

A futuristic, blue-toned digital landscape. The scene is dominated by glowing blue and cyan light trails, spheres, and rings, suggesting a high-tech or artificial intelligence environment. In the background, there are faint, horizontal lines of binary code (0s and 1s) in a light blue color. The overall aesthetic is clean, modern, and tech-oriented.

GRAYMATICS

COGNITIVE MEDIA PROCESSING

*deep sensing at cloud scale*

# Plethora of CCTV's Installed & Being Deployed in Cities, Retail, Buildings, Enterprise ... value to be fully unlocked



> 700M  
CCTV's  
projected to be  
shipped in 2019

Major growth of  
IOT/Surveillance  
products leading to a  
need for transforming  
unused data to  
Actionable Data

## GRAYMATICS G3C.AI UNLOCKS INSTALLED CCTV CONTENT @ MASSIVE SCALE

Vehicle Analytics

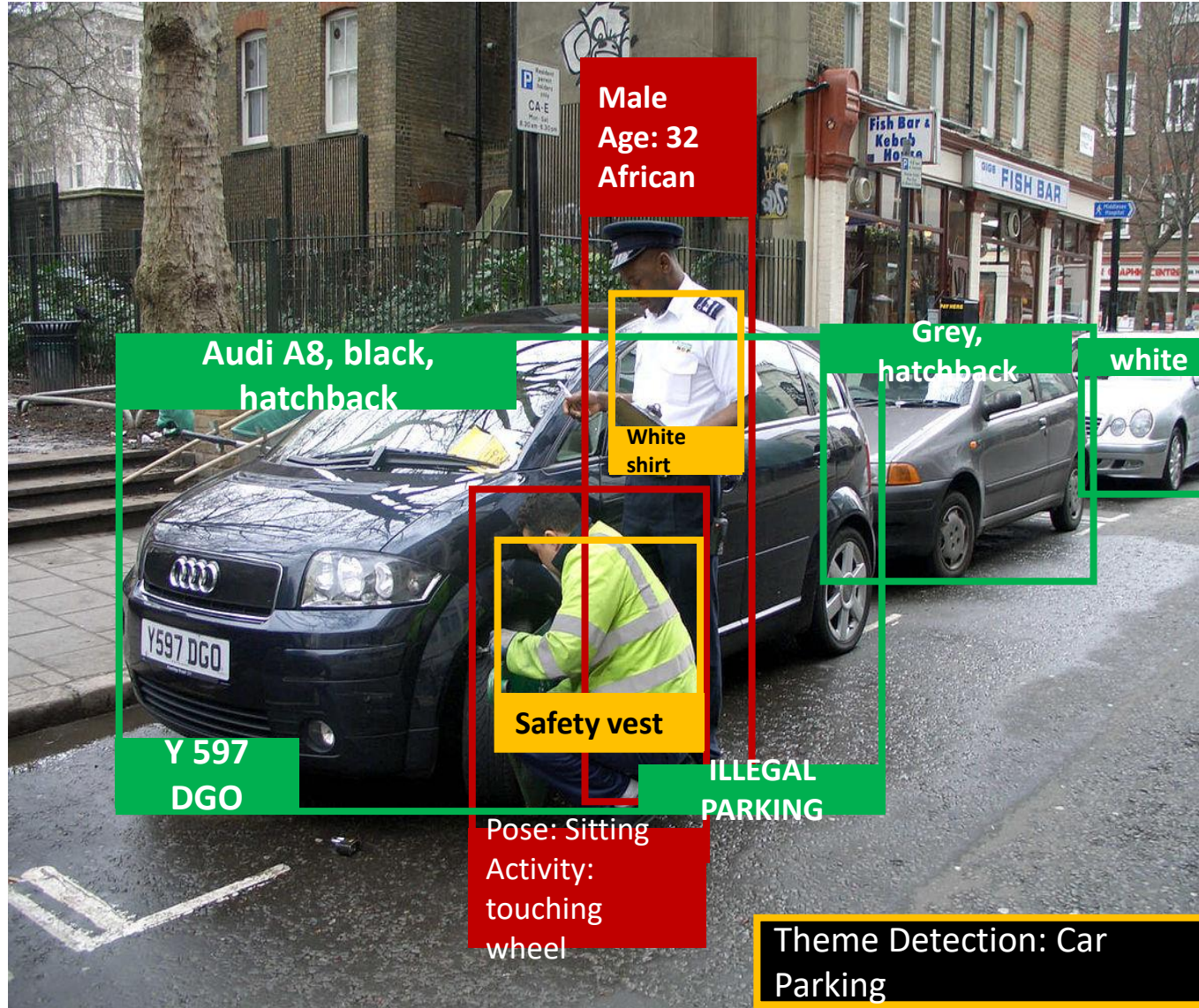
People Analytics

Clothing Analytics

Object Analytics

Activity & Movement Analytics

Audio Analytics



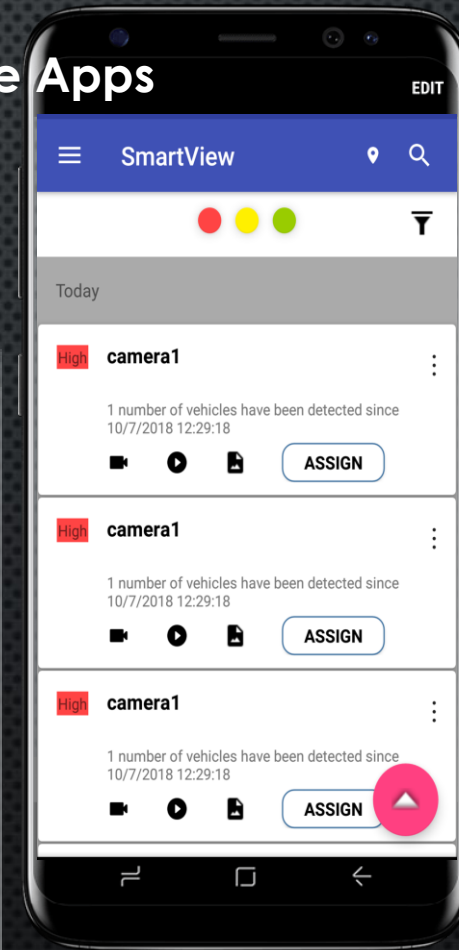
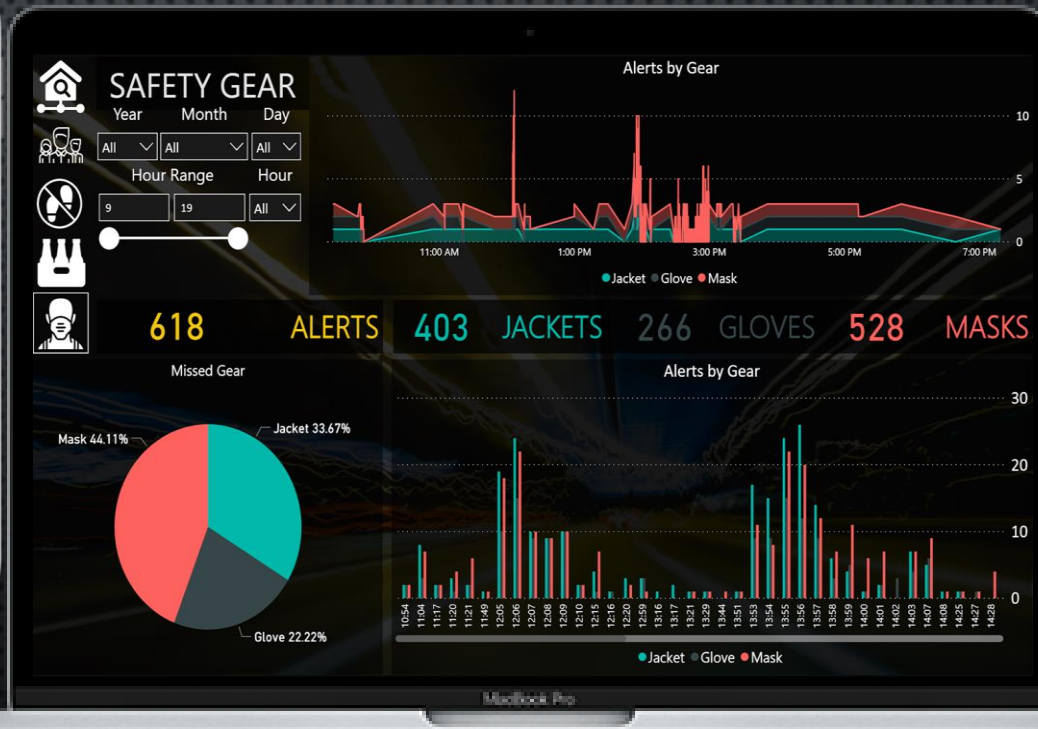
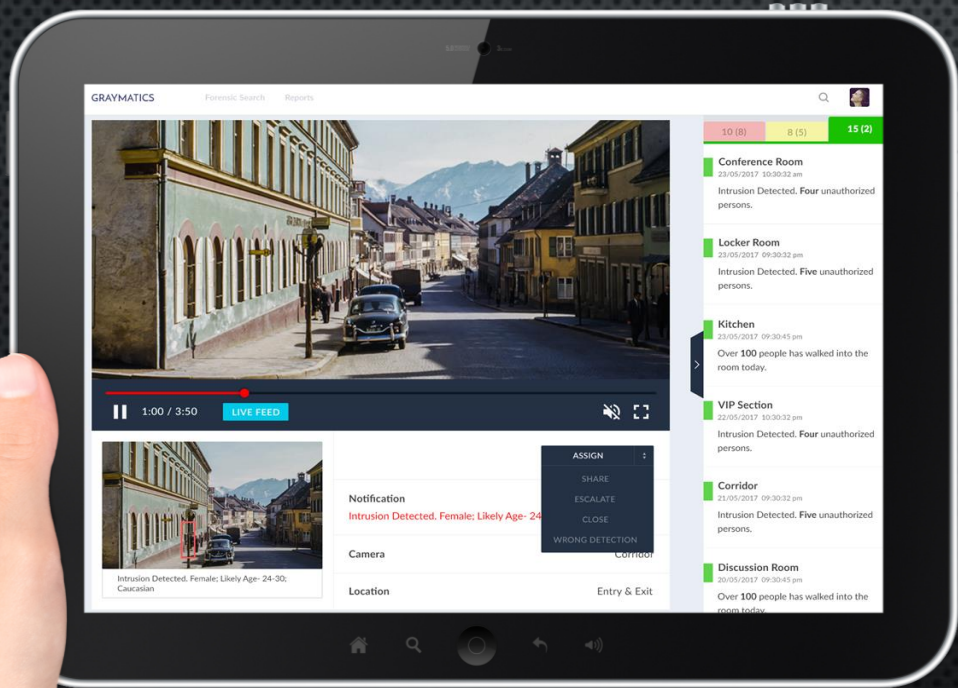
- Deep Learning models deployed in Dockers
- Dockers optimized for speeds in various ways
- Each docker comprises multiple detectors, classifiers with contextual processing
- Continuous online Learning to future-proof performance
- Tools for extracting massive amount of good training data from videos seamlessly
- Unique platform to handle mobile, internet, CCTV videos

## RICHLY FEATURED TOOLS FOR FULL & COMPELLING SOLUTIONS

Full-Featured Notification Panel

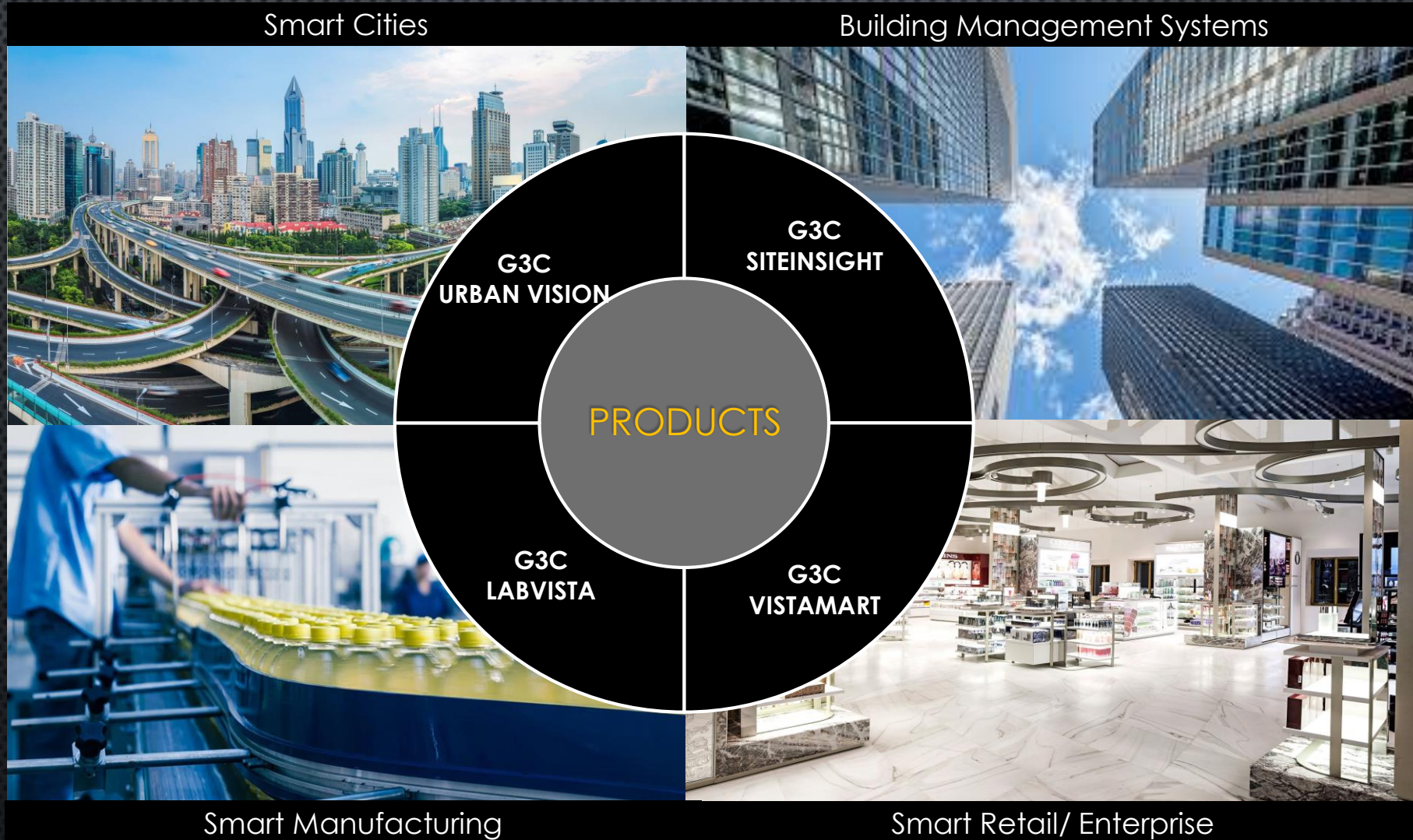
... & Insightful Dashboards

... and Mobile Apps



G3C.AI

# PRODUCTS & MARKET VERTICALS



- ❑ Support Police to maintain Law & Order
- ❑ Act as an aid to investigation
- ❑ Improve Traffic and urban mobility Management
- ❑ Help in deterring, detecting and thus dealing with criminal activities

**Investigate  
Incidents**

**Fast Response**

**Prevent  
Incidents**

**Act as  
Deterrent**

car: 3  
truck: 1  
motorbike: 1



Track every vehicle passing by at street junctions

Mark various risky scenarios

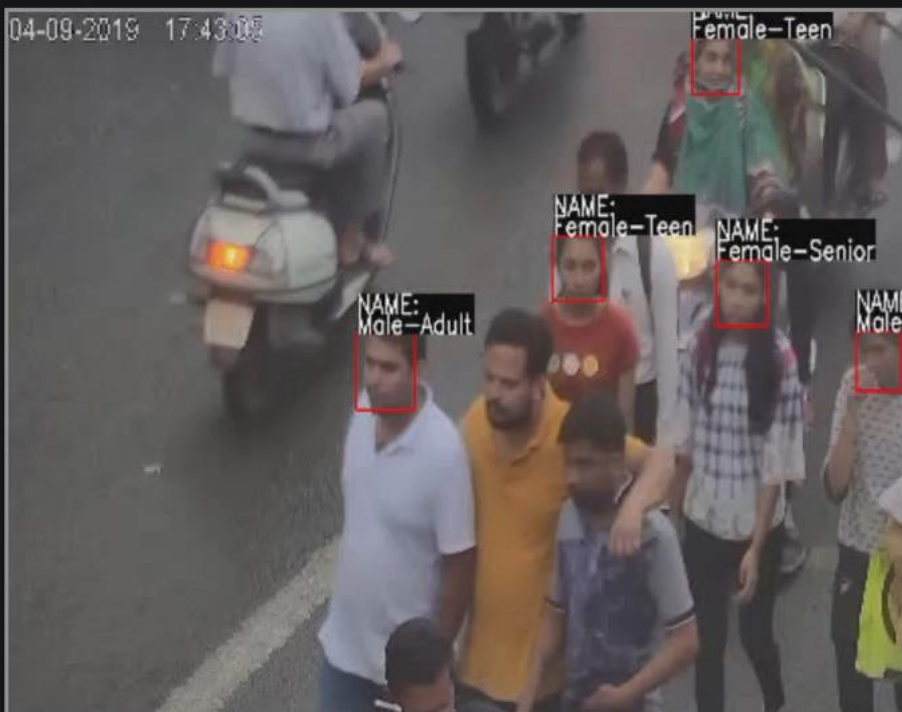
- Motor cyclists without helmets
- Pedestrians not crossing at zebra get too close to moving vehicles
- Overspeeding Vehicles
- weaving in traffic
- Illegal parking
- Incorrect lane driving
- People violence
- Many more

FACE ANALYTICS

# GRAYMATICS

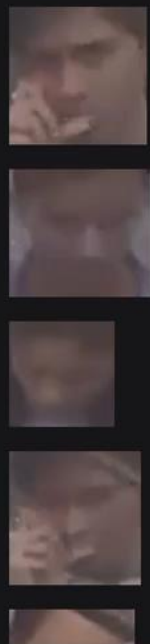
Camera 0

Camera 0



Faces

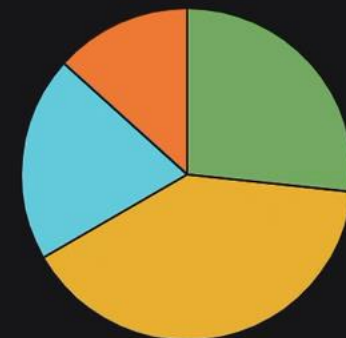
Image



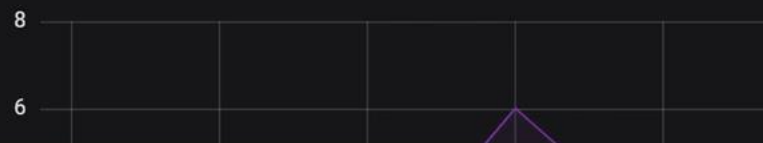
Age Group



Age Group



Gender



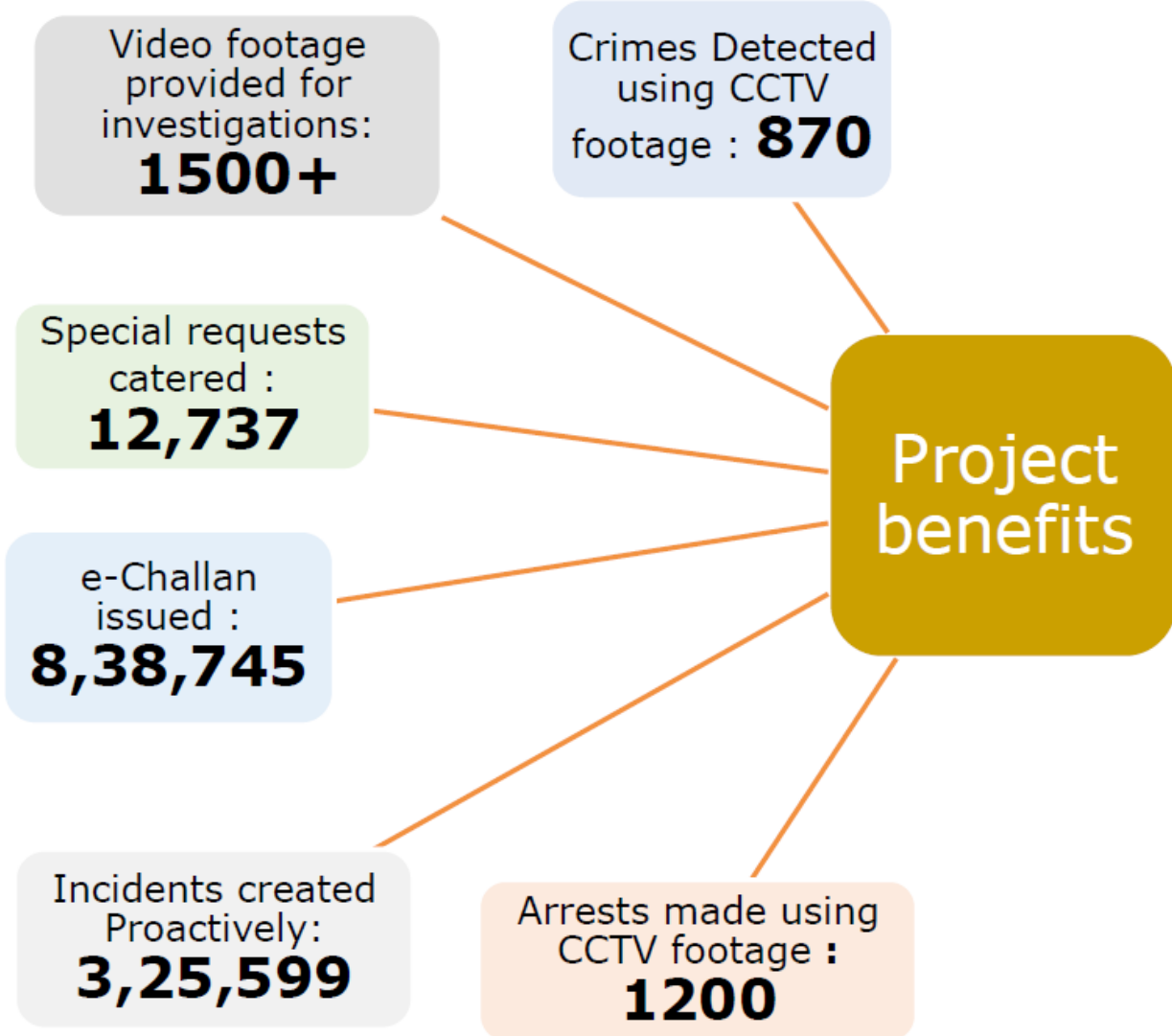
Gender





# Outcomes from the project

| Mumbai | Published: May 10, 2017 3:33 am



### CCTVs: Locating lost property, deterring criminals, reuniting friends

### CCTV network helps accident victim get timely aid

### Mumbai: 9 days after kidnap of toddler, cops rescue her with CCTV help

While the girl has been found, the police are looking for the woman who had allegedly kidnaped

**Anindya Chakravorty** added 3 new photos.  
February 1 at 12:25pm · Mumbai

We can't thank Mumbai Police enough. Powai Police, Bhai Mahadeshwar, Sr Inspector, Smt Angha Satabe who didn't leave our side for the entire ordeal. Dpt Commissioner Police, Virayak Deshmukh, Addl. CP, West Dorje, Commissioner Datta Parsajekar, Law and Order Jnt CP, Devan Bharati and ten thousand policemen who turned Mumbai inside out. BMC city camera project and the quarter million people who liked and shared our post and shared agony we went through. Chief Ministers office, Corporators office and the thousands of friends who came out and combed the streets, biker groups, HCG, RH, 4WDMumbai, Hiranandani Commando team and our friends and neighbors who stood by us. If I missed to thank anyone I think I need to thank you. One anonymous phone call which pointed out the 4 cameras out of 10,000 which found her. A few pics. We go on our knees and thank all. God gave us a second life as a family today.

### With over 5000 eyes on you, it will be hard to bribe Mumbai traffic cops now

5408 CCTV cameras have been installed in Mumbai to monitor traffic and cops which will make it easier to scrutinize corrupt cops.

**Wife** | **Postally** | **Beats** | **Life** | **Family**  
Mumbai, August 3, 2017 | [UPDTCEB 0019 97](#)




CCTV, speed cams bring down Holi drunk driving

### Chain-snatching fell by over 50% in 2016

#### STOPPING THEM IN THEIR TRACKS

Month	NO. OF CASES LOGGED		CASES CRACKED	
	2015	2016	2016	2015
Jan	60	67	244	419
Feb	82	48	11	
Mar	63	34		
Apr	91	32		
May	96	47		
Jun	88	30		
Jul	79	30		
Aug	78	35		
Sep	60	29		
Oct	66	42		
Nov	81	26		
Dec	65	13		
<b>TOTAL</b>	<b>909</b>	<b>443</b>		


**2017**  
Jan 14  
Feb 7

Awareness among women has brought down chain-snatching incidents. Besides, the installation of CCTV cameras and intensified patrolling are deterring criminals.

**SPS Yadav** | **FORUM THAT POLICE CARE**

The main reason why chain-snatching cases have reduced is the extensive coverage of CCTV cameras. There is no way a thief captured on camera can escape for long. The police seek footage from the CCTV cameras in the vicinity so as to identify the perpetrator.

**VP Singh** | **MS OFFICE TRAVEL LIAISON**



### Cops rescue kid abducted and 'sold' by beggar

Mumbai: The police have rescued a two-year-old girl who was abducted from Bandra (east) eight days ago. After the girl, Shifa Sheikh, went missing passers-by told her parents that they had seen her going with a middle-aged woman.

Police examined CCTV footage at railway stations around the area, said inspector Shankar Bhore. The girl was seen with a woman in the footage from Dadar

### MUMBAI AUGUST 04, 2017 00:19 IST

### CCTV camera network leads police to molester

Mumbai: The city-wide Closed Circuit Television (CCTV) camera network installed last year helped the police apprehend an autorickshaw driver who had allegedly molested a teenage girl with a learning disability on July 2 in Versova.

"The victim, who is 15 years old, was injured in a fall, and her mother had hailed the accused's autorickshaw to take her to a doctor. Around 11:45 p.m., the

### Despite no leads, Mumbai police tracks down thieves in just 8 hours

By Anurag Kamble | Posted 17-Mar-2017 [Now Available on the red-dial iOS App, Download Now](#)

They drew route map based on CCTV footage; trace the scooter with the help of cellphone triangulation

# Unfold blueprint of Smart cities with G3C.AI@DELL



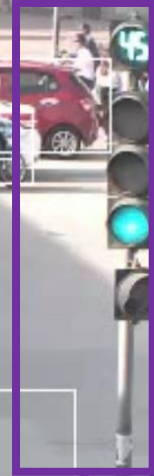
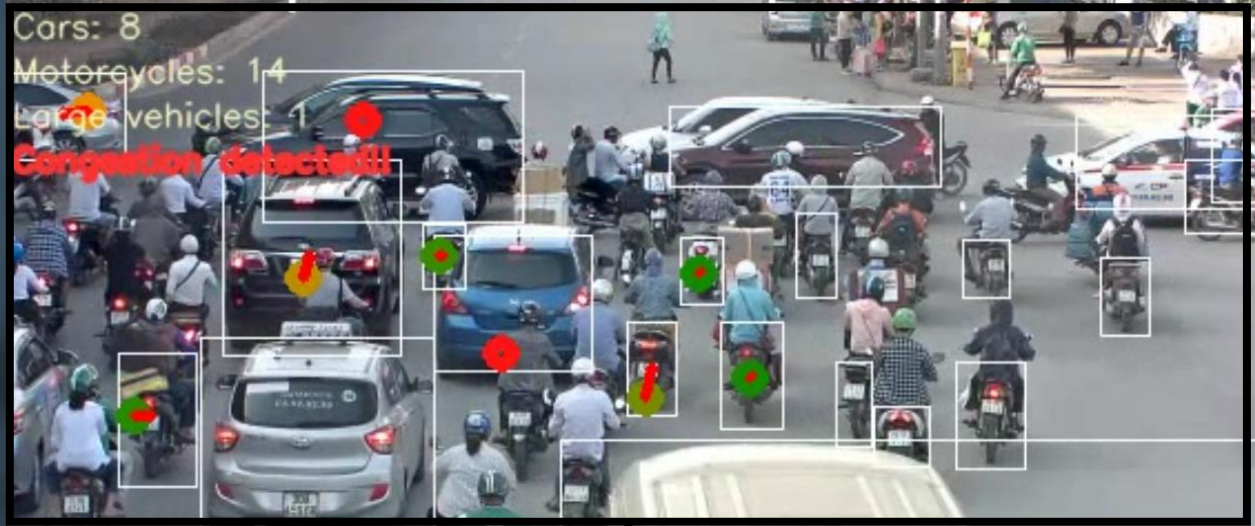
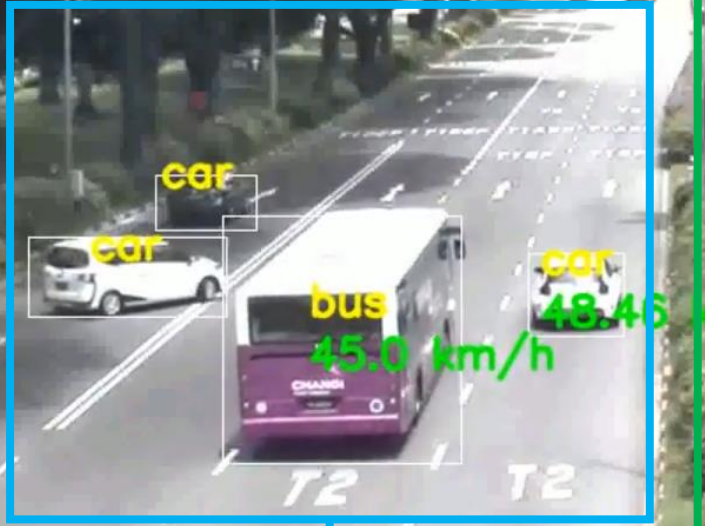
- ✓ Traffic flow analysis
- ✓ Vehicle identification
- ✓ Transport Station Operations & Security
- ✓ Monitor Parking lots and Elevators in residential blocks

# RED LIGHT VIOLATION | SPEEDING | CONGESTION DETECTION | TAIL GATING

**Traffic**  
car: 12  
bus: 1  
truck: 1  
motorbike: 0

**Level of Service**

Lane	1	2	3	4
Status	Normal	Normal	Normal	Normal



**Vehicle classification**

**Speed Detection**

**Lane traffic analysis**

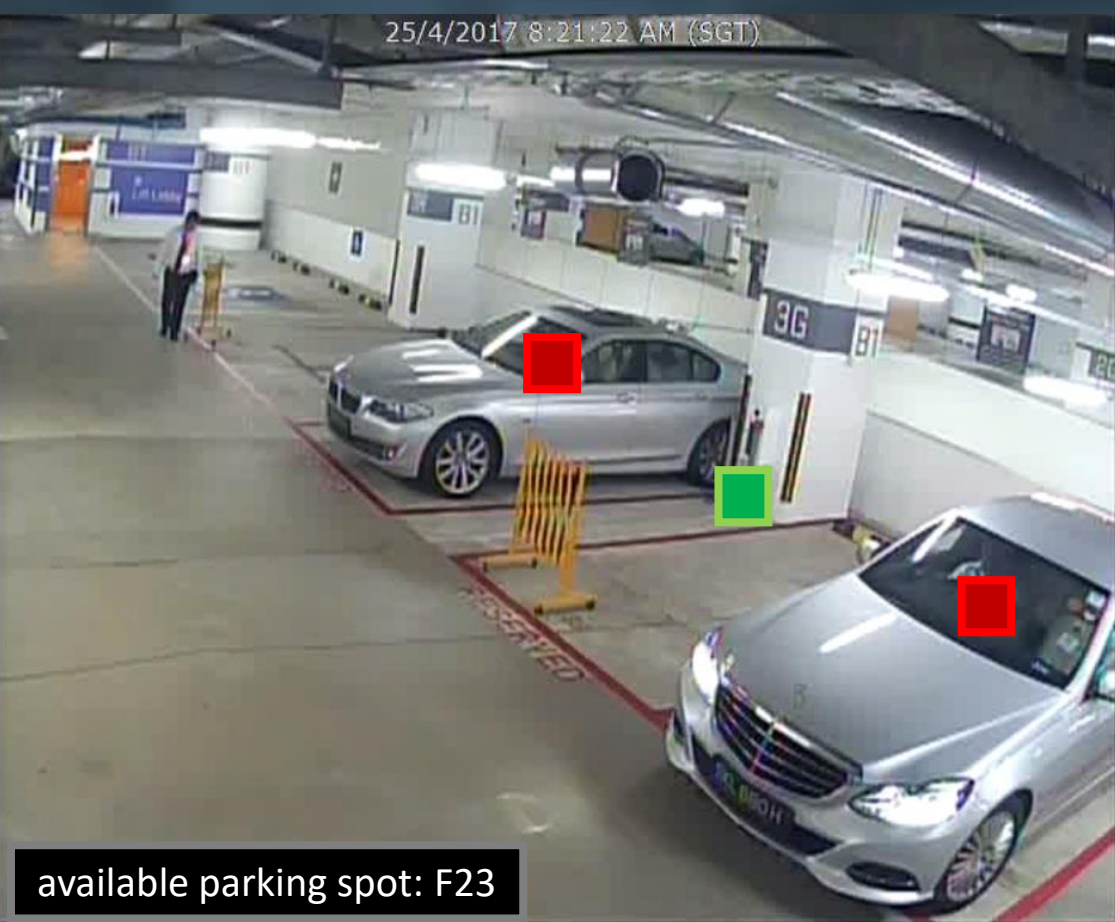
**Congestion detection**

**Red Light Violation**

# MANAGING PARKING SPACE | BOOM BARRIER ACCESS THROUGH ANPR



Check available parking spots in **REAL TIME**



Automatic boom barrier access through **AUTOMATIC NUMBER PLATE RECOGNITION**

Number plate detected  
**S EA 32M**

**Access control**  
Logic

**Access Granted**  
(boom barrier opens)

available parking spot: F23

# Unfold blueprint of Smart cities with Graymatics



- ✓ Security — Identify suspicious activity
- ✓ Security — Identify Intrusions, Violence
- ✓ Security — Detect unattended objects
- ✓ Safety — Worker Safety Compliance
- ✓ Operations — Detect queue formation
- ✓ Operations — Monitor littering

# System Benefits

**Protests in 2017**



**Mumbai Floods- Aug'17**



**Religious procession in 2018**



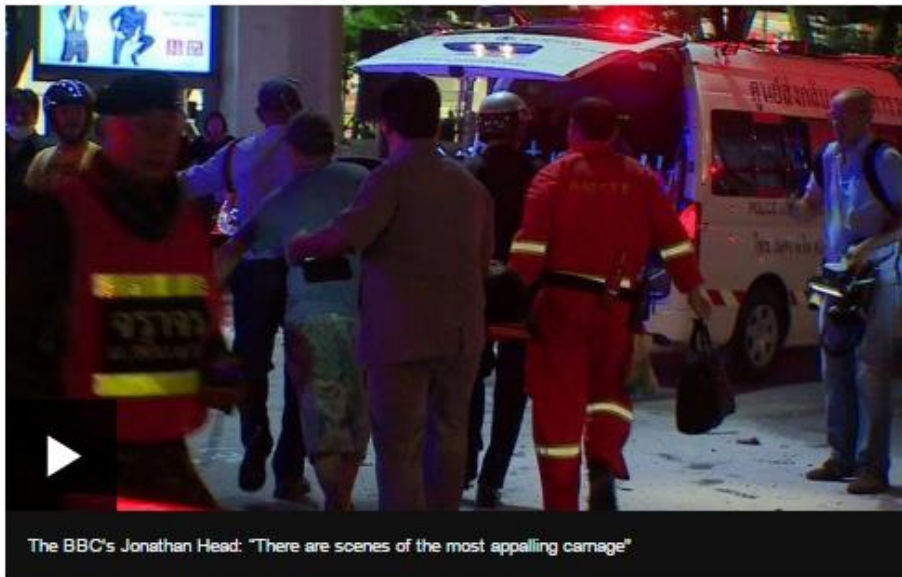
# SMART CITY SURVEILLANCE SOLUTIONS

KEEP CITY SAFE BY SPOTTING CRIMINALS AND SUSPECTS ANYWHERE IN THE CITY

## Bangkok bomb: Deadly blast rocks Thailand capital

17 August 2015 | Asia

Share



The BBC's Jonathan Head: "There are scenes of the most appalling carnage"

A bomb has exploded close to a shrine in the centre of Thailand's capital, Bangkok, killing at least 19 people and injuring more than 120.

Bangkok bomb

SCAN through thousands of cameras:

Based on

Clothing attributes:

- Yellow shirt-round collar
- blue shorts-knee length

NARROW DOWN on SUSPECT

Based on

Facial recognition

FIND HITS

## A Suspect in the Thai Bomb Attack

Police circulated images of a man seen in a security video moments before the blast that killed 20 people.



10:20 am - CCTV #23

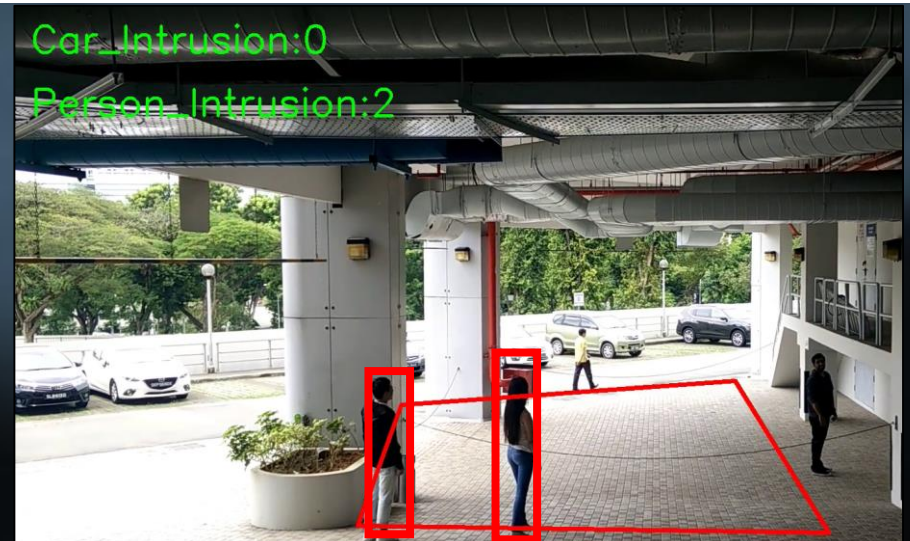
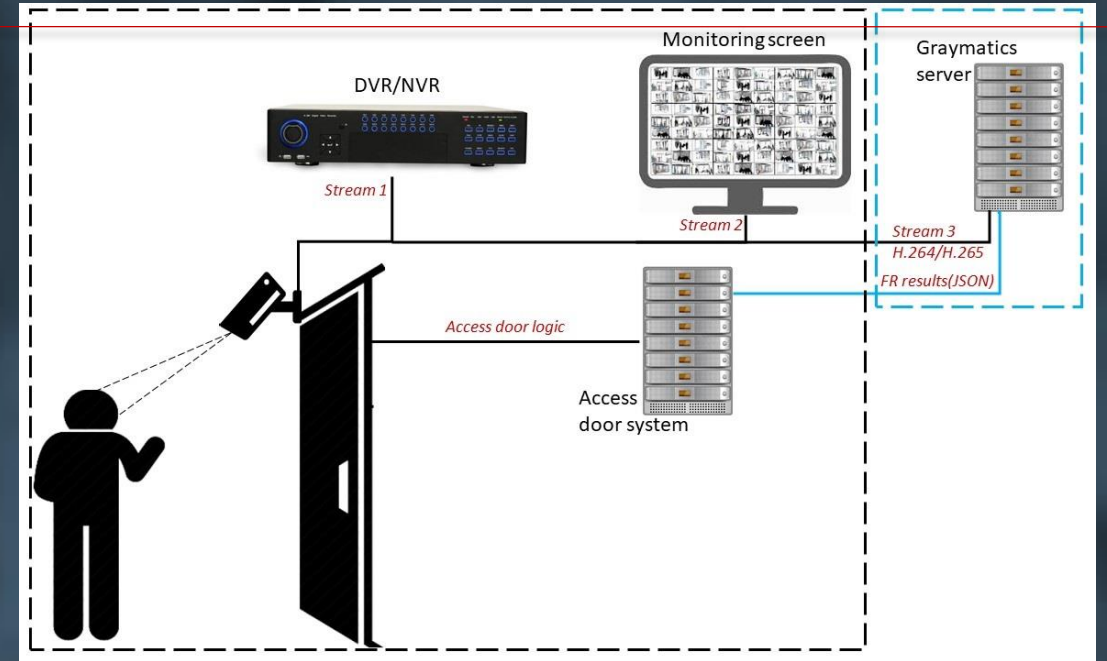
10:30 am - CCTV #30

10:35 - CCTV #35

# ACCESS CONTROL

# LOITERING DETECTION

# INTRUSION DETECTION



Automatically unlock door based on facial recognition

Create lists of people to allow/restrict entry into the building



# Use Cases



Abandoned Object Detection

Send alerts when  
an abandoned  
object is spotted



Violence Detection

Detect and alert for  
violence or fighting

# IMPROVING WORK PLACE SAFETY & OPERATIONS



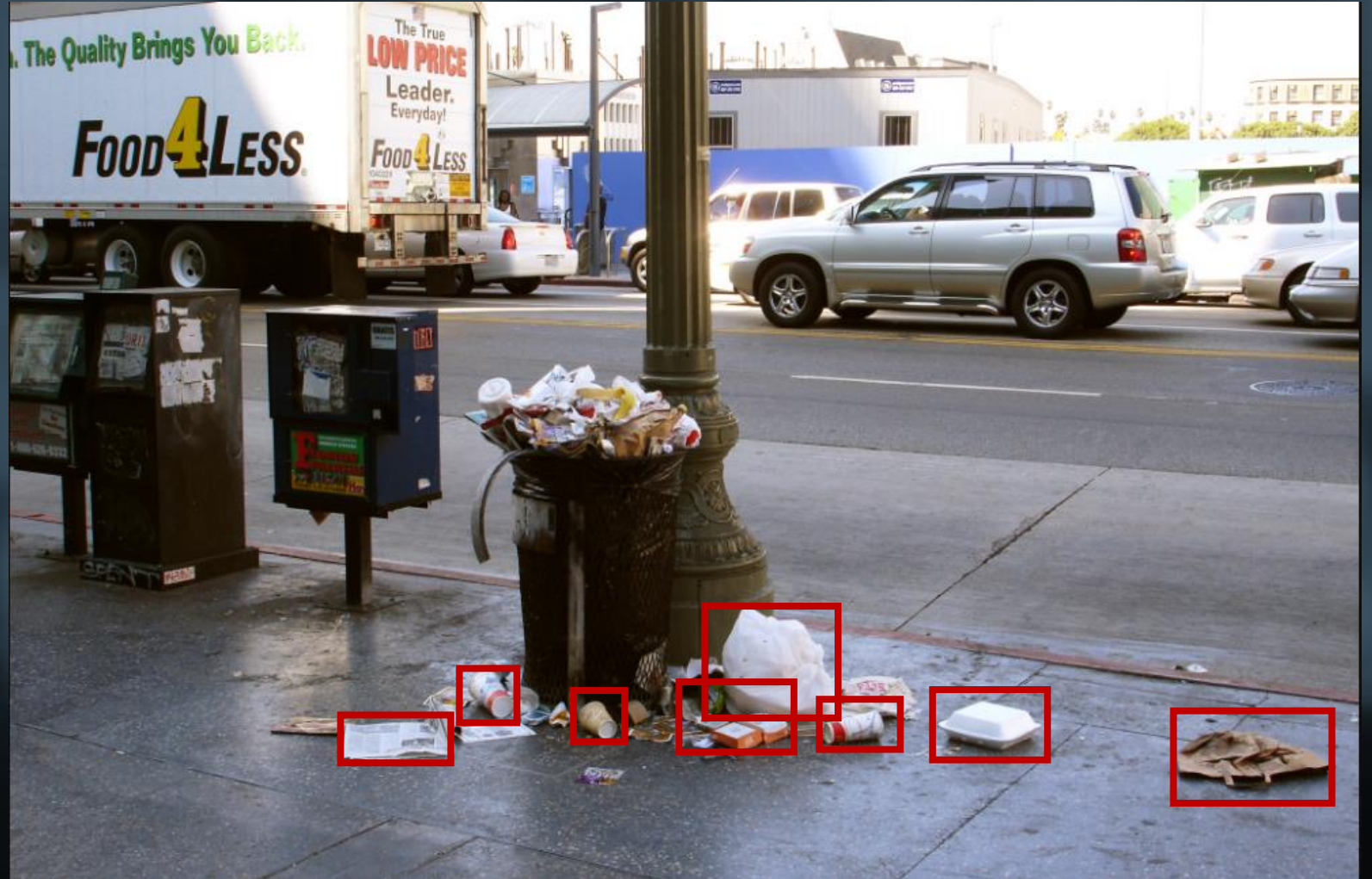
Employee: Richard  
Helmet ✓  
Safety Vest: ✓  
Safety glasses ✓  
Gloves: ✗

Keep a check on the safety gear of your employees. Make sure that they are safe always and prevent any accidents.



# Operations — Monitor littering

- Auto triggering alert when roads get littered
- Send personnel to clean the litter
- Identify defaulters through face recognition
- Analyse littering patterns in different areas and times



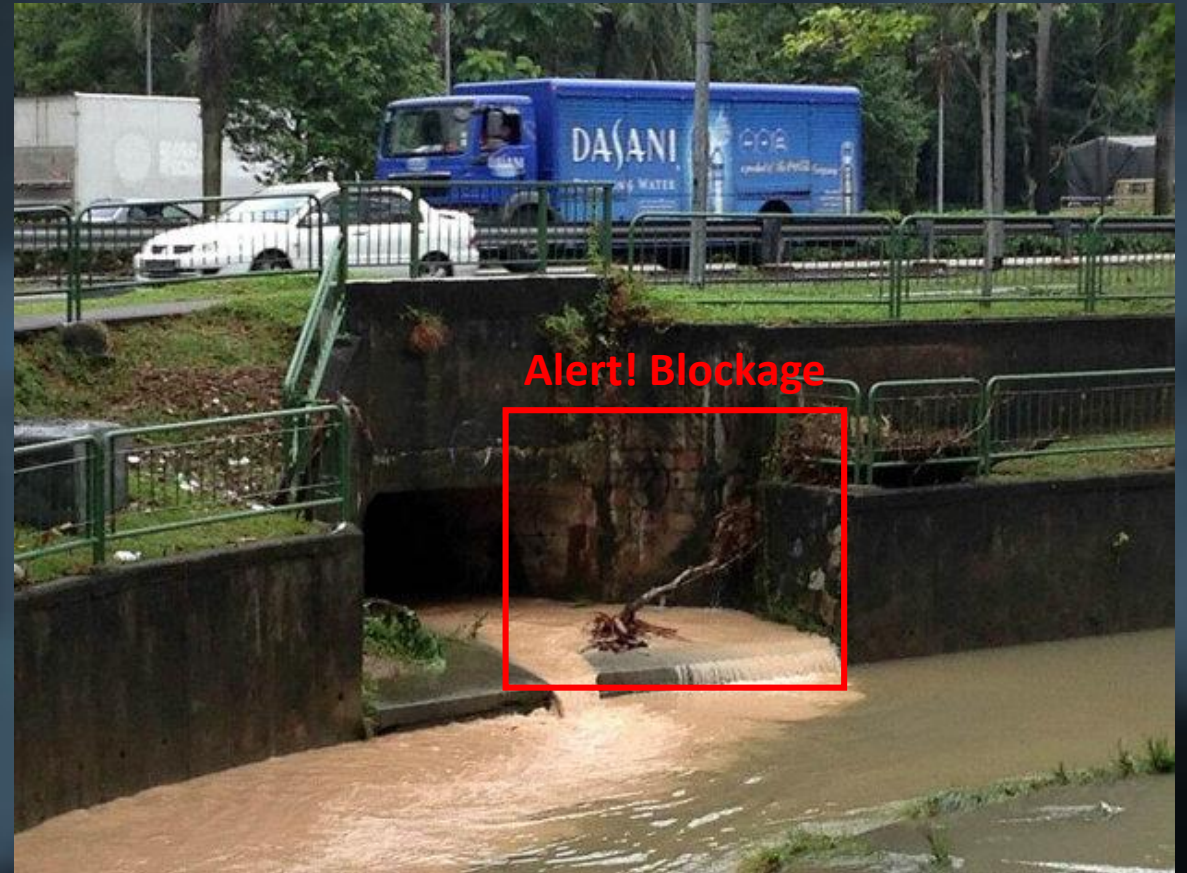
# Unfold blueprint of Smart cities with G3C.AI@DELL



- ✓ Monitor Water Levels in tunnels & on roads
- ✓ Monitor Drainages and Detect Blockage
- ✓ Monitor and Protect Reservoirs

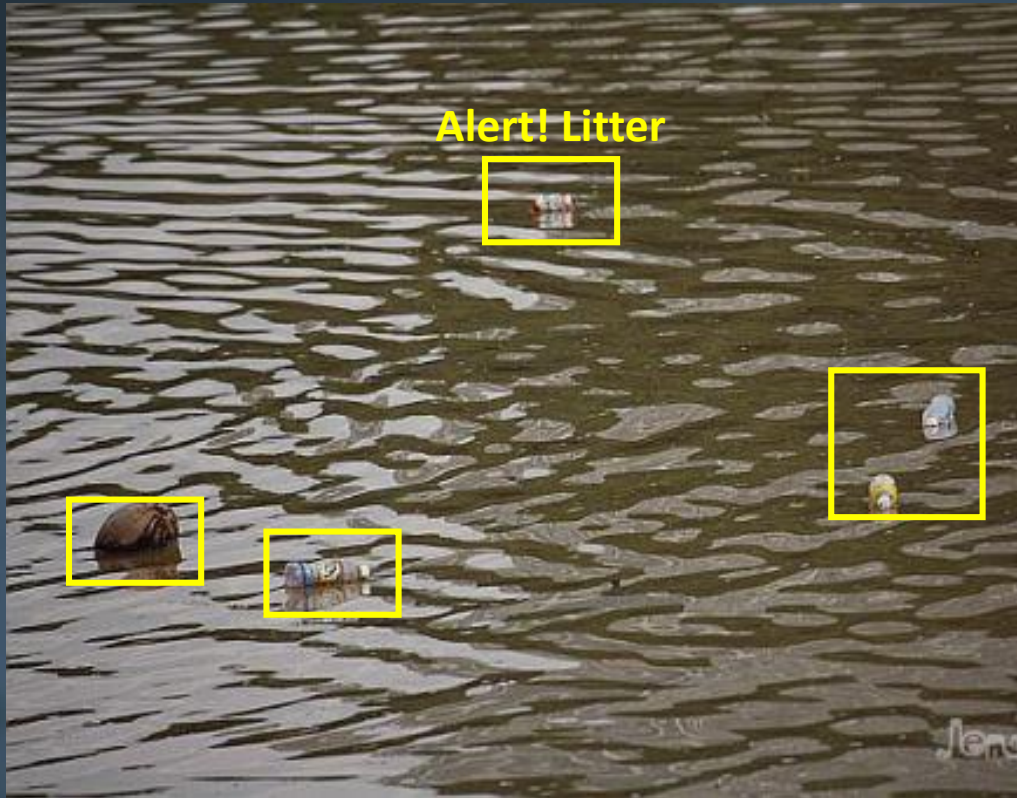
# Monitor Drainages and Detect Blockage

- Auto alerting when drainages get blocked



# Monitor and Protect Reservoirs

- Auto triggering alert when reservoirs get littered
- Send vessels to clean the reservoirs



GRAYMATICS

APPENDIX

# Smart City G3C.AI Configuration and Dashboards

# Algorithms for Typical Smart-City uses case (Deployed for Medium-sized City in India)

- **Traffic Analytics**

- Vehicle counting & classification
  - Car, Bus, Truck, Motorbike,
- Vehicle Plate Recognition (ANPR)
- Vehicle color/model classification
- Parking Violation
- Wrong way & illegal turn detection
- Unwanted/Banned vehicle
- Speeding
- No-Helmet detection

- **Behaviour Analytics**

- Loitering Detection
- Crowd Detection
- People running from a key point
- Person collapsing

- **Citizens Safety**

- People Counting
- Facial Recognition & Demographics
- Person climbing barricade
- Fire detection
- Abandoned object



# Algorithms

A) Solid Waste Management/Vandalism related. **3** **0**

B) Traffic Management related. **6** **0**

C) Citizens Safety related. **5** **5**

Status	Name	RoI	Confidence	Save crops
<input checked="" type="checkbox"/>	Person/Face Recognition	Add an specific area	95 %	<input type="checkbox"/> Save sec.
<input checked="" type="checkbox"/>	Person Climbing Barricade	Add an specific area	95 %	<input type="checkbox"/> Save sec.
<input checked="" type="checkbox"/>	Loitering Detection	Add an specific area	95 %	<input type="checkbox"/> Save sec.
<input checked="" type="checkbox"/>	D&C of human, animal and vehicle	Add an specific area	95 %	<input type="checkbox"/> Save sec.
<input checked="" type="checkbox"/>	People Count	Add an specific area	95 %	<input type="checkbox"/> Save sec.



Save and back Save Back info

## Climbing of barricade

- Person
- Animal

## D&C

### Human

- Age
- Gender
- Ethnicity

### Vehicle

- Brand
- Color
- Licence plate detector

## Crowd control settings

Quantity of people

## Loitering Settings

MM:SS

Reset

# Algorithms

A) Solid Waste Management/Vandalism related. **3 0**

B) Traffic Management related. **6 6**

Status	Name	RoI	Confidence	Save crops
<input checked="" type="checkbox"/>	Parking Violation	Add an specific area	95 %	<input type="checkbox"/> Save sec.
<input checked="" type="checkbox"/>	Speeding Vehicle	Add an specific area	95 %	<input type="checkbox"/> Save sec.
<input checked="" type="checkbox"/>	Helmet detection on two-wheeler	Add an specific area	95 %	<input type="checkbox"/> Save sec.
<input checked="" type="checkbox"/>	Unwanted/Banned vehicle detection	Add an specific area	95 %	<input type="checkbox"/> Save sec.
<input checked="" type="checkbox"/>	Wrong way or illegal turn detection	Add an specific area	95 %	<input type="checkbox"/> Save sec.
<input checked="" type="checkbox"/>	ANPR	Add an specific area	95 %	<input type="checkbox"/> Save sec.

C) Citizens Safety related. **5 1**



Save and back Save Back info

### Loitering Settings

MM:SS

### Speeding settings

Max. Velocity  Km/h

From:

to:

Licence plate detector

### Unwanted vehicle setting

Car

Truck

Two wheeler

Licence plate detector

## RoI for Speeding Vehicle

Save Back Confirm area info Undo Clear Remove last



# Banned Vehicles & Parking Violation

CamerasCam 0

2019-11-05 09:19:25 to 2019-11-05 12:50:32

Alerts Visualizations

TOTAL ALERTS

3261

Avg. Confidence

68%

Detection Accuracy

100%

Alert by vehicle type



Vehicle Type	Total
car	24
truck/rickshaw	3.22 K
bus	4
person	1

Avg. Confidence by Alert



Alert type



Alert Type	Total
banned_vehicle	3.22 K
parking_violation	30

Alerts by vehicle type






Alerts



# Banned Vehicles & Parking Violation

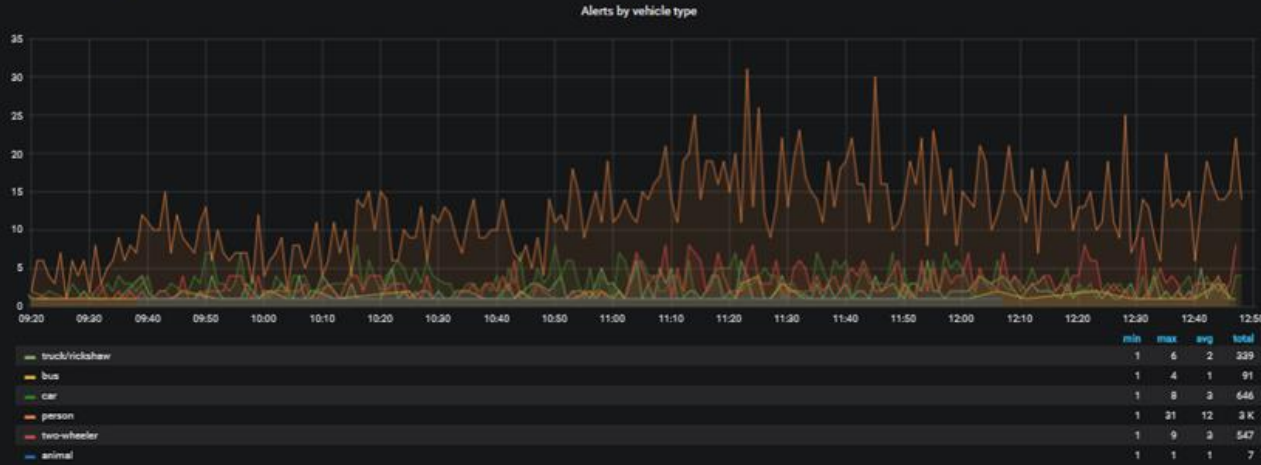


Alerts

Image	Timestamp	Alert	Confidence	Type	Validation
	2019-11-05 09:54:57	banned_vehicle	84%	truck/rickshaw	<a href="#">Correct</a>
	2019-11-05 09:54:54	banned_vehicle	51%	truck/rickshaw	<a href="#">Correct</a>
	2019-11-05 09:54:43	banned_vehicle	86%	truck/rickshaw	<a href="#">Correct</a>

# Classification (vehicle, person and animal)

## Classification Visualizations

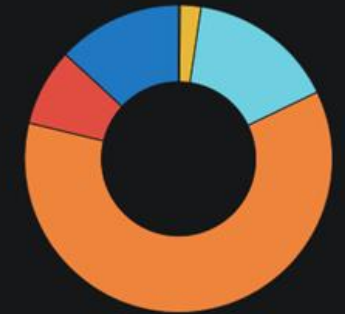


Detection Accuracy

100%

Avg. Confidence

79%



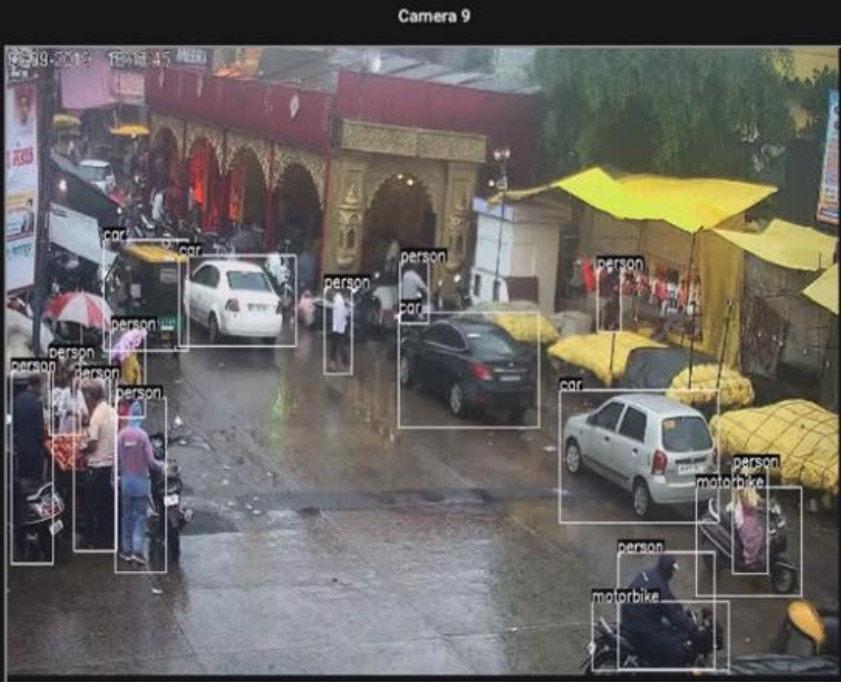
	total
animal	7
bus	91
car	646
person	2,538 K
truck/rickshaw	339
two-wheeler	547

Image	Timestamp	Confidence	Type	Validation
	2019-11-05 10:18:12	89%	person	Correct
	2019-11-05 10:18:12	99%	car	Correct
	2019-11-05 10:18:12	98%	person	Correct

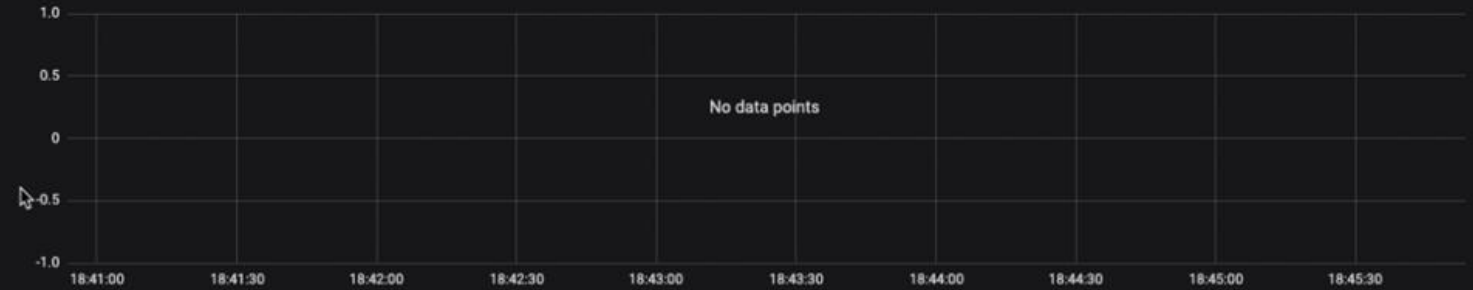
1 2 3 4 5 6 7 8 9

# Classification (vehicle, person and animal)

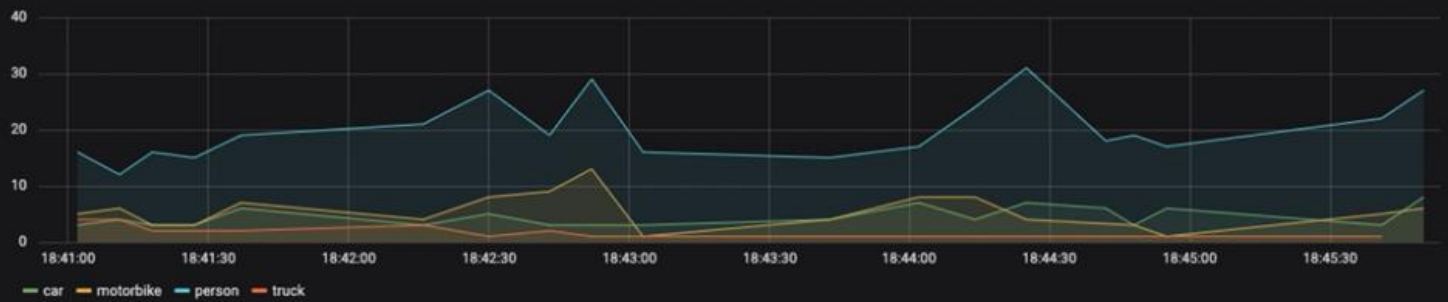
Camera 9



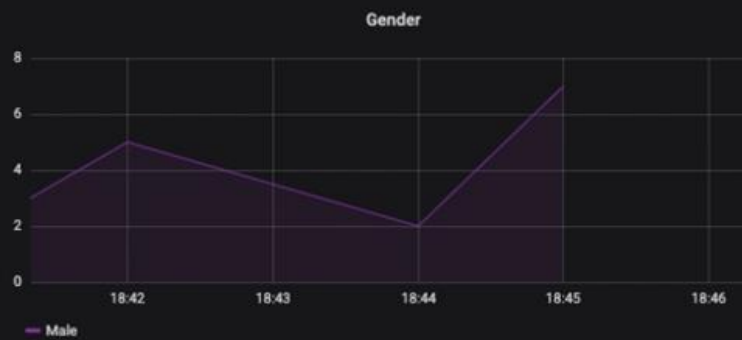
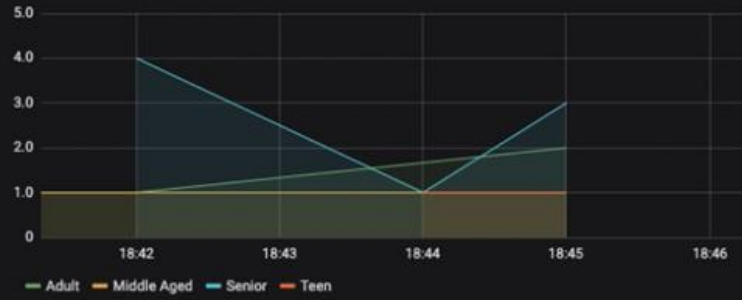
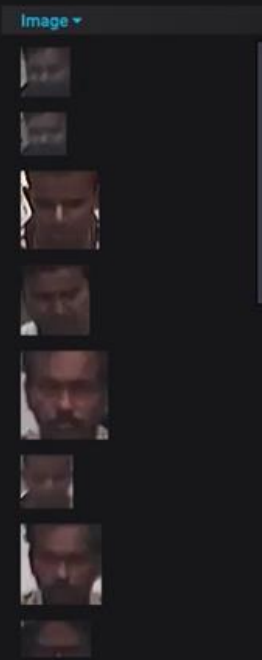
Alerts



Counting



# Facial Recognition & Demographics



# Wrong turn & Speeding

CamerasCam 6

2019-11-04 16:22:50 to 2019-11-04 20:06:59

Visualizations

TOTAL ALERTS

1921

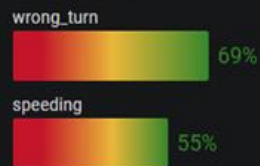
Avg. Confidence

68%

Detection Accuracy

100%

Avg. Confidence by Alert



Alert by vehicle type



Alert type



Alert



Alert by vehicle type



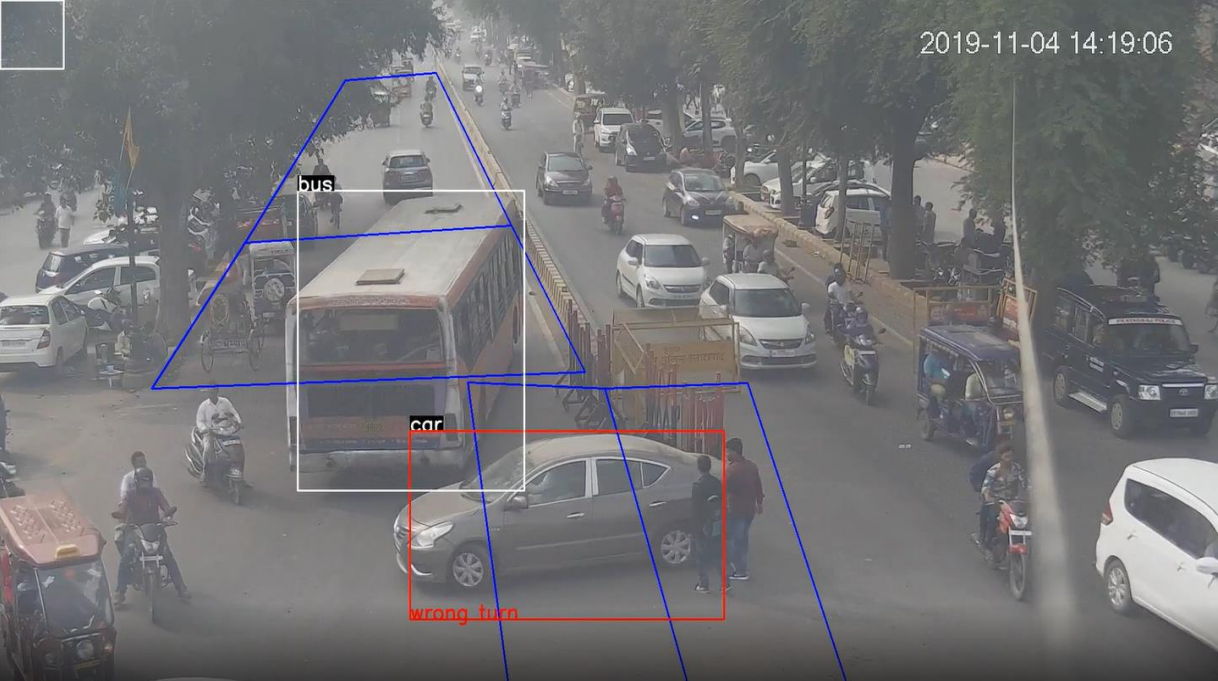
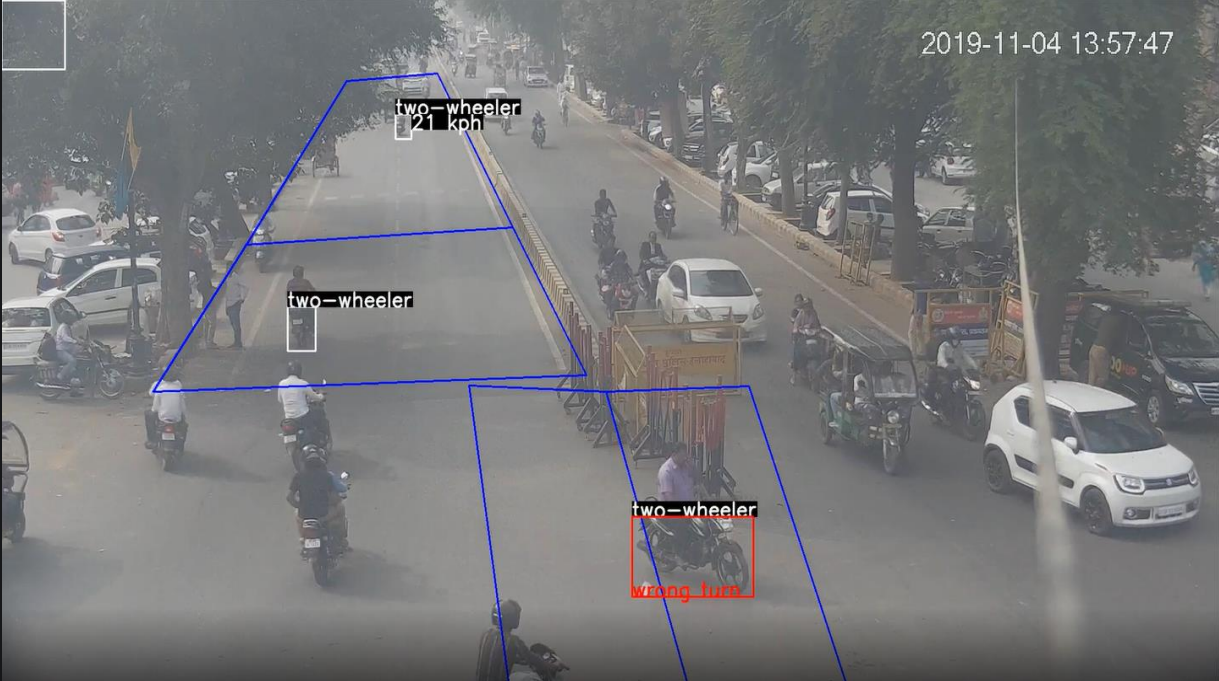
Alerts

Timestamp	id	Video	Alert	Zone Alert	Confidence	Type	Validation
2019-11-04 13:54:17	9	Check video	wrong_turn	6	86%	two-wheeler	Correct
2019-11-04 13:54:20	10	Check video	wrong_turn	6	83%	two-wheeler	Correct
2019-11-04 13:54:23	14	Check video	wrong_turn	6	84%	two-wheeler	Correct
2019-11-04 13:54:27	15	Check video	wrong_turn	6	89%	two-wheeler	Correct
2019-11-04 13:54:42	10	Check video	wrong_turn	6	77%	two-wheeler	Correct
2019-11-04 13:54:44	9	Check video	wrong_turn	6	38%	two-wheeler	Correct
2019-11-04 13:54:46	10	Check video	wrong_turn	6	68%	truck/rickshaw	Correct
2019-11-04 13:54:56	12	Check video	wrong_turn	6	75%	two-wheeler	Correct
2019-11-04 13:54:56	13	Check video	wrong_turn	6	68%	two-wheeler	Correct
2019-11-04 13:54:57	12	Check video	wrong_turn	6	76%	two-wheeler	Correct
2019-11-04 13:55:09	12	Check video	wrong_turn	6	60%	two-wheeler	Correct
2019-11-04 13:55:09	6	Check video	wrong_turn	6	79%	two-wheeler	Correct

1 2 3 4 5 6 7 8 9



# Examples of wrong turn



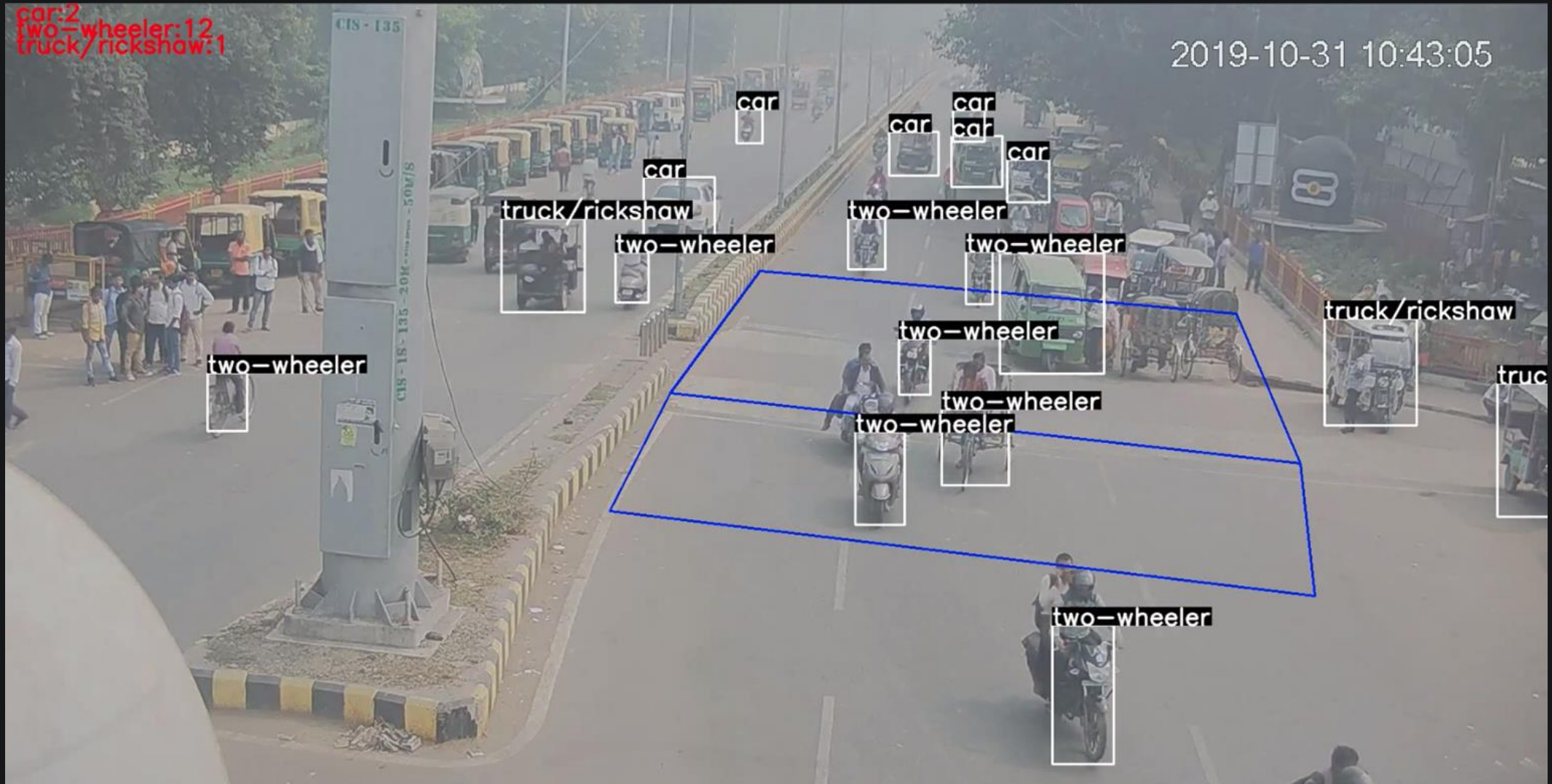
ANPR & Type & Color



# Vehicle counting and classification

car:2  
two-wheeler:12  
truck/rickshaw:1

2019-10-31 10:43:05



# No-helmet Detection

CamerasCam 8

2019-11-04 13:36:06 to 2019-11-05 15:00:24

Visualizations

Total alerts

43941

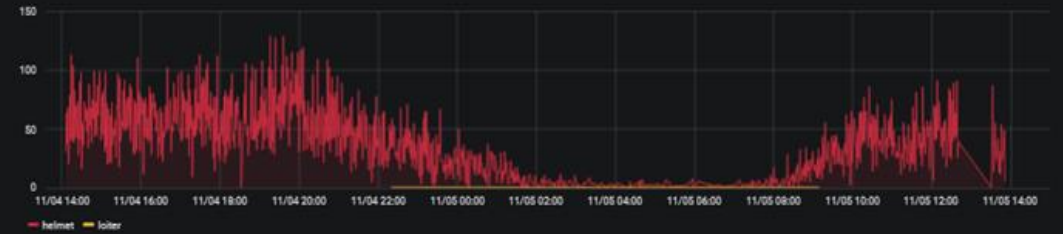
Avg. Confidence

90%

Accuracy

99.70%

Alert




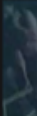


Alerts

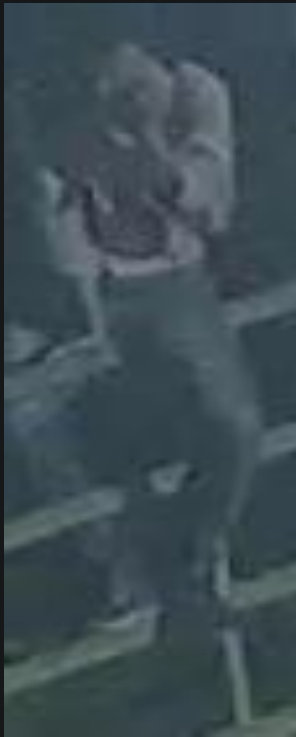
Image	Timestamp	Alert	Confidence	Type	Validation
	2019-11-04 11:38:58	helmet	85%	two-wheeler	Correct
	2019-11-04 11:38:58	helmet	93%	two-wheeler	Correct
	2019-11-04 11:39:09	helmet	82%	two-wheeler	Correct

1 2 3 4 5 6 7 8 9

# Person Climbing Barricade Detection

Image	Timestamp	Alert	Confidence	Type	Validation
					
	2019-11-04 17:58:03	climbing_alert	10%	person	<a href="#">Correct</a>
	2019-11-04 17:58:03	climbing_alert	48%	person	<a href="#">Correct</a>
	2019-11-04 17:58:08	climbing_alert	18%	person	<a href="#">Correct</a>

1 2



GRAYMATICS

SEE THROUGH THE CLUTTER