



Artificial Intelligence, AI Camera: Market & About

**“Machine intelligence is the last invention that humanity will ever need to make.” —
Nick Bostrom**

**Vivek
Gujar
IndoAI Technologies P Ltd**

AI & Why AI now

AI is a buzzword today. In 2017, in one of meeting of 1500 audience of policymakers, opinion leaders, and interested observers of industry were asked question about knowing of AI, where only 17% heard about AI. Later PwC undertook a very extensive global and India-specific survey of CXOs and decision makers across a number of diverse sectors to understand the trends and share insights around the adoption of, benefits and risks of AI; the survey found that the rate of AI adoption has increased from 62% to 70%.

*“As more and more artificial intelligence is entering into the world, more and more emotional intelligence must enter into leadership.”
Amit Ray, Famous AI Scientist, Author of Compassionate Artificial Intelligence*

Today, we have reach to the level where every process of an industry may be AI triggered. Artificial Intelligence is a term coined by emeritus Stanford Professor John McCarthy in 1955, defined AI as “the science and engineering of making intelligent machines”. The founding father of AI, Alan Turing, defines this discipline as: “the science and engineering of making intelligent machines, especially intelligent computer programs.” Wikipedia defines AI as —perceiving, synthesizing, and inferring information—demonstrated by machines, as opposed to intelligence displayed by non-human animals and humans. AI is a tool to know how the system behave after inputting some data.

When cognitive science (the study of the human brain) and computer science put together AI born: The aim is to allow a computer to simulate human thought and mimic how our brains work which normal humans takes these as mundane tasks, allows computers to understanding natural language or recognizing objects in a picture.

Artificial Intelligence is the element of computer science behind teaching computers to ‘think’, make assessments and generally perform tasks similar to a human. AI teaches a device to recognise and adapt to certain behaviours. This basically means that an AI camera is better equipped to perform routine tasks, as it has been given the ability to not only act as a ‘dumb’ recording device, but also to learn, make assessments and in a basic manner to ‘think’ about the images and video it records.

Stuart Shapiro in his article Artificial Intelligence defines AI as field of computer science and engineering concerned with the computational understanding ie intelligent behavior and with the creation of artifacts that exhibit such behavior from the perspective of three points of view: computational psychology, computational philosophy & machine intelligence

According to author AI is simulated experience, imitating a real world, for predictive outcome.

Thus, AI is a simulation of human intelligence programmed or fed by specific inputs to get desired results what a human brain may perceive. Just to add here, Artificial intelligence and machine learning are not the same, but they are closely related. Machine learning is the *method* to train a computer to learn from its inputs without explicit programming for every circumstance. Machine learning is actual methodology to achieve artificial intelligence for a specific input.

The voice assistants that we see today are a prime example of current AI. The system ‘learns’ as it processes information, so the more data the system is given, the more it learns, and the more accurate it becomes. In practical terms, this technology could be used in any field in which a large amount of complex data needs to be processed and analysed to solve problems, including healthcare, law, education, finance and, of course, business.

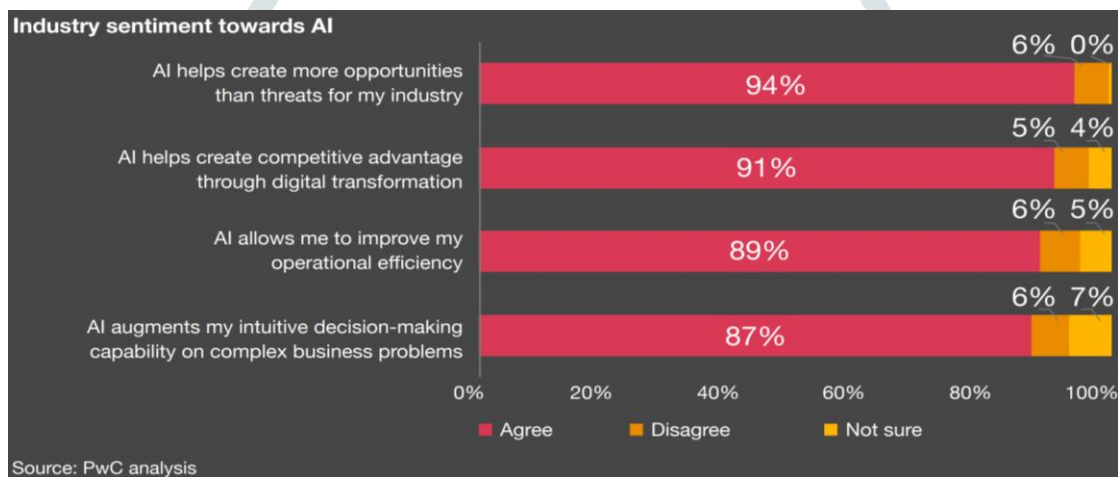
What we understood now that AI needs lot of data as input to analyse so that it trains itself to give its output as probable or specific result.

How AI shapes to infer from raw data can be inferred from process of transformation of Random dots into Structured dots and then these structured dots are made into packets of various sizes which we call a *useful data*, a Decision Making event.

Bill Gates in his interview with TOI in G20 summit opined that AIs can write and help us in lot of things. He also added that AIs should be used in right way and not scariest technology.

Sunder Pichai in his last visit to India asserted about tremendous public data being generated in India. The IT Minister said that after having privacy bill, telecom bill, etc will create a robust framework in which India can use some of the public datasets and harness the power of technology to provide better solutions and better services,” Also the world is producing humungous amount of data. The IDC(Data Age 2025) predicts by 2025 this data will be in tune of 175 zettabytes. Almost every action is a digital trail: browsing online, shopping in a kirana/retail store with a credit card, sending an email, taking a photograph, reading an online article, even walking down the street if you’re carrying a mobile phone or there are CCTV cameras in the vicinity.

PwC found that after Covid, enterprises were more aware than earlier that AI is no longer a ‘nice to have’ technology but a ‘must have’. The surveyed companies showed strong adoption of AI and 94% said AI helps create more opportunities than threats for my industry, and another 91% affirmed AI helps create competitive advantage through digital transformation.

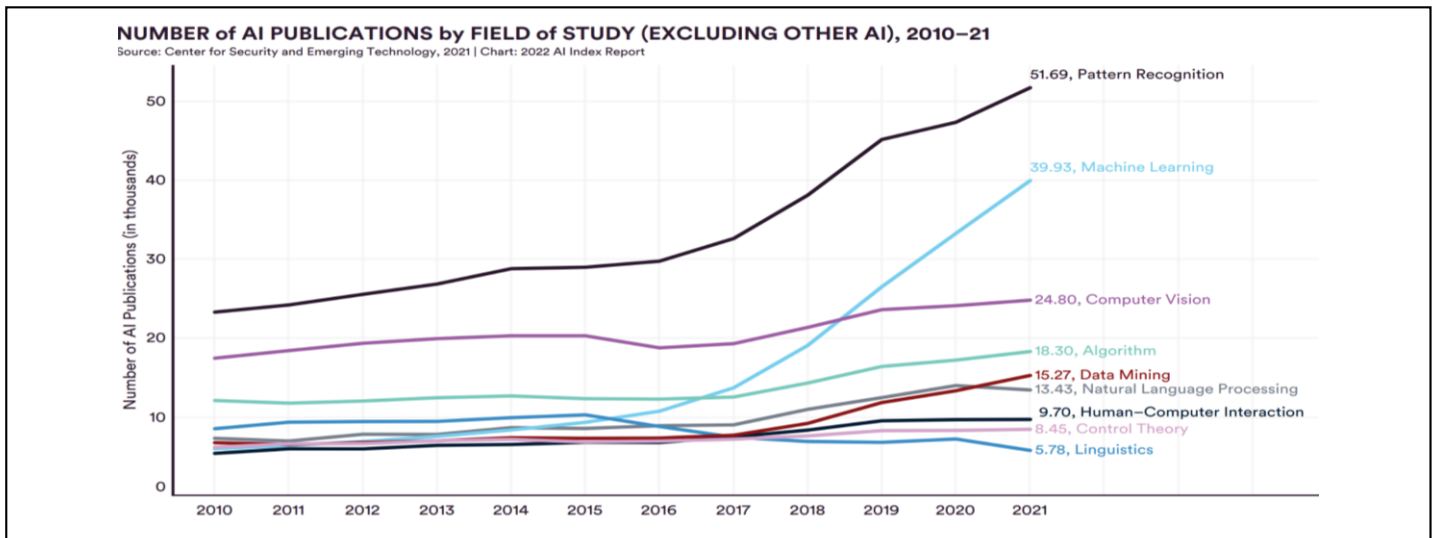


PwC(Dec 2020) research shows that adoption of AI could result in a boost of up to 26% for some local economies.

“Predictive problem-solving capabilities of AI will definitely help companies further automate the business process by anticipating consumer interaction patterns. However, it is extremely likely that artificial intelligence will almost always require human intelligence either before, during, or after processing.”

- Setu Kulkarni, VP of Strategy and Business Development at WhiteHat SecurityOpens

The adoption of technology or trends can be primarily found by research in universities & big companies. Publishing its studies makes access to students, professionals alike. Stanford University AI Index report shows below that publications in Pattern Recognition and Machine Learning have more than doubled since 2015. Other areas strongly influenced by deep learning, such as computer vision, data mining and natural language processing, have shown smaller increase.



Livia R in her book writes 3 factors why AI gained prominence. These three factors are

- The high computing power: Moore's Law states that the power of computers to process information doubles every 18 months.
- The high speed of communication: Butters Law states that the amount of data transmitted over an optic fiber doubles every 9 months.
- The high storage capacity: Kryder's law states that the density of hard drives doubles every 13 months.

In AI, a distinction is made between:

- ANI – Artificial Narrow Intelligence: algorithms that can perform individual tasks well
- AGI – Artificial General Intelligence: Can do everything humans can do
- ASI – Artificial Super Intelligence: An intellect far more intelligent than the brightest minds of mankind and superior to us in practically everything.

ANI application examples: AI Cortana, Alexa, Siri and other natural language may give the impression of being intelligent because they can interact with user and process human speech. Livia further writes in reality, however, ANI only operates within a predetermined, predefined domain and cannot think for itself.

Examples of ANI

- Search engine results: Google search algorithms
- Weather forecast: Watson from IBM
- Facial recognition software: passport control machines at the airport
- Email spam filter: Gmail, Spark
- Social media feeds: LinkedIn, Facebook
- Virtual assistants: Siri from Apple, Alexa from Amazon, Cortana from Microsoft
- Buying recommendations: Amazon, Zalando
- Self-driving cars: Tesla, Volvo
- Translation Services: DeepL, Google Translate
- Streaming services: Spotify, Netflix, YouTube
- Navigation services: Google Maps, Apple Maps, Uber

"We have seen AI providing conversation and comfort to the lonely; we have also seen AI engaging in racial discrimination. Yet the biggest harm that AI is likely to do to individuals in the short term is job displacement, as the amount of work we can automate with AI is vastly larger than before. As leaders, it is incumbent on all of us to make sure we are building a world in which every individual has an opportunity to thrive."

Andrew Ng, Co-founder and lead of Google Brain

Facial recognition

Facial recognition is a process to identify a person from an image or video as well as what attributes those faces have. It can analyze attributes such as eyes open or shut, mood, hair color, as well as the visual geometry of a face. These attributes become increasingly useful for customers that need to organize or search through millions of images in seconds using metadata tags (e.g. happy, sad, glasses, age range) or to identify a person (i.e. facial recognition using either a source image or a unique identifier). From a secondary authentication, face will be primary. In immediate future,

"It seems probable that once the machine thinking method had started, it would not take long to outstrip our feeble powers... They would be able to converse with each other to sharpen their wits. At some stage, therefore, we should have to expect the machines to take control."
 Alan Turing

Artificial Intelligence - Facial Recognition

AI-based facial recognition technology is a process of recognising face instantaneously, searching databases of faces and given a task could compare them to one or multiple faces that are detected in a situation. Further, the technology could use deep learning methods to identify individuals where it maps points on the face and angles. This helps in identifying a person on a mask too. Thus, AI FR tech is a biometric software that detects facial points(features) and store this data on server.

Surveillance & Video Analytics

Surveillance is defined as careful watching of a person or place to avoid further mishap by the police or army of state administration. This surveillance may be to avoid a expected crime or a after a crime happened. For a private it is identifying a person or looking after a place.

According to Wikipedia Surveillance is the monitoring of behavior, many activities, or information for the purpose of information gathering, influencing, managing or directing.

Thus, the principles of surveillance involves data collection, data analysis, response to data, and assessment of response & it enables corporations and governments to manage or govern resources, activities and populations.

Surveillance technology is used to monitor individuals' digital and physical actions and communications. Common forms include data-gathering apps on smartphones, and facial recognition software in smart security camera systems.

Ashwin et al in their study of research papers observed that within the application domain of visual surveillance, face recognition was the most common computer vision research task, appearing in over a thousand papers in 2019. Other common visual surveillance tasks were person re-identification, action recognition, and emotion/expression recognition.

TASK AREA	2019 PAPERS	TOP 10 MOST FREQUENT TERMS IN THE AREA
General*	30,994	Classification, Segmentation, Detection, Computer vision, Image processing, Object detection, Recognition, Feature extraction, Image segmentation, Image classification
Visual surveillance**	3,116	Face recognition, Action recognition, Face detection, Facial expression recognition, Video surveillance, Security, Human action recognition, Re-ID, Surveillance

By Ashwin Acharya, Max Langenkamp, James Dunham(Center for Security & Emerging Tech)

Jammy Desousa in his blog writes that today's tech offers better video compression standards, higher megapixel cameras and greatly improved field of view that are driving better image quality, less bandwidth consumption and improved data. While the introduction of Artificial Intelligence (AI) into the surveillance industry has spurred an additional transformation, enabling cameras and video management systems to become faster and smarter. And with the help of AI, these devices and systems have a greater ability to mine data and turn that information into useful, actionable tasks.

Surveillance cameras, or security cameras, are video cameras used for the purpose of observing an area. Visible smart security cameras can often deter criminal activities, such as burglaries, theft, and vandalism. They can also assist law enforcement in identifying—and even apprehending—suspected perpetrators through cloud-based images and video stored within network video recorders (NVR). One of the benefits of surveillance cameras in public places is a CCTV designed to help prevent and detect crime & with the video analytics of public for better crowd behaviour.

AI algorithm spurred Video analytics and in video surveillance systems to improve security and safety processes even providing actionable business intelligence for organisations

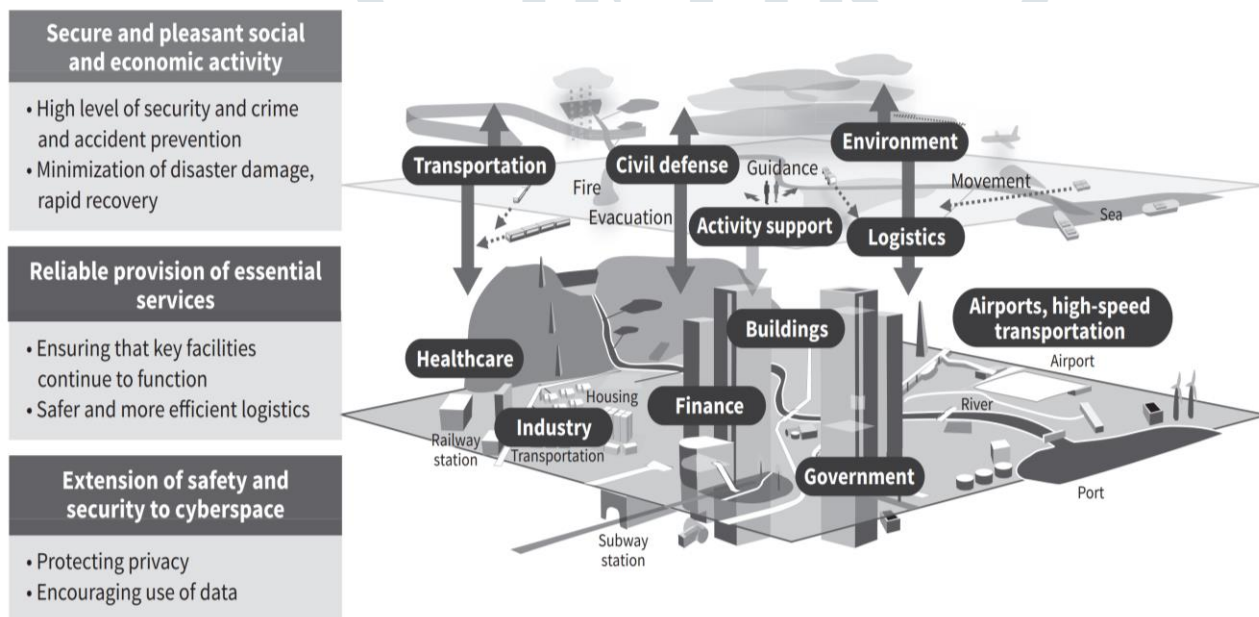
Four segments in surveillance: security cameras, access control devices, intrusion detection devices, and video recording devices make up this market. India's surveillance systems market is currently estimated to be a \$2.5 billion industry. It is largely comprised of video surveillance and is expected to grow at 25-30% annually.

Final List of Surveillance Task terms found by authors Ashwin et al in the 39,000 research paper are given shown adjacent. This also define market about use cases being developed. The task developed are Action Recognition, Crowd Counting, Facial Spoofing Detection, Face Recognition, Emotion Recognition, Person Re-Identification

Task	Terms
Action recognition	action classification, action recognition, activity recognition, har, human action recognition, human activity recognition
Crowd counting	counting people, crowd analysis, crowd behavior analysis, crowd behavior recognition, crowd count, crowd counting, crowd density, crowd density estimation, crowd scene understanding, crowded scenes, people counting, people tracking
Facial spoofing detection	face anti-spoofing, face antispoofing, face liveness detection, face presentation attack detection, face presentation attacks, face spoofing, face spoofing attacks, face spoofing detection
Face recognition	face detection, face recognition, facial recognition
Emotion recognition	emotion recognition, expression recognition, facial emotion recognition, facial expression analysis, facial expression recognition, fer
Person re-identification	person detection, person re-identification, person re-identification, re-id, reid

Source: CSET analysis.

Hitachi presents its view holistically: Video Analytics AI for Safety and Security at Organizations that Support Human Life and Social and Economic Activity in the following diagram:



The video analytics AI helps people in their daily lives and movements and supports the urban management activities of companies through an in-depth understanding of the behavior of people out on the street or in other public places. It also offers extensive support for things like disaster prevention and environmental protection by providing a broad analysis of the conditions under which people go about their lives.

Video Analytics AI for Public Safety and Security

Use of security cameras and video analytics AI to maintain safety and security in public facilities is growing. Hitachi with its solution provides safety and security of public spaces through its commercialization of solutions that are able to search for missing children or suspicious persons in real time analyzing large quantities of security camera footage.

In India, the surveillance industry has now grown beyond \$841 million in terms of market size and is experiencing a phenomenal 27.16 percent CAGR (Compounded Annual Growth Rate). The ongoing digitization and the ever-increasing deployment of IP-driven surveillance systems are further catalyzing this market growth and are expected to make it nearly triple its current market size to \$2.4 billion by 2020.

Harnessing AI and the immense processing power of computers, today's analytics offer: people counting, heat mapping, facial recognition and number of other features allowing operators to track suspects and recognising patterns and without constant monitoring by a human. According to a blog from 3S Security Systems, quoted by Security and IoT magazine asmag.com, research in the US has suggested that staff watching video systems can experience fatigue "in as little as 12 minutes, overlooking

up to 45% of activity in the camera scenes. After 22 minutes, that increases up to 95% of overlooked activity." Even a fatigued blink of staff can cause huge loss to the organisation.

AI Camera & technology

Integrating video surveillance systems into advanced AI-powered solutions allows security staff to keep watch over the entire premises 24/7 and have better situational awareness without having to be glued to monitors all the time. The need of continuously looking at the monitors at command centre is passe. The predesigned anomaly is face-checked or situationally-checked real time to avoid the cliché Incident Management.

An AI camera which is also called deep learning camera, its algorithm to understand classifications like humans, vehicles, and more situational awareness driven by data-rich decision-making capabilities to detect movement and capture high-quality images while avoiding irrelevant information.

Standalone AI Cameras like in mobile, were introduced for better image quality & 'learn'. This is the self-adaptive technology, means camera itself learns and built its own picture quality using previous pictures and various machine learning algorithms. There are various algorithm but some important ones are

1. DeepExposure
2. Pixel Binning
3. Auto Focus detection
4. Image histogram
5. RGB image
6. TrueDepth

An AI camera records video footage the same as a conventional camera, then feeds the captured information through an analytic layer. Rather than just creating a live video stream of a space or event, the AI camera will – in real-time – be able to process millions of options for that footage and help people make fast, informed decisions based upon the information.

Further to this, an AI-powered camera can do much of the heavy lifting associated with monitoring cameras – that is, it reduces the burden on humans monitoring screens by filtering and analysing information, allowing much of a surveillance network to be automated.

AI in the camera – video surveillance

Video surveillance data evolved to easily being sent to the cloud for storage and further analysis. With AI providing deep learning capabilities and the ability for cameras to analyze video without any human interaction integrated with an access control device, an AI powered camera with facial recognition technology can be used to detect faces and, in turn, provide a frictionless method for people to access a secure area. Another example is that with a greater emphasis being placed on AI video surveillance, by continuously monitoring an area, the software can learn what is normal and abnormal behavior. This could include detecting large groups of people beginning to gather in an area, or a traffic jam on a highway or a person not be in place or location.

AI Camera Market was valued at **US\$ 9.1 billion in 2021**, and is predicted to grow at a CAGR of 24 % to USD 50.86 billion by 2029.

AI to detect objects

Security awareness has evolved over the years so that simple actions, such as a person leaving a backpack by a park bench, can now be perceived as a serious threat requiring immediate action. The introduction of object detection technology has proven to be a valuable tool, helping security personnel quickly identify these types of scenarios. However, with AI now at the helm, issues like these can automatically be detected without a person having to go into a VMS system to manually define and train the system to watch a predefined area within the camera's field of view.

It's clear the surveillance industry is at a critical juncture. Technological advancements and the introduction of AI are enabling surveillance systems today to truly become the surveillance systems of the future.

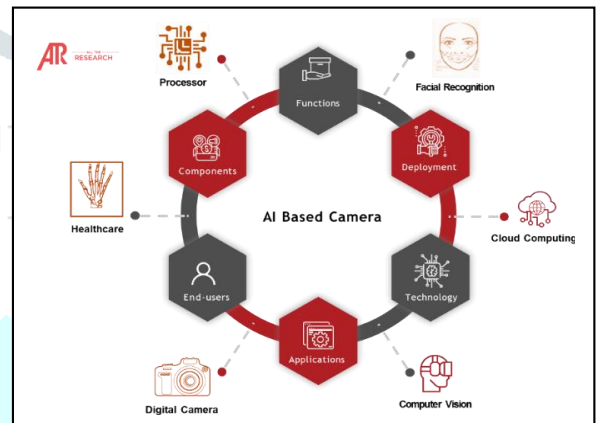
The Global Artificial intelligence camera market is expected to reach USD 61.2 Billion by the end of the year 2030 at 15.20% CAGR

According to AR(All The Research) estimates, the public & social sector holds approximately 40% share in the AI based camera market, followed by retail, automotive, healthcare, and BFSI. Smart cities are a major application area for AI based camera market ecosystem.

AI camera – Ecosystem

According to All the Research(ATR) the ecosystem has following elements:

- Processor: Functional Component
- Face Recognition: Functional Deployment
- Cloud Computing: Deployment Technology
- Computer Vision: Application of Tech
- Digital Camera: End User's application
- Healthcare: End users using components



Further ATR asserts rapid technological advancements have resulted in the growth of the AI based camera market. And Hardware will account for more than 35% of spending made on smart cities.

AI Camera application - Segmentation

- Industry
- Retail
- Household

Common applications for AI video analytics

AI Video analytics are a very versatile tool, apart from security, its use in other sectors are overwhelming:

Retail

Global AI CCTV Market

Opportunities and Forecast, 2021-2030

Global AI CCTV Market is expected to reach **\$55.22 Billion** by 2030.

Growing at a **CAGR of 14.9%** (2021-2030)

This sector is dogged by shoplifting, preventing it through by video analytics will be understatement. On the other, the retail sector employs it to track the customer experience and behaviour (e.g. direction of gaze and visit duration) for more effective selling and upselling locations relationship can be established. The specific questions they needed to answer included:

- How many people actually pass our shops?
- How many stop to look in the window and for how long?
- How many of them then come into the shop?
- How many then buy?

To answer above questions, no better tool than AI video analytics will suffice!

Healthcare

Use of video analytics from locating of staff, patients and visitors to the theft of drugs & abduction of infants hospitals, will be immense help. Also, elderly people who are being cared for at home can be monitored for necessary medication.

Smart cities

Video analytics can control traffic light control systems and monitor traffic jams, monitor speed, and it can detect hazards such as vehicles stopping vehicle stopping unauthorised spaces, erratic driving, or vehicles involved in an accident. Recognizing vehicle number plates, accidents is commonest application one can imagine. Security and surveillance of gated communities & housing societies is of utmost importance to control burglaries, any untoward incidents, etc.

Logistics

To streamline inventory management in logistics Video analytics to improve quality control and efficiency and assist in security processes. This is helpful in early detection of damaged goods & response time. Video analytics are used for a wide range of tasks, including, as mentioned above, facial recognition. Here are some of the most common:

Object tracking

In this single object or multiple object can be tracked through single camera or multiple cameras, eg, a car passing a pre-designated virtual line can be detected, along with the direction it is travelling and for multi-camera tracking, where an object is tracked from one camera to another.

This facility can detect and monitor the movement of vehicles and people in outdoor environments, and it is used for traffic control, visual surveillance, forensics, human-object interaction, gesture recognition and augmented reality. AI-based object tracking analytics can identify the type of object, such as vehicle or person.

Left/abandoned and removed object detection

A static object within a predefined area identified. This type of detection is often used in public place like railway stations/tracks, Bus stands, airports to identifying potential bomb threats.

Loitering detection

This is to detect and identify a person or vehicle in no-go zones.

People counting

Detects and counts people as they cross through a designated area. Immense use in religious places, malls, government buildings etc for occupancy control, capacity evaluation, sales and conversion metrics, personalised visitor experiences.

People tracking - Crowd detection

Uses for it include: detecting intruders, wrong-way detection, people counting, physical distancing and customer behaviour analysis.

The global Video Analytics Market size was valued USD 7.1 billion in 2022 and is expected to reach **USD 20.3 billion by 2027**, at a CAGR of 23.4%.

AI Camera Market was valued at **US\$ 9.1 billion in 2021**, and is predicted to grow at a CAGR of 24 % to USD 50.86 billion by 2029.

The global facial recognition market size was valued at \$3.83 billion in 2020, and is projected to reach \$16.74 billion by 2030, growing at a CAGR of 16.0%

According to India CCTV Market Outlook, 2027-28, the India CCTV market potential is more than INR 27000 Crore.

Facial Recognition Market(India) USD 280.06 M in FY2022, growing at CAGR 18.71

Crowd Detection is a real-time surveillance technology to detect crowd density per designated area to evaluate capacity or occupancy issues. Specific cases include population counting, public event management, disaster management, safety monitoring and suspicious activity detection.

Image change/tamper detection & Motion Detection

Detects when power cut or the camera has been moved, removed, spray painted etc.

Video Motion Detection (VMD) comes with motion detection analytics, network video recorders, and video analytics and video management software systems and is active as soon as it senses physical movement for a given area in real-time. A perfect use case for the military, critical infrastructures, robotics and in the entertainment, sports, healthcare sectors. Any motion is detected when a person in view of camera.

Automatic Number Plate Recognition

This has become commonest use of optical character recognition (OCR) technology to identify and read vehicle license plates from CCTV, video cameras, law enforcement cameras, or dedicated high-speed ANPR cameras mounted on roadway infrastructures.

Pan-tilt-zoom (PTZ) Auto-Tracking

PTZ auto-tracking video analytics allow surveillance cameras to follow and zoom in on people within a larger field of view.

Global AI Based Camera Market Ecosystem: Total Market- India

Trends: AI Camera	Tech	Application	End User	Nos
Retailers using for footfalls & later recalls	AI	Customer Engagement, Behaviour studies	Retail	
ADAS system to monitor fatigue, etc	AI	ADAS	Automotive	
Smart city: to identify criminals	AI	Security & surveillance	Social public	
Schools: to monitor students	AI	Monitoring, behaviour	Social Public	1.5 m
8.5 million teachers and 250 million children.				
Kirana/ shops	AI	Customer engagement	Retail	13 M
Small Shops	AI	Customer Engagement	Retail	45M
supermarkets(marts)	AI	Customer Engagement	Retail	435000 +
Big Malls	AI	Customer Engagement, Behavior studies	Retail	44000+
8.72 Cr sq ft/2000 = 44k				
MSME industries : attendance	AI	Attendance Management	Industry	12,201,448
Registered micro-enterprises stood at 11,735,117 (96.17%), followed by small enterprises at 426,864 (3.49%) and mid-sized enterprises at 39,467 (0.32%).				
Gated Communities:At present, gated communities comprise 32% of India's population in top-50 cities	AI	Security & Surveillance	Infrastructure	67,000
67 lakh units /100 units = 67K				
ultra-high-net-worth individuals (UHNWI) in India owning 5.1 residential area	AI	Security & Surveillance	Infra	13,637
Gram Panchayat /village	AI	Security & Surveillance	Public/ Social	250,000+ Gram Panchayats
Cameras spread among India's top 15 cities.	AI	Replacement to present CCTVs	Public social	1.54 million
Hill station(+750) bungalows, Hotels, Farm houses	AI	Crowd management, Behaviour, tourists	Tourism	6000+
Govt buildings(Post offices, Museums, Circuit houses, Ministries building, etc)	AI	Security & Surveillance	Critical Infrastructure	1000+
Indian Railways(22 M passengers per day) platform	AI	Security & Surveillance	Critical Infra	7325
Indian Railway Crossing: Manned & Unmanned	AI	Security & Surveillance	Critical Infra	31846
Inter State Bus Terminus(Kashmere Gate terminus handle 75k passengers per day)	AI	Security & Surveillance, Crowd Management	Critical Infra	77
Police stations	AI	Security & Surveillance	Social Public	16955
Inland National Waterways	AI	Security & Surveillance	Critical Infra	111

Temple	AI	Security & Surveillance	Social Public, tourism	2M
Approved Hotels for foreign tourists	AI	Security & Surveillance, Monitoring	Tourism	1961
Major Airports	AI	Security & Surveillance, Crowd Management, Monitoring	Critical Infra	137
Major & Minor Sea Ports	AI	Security & Surveillance, Crowd Management, Monitoring	Critical Infra	13 Major, 203 Minor Seaports covering 15000+ acres
Drones (AI embedded)	AI	Security & Surveillance, Crowd Management, Monitoring	Social Public	29500 registered
Compiled: BrandPiper Team				

Conclusion

The areas where AI video analytics can really make a difference are improving decision making, understanding customers and markets, creating better products, creating better services, improving business operations and, finally, becoming a direct source of revenue. Darrell M. West & John R. Allen opines that the big data analytics associated with AI will profoundly affect intelligence analysis, as massive amounts of data are sifted in near real time—if not eventually in real time—thereby providing commanders and their staffs a level of intelligence analysis and productivity heretofore unseen(...)artificially intelligent intelligence systems, tied to AI-assisted command and control systems, can move decision support and decision making to a speed vastly superior to the speeds of the traditional means of waging war. Iain M. Cockburn & Rebecca Henderson while writing on AI & Innovation asserts that deep learning will change the nature of scientific and technical advance itself involving many fields of science and engineering, adds that deep learning offers an alternative paradigm based on the ability to predict complex multi-causal phenomena using a “black box” approach that abstracts away from underlying causes but that does allow for a singular prediction index that can yield sharp insight.

Along with the numerous benefits of AI , it also raises some major ethical issues such as the potential risk of bias and discrimination, specifically in healthcare into the diagnostic process through the use of databases and algorithms that need to be addressed to ensure the success of these technologies. On Threats to Data Privacy and Security: The AI system heavily relies on massive data both public and private, the vulnerability increases eg in medical such as EHRs, insurance claim records, sexual preference, genetic information, dietary habits, etc. However, a large data pool of digital data can urge to implement new AI laws, data policy, and regulations.

Research on fairness and transparency in AI has exploded since 2014, with a fivefold increase in related publications at ethics-related conferences. Algorithmic fairness and bias has shifted from being primarily an academic pursuit to becoming firmly embedded as a mainstream research topic with wide-ranging implications. Researchers with industry affiliations contributed 71% more publications year over year at ethics-focused conferences in recent years.

AI Google is upbeat on AI FR tech, and that face-related technologies can be for people and for society overall (social good like tracking trafficking minors, etc). It will be used for face authentication, can ensure that only the right person gets access to sensitive information meant.

AI Google further says this tech should be used responsibly and when it comes to face-related technology:

- It needs to be fair, so it doesn't reinforce or amplify existing biases, especially where this might impact underrepresented groups.
- It should not be used in surveillance that violates internationally accepted norms.
- And it needs to protect people's privacy, providing the right level of transparency and control.

In order to maximize AI benefits, Darrel & John recommend nine steps for going forward:

- o Encourage greater data access for researchers without compromising users' personal privacy,
- o invest more government funding in unclassified AI research,
- o promote new models of digital education and AI workforce development so employees have the skills needed in the 21st-century economy,
- o create a federal AI advisory committee to make policy recommendations,
- o engage with state and local officials so they enact effective policies,
- o regulate broad AI principles rather than specific algorithms,
- o take bias complaints seriously so AI does not replicate historic injustice, unfairness, or discrimination in data or algorithms,
- o maintain mechanisms for human oversight and control, and
- o penalize malicious AI behavior and promote cybersecurity.

"The real question is, when will we draft an artificial intelligence bill of rights? What will that consist of? And who will get to decide that?"
Gray Scott

Way Forward

Recent development in this area is machine vision(MV) where Camera technology, Artificial intelligence (AI) & Chipsets will come together. MV combines different technologies and methods to automate the extraction of image information for providing operational guidance/key data for machines to execute a given task, in industrial and non-industrial settings. These advancements enhance typical machine vision benefits such as saving costs, increasing competitiveness, or improving product quality overlooking ROI. Deluge of Chatbots in every stream is just another success of AI-in-everything. Selection of best candidate in HR, bots helping people who don't know to read and write or having some kinds of physical disabilities as these bots can interact with them, drones delivering at remotest place, smart cars. Companies have started to integrate their security system with bots and intelligence security system to detect any kind of breach not only to detect the occurrence but to prevent such breaches. Another use in healthcare where bots can answer the frequently asked question regarding health, can send modifications for prescription refills, can make the hospital authority alert about changes in patient health condition, and can keep a medical record for further assistance. Intelligent bots will help controlling the lights, cooling system, and cleaning, can act as your personal assistant and are able to even fix appointments to doctor or saloon; they can take care for your medicine schedule and monitor health. AI will help to reduce time to make a new blockbuster molecule in pharma R&D.

"We have seen AI providing conversation and comfort to the lonely; we have also seen AI engaging in racial discrimination. Yet the biggest harm that AI is likely to do to individuals in the short term is job displacement, as the amount of work we can automate with AI is vastly larger than before. As leaders, it is incumbent on all of us to make sure we are building a world in which every individual has an opportunity to thrive."
Andrew Ng, Co-founder and lead of Google Brain

"Insecurity is by-product of human advancement." – Dr Vivek Gujar

REFERENCES

- Ashwin Achary, Max Langenkamp, James Dunham, January 2022, Trends in AI Research for the Visual Surveillance of Populations, CSET Data Brief
- Iain M. Cockburn, Rebecca Henderson, THE IMPACT OF ARTIFICIAL INTELLIGENCE ON INNOVATION, Scott Ster Working Paper 24449, <http://www.nber.org/papers/w24449>
- Bernard Marr, 2022, Data Strategy: How to profit from a world of big data, analytics and artificial intelligence, Kogan Page Limited, SECOND EDITION
- Livia Rainsberger, AI - The New Intelligence in Sales; Tools, Applications and Potentials of Artificial Intelligence, ISBN 978-3-658-38250-6
- Astha Mishra, Ajay Kumar Garg, Artificial Intelligence in Robotics and Automation, Udit Pratap Singh, Chandigarh University Engineering College
- Artificial Intelligence: Fundamentals and Applications, Edited by Cherry Bhargava and Pardeep Kumar Sharma 2021, CRC Press ISBN: 978-1-003-09591-0 (ebk)
- PwC AI: An opportunity amidst a crisis, Dec 2020
- Annual Report 2020-21 Government of India, Ministry of Micro, Small and Medium Enterprises Udyog Bhavan, New Delhi – 110011, www.msme.gov.in
- Tomoaki Yoshinaga, Yasuhiro Fukuda, Yuki Watanabe, Atsushi Hiroike; AI and Digital Innovation for Resolving Societal Challenges, Hitachi Review Vol. 71, No. 2 130–131
- India tourism statistics, 2019, Government of India, Ministry of Tourism, Market Research Division
- National Restaurant Association Of India. Snapshot: Indian Restaurant Industry, Www.Nrai.Org
- Shopping Malls in India, 22 July 2019, Infomercials Valuation And Rating Pvt. Ltd
- Jack Clark and Ray Perrault Artificial Intelligence Index Report 2022 by Stanford University

Websites:

<https://www.spiceworks.com/tech/artificial-intelligence/articles/future-of-ai/>

<https://www.techsciresearch.com/report/india-facial-recognition-market/10704.html>

<https://connect2india.com/global/Cc-Camera-import-to-india/1>

<https://analyticsindiamag.com/ten-famous-quotes-about-artificial-intelligence/>

<https://www.brookings.edu/research/how-artificial-intelligence-is-transforming-the-world/>

<https://towardsdatascience.com/7-famous-ai-quotes-explained-782dda72d2c5>

<https://www.aninews.in/news/business/business/1k-kirana-brewing-a-revolution-building-bharats-largest-network-of-neighborhood-kirana-stores20221126123252/>

<https://www.maximizemarketresearch.com/market-report/ai-camera-market/145884/>

<https://www.easyleadz.com/lists/List-of-Supermarkets-in-India>

<https://www.ibef.org/industry/msme-presentation>

https://en.wikipedia.org/wiki/List_of_hill_stations_in_India

<https://www.unicef.org/india/reports/catalysing-transformational-change-school-education>

<https://economictimes.indiatimes.com/small-biz/sme-sector/indian-kirana-stores-will-continue-to-be-dominated-by-standalone-shops-this-time-around-with-an-online-avatar/articleshow/79692171.cms?from=mdr>

<https://economictimes.indiatimes.com/industry/services/retail/cait-says-4-5-crore-shops-open-across-india-urges-delhi-govt-to-reconsider-odd-even-plan/articleshow/75822614.cms?from=mdr>

<https://economictimes.indiatimes.com/news/economy/indicators/consumption-in-gated-communities-in-india-poised-to-grow-2-5-times-to-touch-500-billion-in-five-years-report/articleshow/87619005.cms?from=mdr>

<https://www.financialexpress.com/investing-abroad/featured-stories/indian-super-rich-own-5-1-residential-properties-compared-to-the-global-average-of-4-2-units/2949534/>

https://www.panchayat.gov.in/documents/20126/0/Statistical+handbook_MoPR+02082019.pdf/4988ca1b-4971-1f3b-54e7-980228eb47f9?i=1564729098415, Ministry of Panchayati Raj

<https://thewire.in/rights/cctv-surveillance-is-rising-in-india-world-but-crime-rates-remain-unaaffected#:~:text=The%20rising%20number%20of%20CCTV,surveillance%20cameras%20in%20the%20country.>

https://commons.wikimedia.org/wiki/Category:Government_buildings_in_India_by_city

<https://www.holidify.com/pages/biggest-railway-station-in-india-4332.html#:~:text=Indian%20Railways%20ranks%20fourth%20in,body%2C%20the%20Ministry%20of%20Railways>

<https://international-railway-safety-council.com/wp-content/uploads/2017/09/jain-kumar-level-crossings-scenario-of-indian-railways.pdf>

https://morth.nic.in/sites/default/files/circulars_document/N_3012405_1637043131682.pdf

https://www.mha.gov.in/sites/default/files/2022-09/RankingofPoliceSation_06122019E_0%5B1%5D.pdf

<http://www.iwai.nic.in/waterways/new-waterways/106-new-waterways>

<https://traveltriangle.com › Blog › Temple>

<https://guidely.in/blog/list-of-domestic-and-international-airports-in-india>

<https://www.statista.com/statistics/686604/india-number-of-ports/c>

<https://economictimes.indiatimes.com/news/india/india-registers-29500-drones-as-govt-sets-up-database/articleshow/88079798.cms>

ANNEXURES

AI Camera ecosystem

Components	Function	Deployment	Technology	Application	End User
Processors	Footfall Analytics	Cloud	Computer Vision	Smartphones & Tablets	Logistics and Transportation
Memory	Traffic Monitoring	On- Premise	Machine Learning	Imaging Systems	Healthcare
Storage	Number Plate Recognition		Context Awareness	CCTV	Automotive
FPGA	Facial Recognition		Others	Digital Camera	Retail
ASIC	Others			Others	BFSI
Module					Telecom & Consumer Electronics
					Oil & Gas
					Others

USES IN NUTSHELL - FEATURES

Intruder	Trespass	Loitering	Access	Left object
Intruder detection on fenced areas, alert monitoring at the entrance, detection of illegal crossing of railway lines or getting closer to a restricted zone.	Sabotage attempts by vandals (initiated with camera tampering) are detected and alerted for necessary action	People loitering in malls even after closing hours; people or vehicle having longer dwell time in restricted area; people persistence near critical assets.	Unauthorized access at the mall entrance, gated communities, office premises, factories.	Threat detection due to baggage left unattended in public places like malls, roads, railway station, airports etc. Unmindful passenger leaving any luggage.
Missing Object	Crowd behaviour	Crowd Counting	Smoke / Fire	Vehicle Counting/Jams
Detection of removal or theft of precious items like paintings hanging on a wall. Critical Asset protection in museums, etc.	Detecting illegal gathering of masses, or getting alert for overcrowding scenario in public places (malls/railway stations/airports) and entry/exit/lobby	In festivals & public places crowd counting is used for crowd management and for taking corrective action against crowd surge or overcrowding	Rapid detection of smoke as an early warning for industrial & non industrial uses	Vehicle movement statistics for traffic study, traffic density calculation
Face Recognition & Face Verification	Face recognition & verification is used in multiple applications such as VIP identification, Black List alarm, Forensic Face Search, People Authentication, Attendance Recording & Reporting.			

AI Based Camera Market Ecosystem: Key Players

Company	Ecosystem Positioning	Total Revenue	Region
IBM Corporation	Solution & Service Provider	\$ 79 Billion	Global
Amazon.com Inc.	Solution & Service Provider	\$72.4 Billion	Global
Google Inc.	Solution & Service Provider	\$136.22 Billion	Global
Intel	Hardware Manufacturers and Service Providers	\$37 Billion	Global
Microsoft Corporation	Solution & Service Provider	\$110.36 Billion	Global



Future of AI usage – by PwC :

AI implementation across sectors, as per the Enhance and Explore framework(below).

Sector	Enhance	Explore
Travel and hospitality	Dynamic pricing model (71%*)	Context-aware, targeted marketing (20%)
Healthcare and pharma	Clinical trial and drug discovery (67%)	Demand forecasting for inventory management (35%)
Financial services	Fraud detection and anti-money laundering (79%)	Reducing loan underwriting bias and risks (34%)
Retail and consumer	Hyper-personalisation of customer experience (75%)	Personality profiling of call centre agents/ customers (11%)
Industrial products	AI-based virtual assistants for improved learning and development (64%)	Intelligent sanctions and compliance monitoring (10%)
Telecom, media and technology	Network threat prevention and detection (68%)	Intelligent and faster ticket management (12%)

*Percentage figures reflect the percentage of firms in that sector currently implementing the use case or that will do so in the next couple of years. The list of use cases is not exhaustive.

Source: PwC analysis

