Nanostore format, AiFi’s cashierless checkout technology has also been deployed in a larger convenience store format across the globe.



Image courtesy of AiFi

# QUALITY CONTROL

## DATA MONSTERS

### Reducing packaging defects at the world's largest brewer.

One of the world's largest brewers is tackling the most challenging supply chain inspection problems—detecting defects on beverages packaged in aluminum cans being processed on high-velocity conveyor belts. There are about 50B aluminum cans processed each year in the US on high-speed belts such as the ones this brewing company runs. It's a challenging problem given the line speed, defect variability, condensation, vibration, can placements, and frequently changing package design, not to mention Internet bandwidth. But it's a challenge well-suited for AI.

Data Monsters, an NVIDIA Metropolis partner, developed an AI application for the brewing company that used GPU-accelerated, real-time AI vision inference and edge re-training capability with specifically designed self-supervised learning algorithms in-the-loop.



# PACKAGE SORTING

UNITED STATES POSTAL SERVICE (USPS)

## Using AI to improve delivery and processing on billions of packages.

The USPS operates the world's highest volume logistics operation, processing and delivering 146 billion pieces of mail each year, including more than 6 billion packages. USPS is using AI and NVIDIA Metropolis to process package data 10X faster and with higher accuracy—greatly improving package-sorting site productivity.

Complex feature data is extracted on approximately 20 million packages per day to enable fast package search, along with maintaining package safety. Accelerated edge servers powered by NVIDIA EGX are deployed at all 192 USPS package sorting sites running real-time video analytics with NVIDIA Triton Inference Server and NGC containers.



# WASTE MATERIAL PROCESSING

RECYCLEYE

## Reducing waste going into landfills by enhancing recycling capabilities.

Global consumption is accelerating, with \$2 trillion worth of materials thrown away each year globally, of which only 8% is recycled. Finding new ways to increase worldwide recycling levels is necessary to speed the transition towards a circular economy.

Recycleye deploys AI-powered automated waste analysis and sorting systems to improve material recycling facility efficiency, cost, and speed. Their computer vision system detects and classifies items in the waste sorting process by material and object. Then, Recycleye uses the NVIDIA DeepStream SDK and Transfer Learning Toolkit to deploy highly optimized video analytics. These - deliver high throughput and accuracy, as well as the ability to fit the compute-intensive algorithms into space and power-constrained industrial environments using NVIDIA Jetson Xavier AGX. Recycleye's models can run at 60FPS, which means higher-capacity sorting thanks to faster conveyor belt speeds.

Recycleye's technologies exceed human performance in identifying, classifying and sorting individual items on waste streams, with over 95% accuracy 24/7. At a fraction of the cost of existing systems, Recycleye's solutions have been installed across the UK and France, enabling recycling facilities to tackle more of the world's waste.

