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Impact of IOT and Artifical Intelligence on the daily living in the near future

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Every corner we turn, the world is abuzz with words like: 'IoT', 'AI', 'VA' and 'ML', but what do these buzzwords mean? Can we imagine a world today without a mobile and internet? The answer seems to be a big 'No!' to most part of the world today. The advent of internet has definitely made the world a very small place by providing tools to connect and communicate across long distances and complex environments. Whilst we celebrate the connectedness that Internet and internet of things brings to us, are we able to cope with the digital consumption map we are leaving for everyone else to analyse? How much of these data are important for the world we live today? Is there a structured way of organising such large data to predict the next move of digital behaviours?

That is where the advent of Artificial intelligence and Machine Learning takes the next important step of digital evolution, where machines are now not only intelligent enough to start prompting the possible behavioural outcomes, but also provide significant analysis of the past actions to determine the future outcomes.

First, let's look at each of them:

> IoT or Internet of Things is a system of interrelated or physical devices, also called connected or smart devices, including buildings, machines, vehicles, and other objects with unique identifiers. Each of the identifier which is embedded via electronics, software, sensors, actuators, or the internet, allows collection, dissemination or exchange of data over a network. Simply put, IoT allows one device to connect to another and exchange information, facilitating efficient performance.

> AI or Artificial Intelligence is that field of science wherein computers simulate basic human tasks like visual perception, speech recognition, language translation, problem solving, etc., by identifying the environment, to provide successful results.

> ➤ VA or Video Analytics is the technique of monitoring video feeds in real time through computer algorithms, which provides key information for crucial, time-sensitive decisions; it aids in triggering alarms, or processing BAU for everyday business insights.

> ➤ ML or Machine Learning is that part of AI, wherein computers pick up information, patterns, and other data without being explicitly programmed.

Here is a video of Google's CEO Sundar Pichai addressing the question of 'Why AI/Machine Learning is the buzzword now' at IIT India - https://www.youtube.com/watch?v=5cFUZ03Sbhc

Economic Impact:

McKinsey Global Institute (MGI) predicts that IoT applications will have a potential economic impact of $3.9 to $11.1 trillion a year by 2025, and as per Machina Research, the global Internet of Things (IoT) market is expected to grow from 6 billion devices in 2016 to 27 billion in 2025.

By 2025, Video Analytics will facilitate cities to capture $14 to $31 billion in economic value through improved crime detection and monitoring, and retailers could capture between $410 billion and $1.2 trillion in annual economic value.

As per United Nations, there will be 37 global megacities with over 10 million populations by 2025, with 22 of them from Asia. The Navigant Research Leader board 2014 Report of Smart City Suppliers also reports that between 2010 to 2050, the population of the cities is expected to increase from 3.6 to 6.3 billion.

The impact of such urbanisation is already having a profound impact on the global economy, with consequent rise in demand for infrastructure and other resources for city planning/management. While cities represent only 2% of global land use, they provide for around 80% of global gross domestic product (GDP), and 70% of the world's energy use. Many governments around the world such as the United Kingdom, Japan, Taiwan, India are already recognising the imperative role of smart cities in national development, and have channelised funding & related support for urban innovation.

While well-established technologies already offer most of the developmental solutions for such governance, solution implementation still faces its hurdles. The need for broader data integration, near real-time response, and parallel analysis of highly granular data across a wide range of city operations is vital for drastic improvements in policymaking and operational

efficiency.

Tapping into the IoT-VA and Artificial Intelligence markets for process integration in existing silos of operations, whilst a challenge, is being recognised as the next essential milestone. In 2017 alone, the global AI market is estimated to be worth $1.25 billion as per Statista, growing to $36 billion by 2025.

Rising popularity:

It is no wonder then that these fields are growing at an escalating pace.

Top technology & AI leaders in the business world such as Amazon, Facebook, Google, IBM, and Microsoft have already formed a nonprofit AI partnership to facilitate better public awareness on the subject matter, along with research options to discover best practices.

Even on an individual front, each of these tech giants is already making rich contribution in these domains. Right from IBM's Watson, Sundar Pichai's recent keynote speech at I/O 17 about Google's tryst with AI & Machine Learning, to Mark Zuckerberg's AI assistant Jarvis, the companies and the management have taken deeper strides to lead the momentum.

While talking about VA for a better social network experience and the future it holds, Joaquin Candela, Facebook's Director of Applied Machine Learning, had remarked, "We think video understanding is going to be ridiculously impactful…" "We're at a point now where we're pretty good at understanding photos, but now there's video. You even have live video, and the question becomes, well, how fast can you figure out what's going on in this video?" Giving AI-VA industry a significant prominence.

The below chart by CB Insights also shows how each of them are competing against each other to get an edge through acquisition of AI start-ups:

The Race For AI: Google, Twitter, Intel, Apple In A Rush To Grab Artificial Intelligence Startups
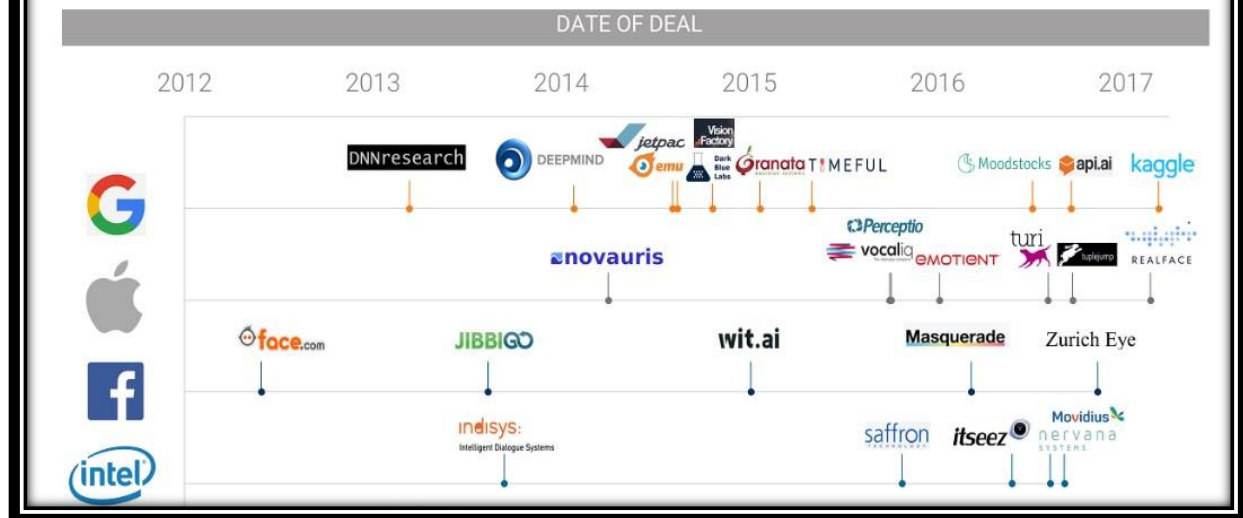
CB further reports that since 2012 over 200 private companies with AI algorithms have been acquired across various verticals. 2016 saw over 40 acquisitions, with Samsung and GE joining in at the fag end of the year, wherein the former South Korean MNC acquired Viv Labs, the developer of Siri-like AI assistant.

2016 also saw VC firm Octopus Ventures, an active AI investor, winning a standout deal, as Microsoft bought over the AI language input app Swiftkey. ML platform Magic Pony Technology's purchase by Twitter was another significant one. As of 24/3/2017, this year has already seen over 30 acquisitions, with Ford's $1 Billion Argo AI acquisition being the largest M&A.

Tractica forecasts the AI spending to grow from $640 million in 2016 to $37 billion by 2025.

Even governments around the world are recognising the importance of advanced tech & AI for national growth that recently Germany's Parliament of the Federal Republic decided to amend its existing traffic law to allow autonomous mode in vehicles.

Canadian Finance Minister Bill Morneau in the 2017 budget announced the allocation of $125 million to create a pan-Canadian strategy to aid R&D and industry partnerships in AI.

What's more, Toronto's Vector Institute, which looks to be a global leader of AI will receive $40-$50 million from this $125 million budget. 30 more private companies, including Shopify & Google, will be collectively contributing another $80 million to the institute over the next ten years.

UK, however, seems to be leading the show hands down, with the government allocating a separate budget of £270m investment fund for disruptive technologies like Self-driving cars and AI, for their potential to transform the economy. Chancellor Philip Hammond's simple remark was, "keep the UK at the forefront of disruptive technologies like biotech, robotic systems and driverless vehicles".

The April 2017 report by CB Insights proves this rising global sentiment, as it reported that AI commerce companies raised a total of $990 million across 201 deals between 2012 - March 2017, with Q1'17 alone seeing as much as $100 million across 21 deals.

CB also shortlisted 100 most promising private companies with AI application in the 'Innovation Summit', across various industries such as healthcare, automobile, fintech, etc. These companies had raised an aggregate funding of $3.8 billion across 263 deals since 2012.

The chart below shows the interesting journey that AI funding has taken over the years, and how we are seeing the sector peak in the current days:
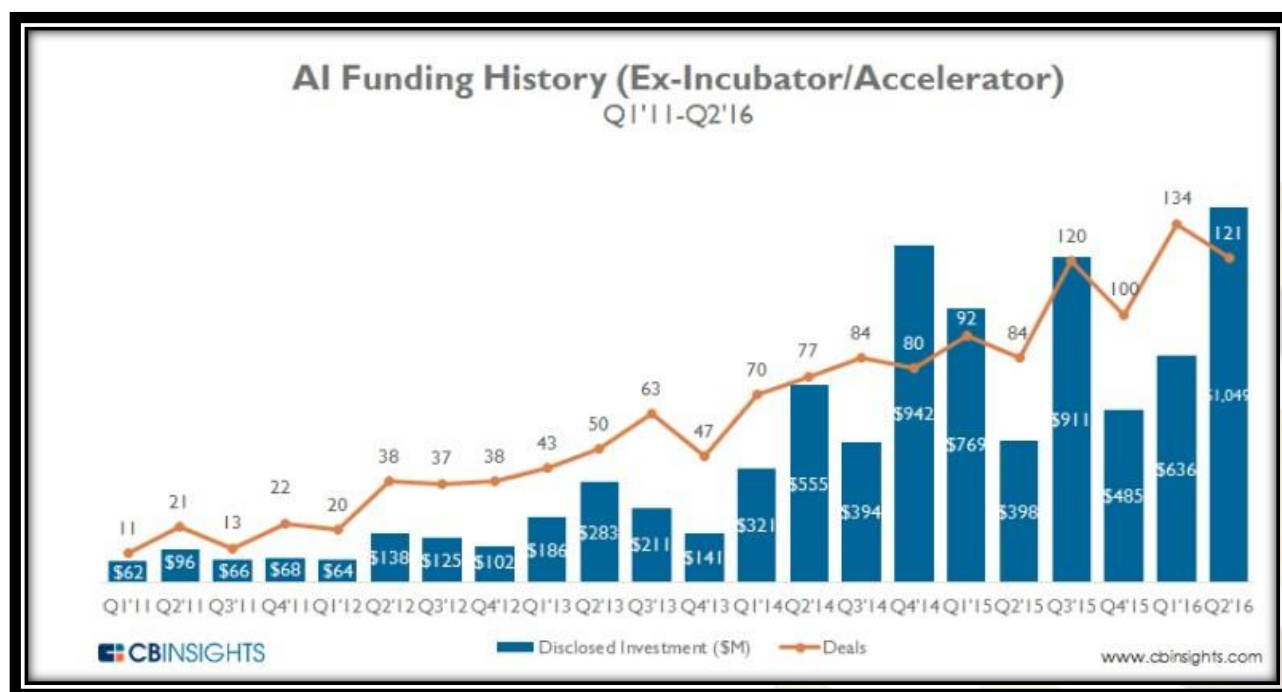
The report also mentions that almost 70% of the deals went to US startups in Q2'16.

The below chart highlights all the countries which won equity deals because of their AI focus:

Artificial Intelligence: Q2'16 Equity Deals Outside United States
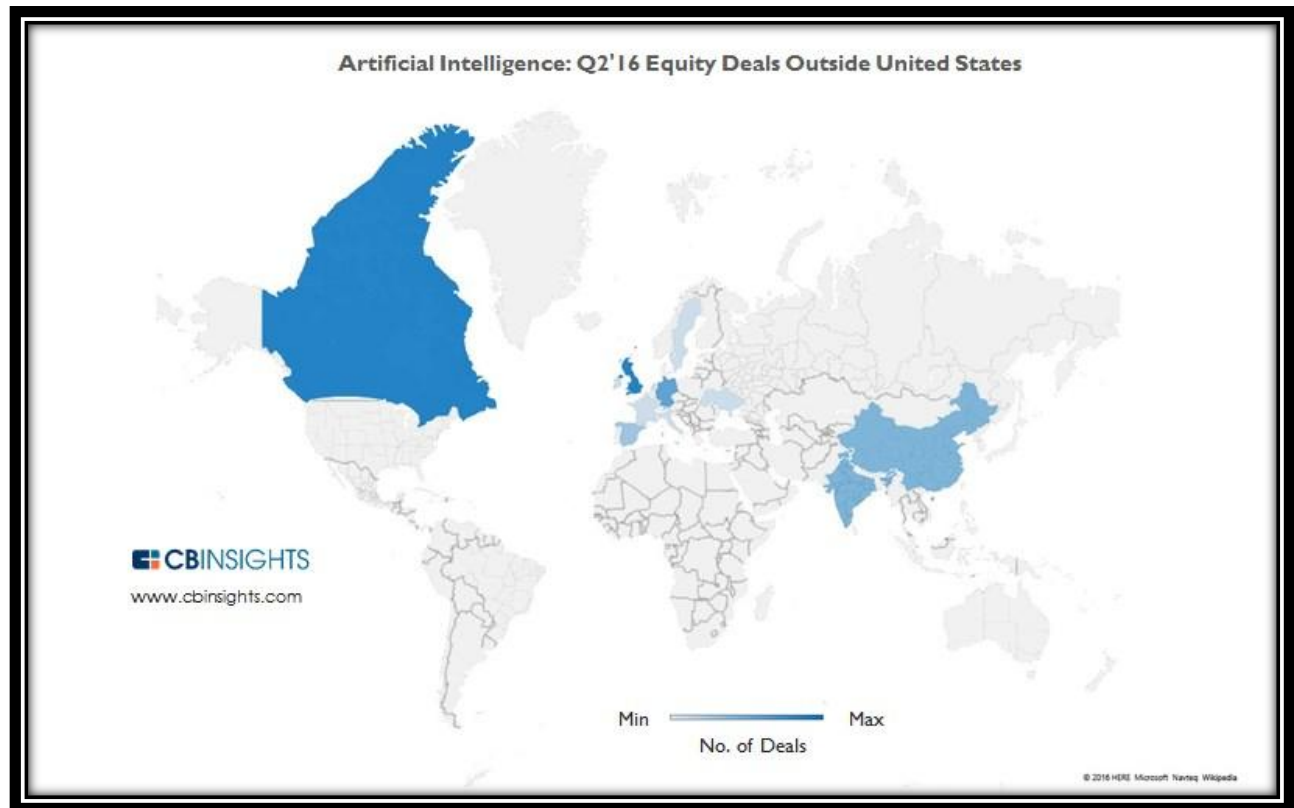
"If you don't have an AI strategy, you're going to die." – eBay CEO Devin Wenig (Shoptalk 2017)

Functional area:

With such skyrocketing demands and global recognition, where are these niches thriving?

McKinsey reported that the demand for video-analytics applications will be greatest in the city, retail, vehicle, and office site by 2020, wherein much of VA will be employed in the spheres of business operations, public safety, employee productivity, and improving maintenance.

Emphasis however was laid on the last two to address privacy concern, as workers might be against the idea of video monitoring, if it could lead in the criticism of their work habits. The largest market share will however heavily indulge in optimizing city & factory operations.

VA will also play a key role in enabling various functions of autonomous vehicles, such as blind-spot monitoring, says McKinsey.

In the Retail domain, VA will involve heat mapping, people counting, shopper-demographics analysis, loitering detection, and dwell-time analysis. This monitoring allows easier sifting of various customers to asses their age range, demographic profile, and behaviors, facilitating better product placement insights. These inferences in turn offer considerable economies of scale, as it helps businesses make crucial decisions in milliseconds.

Seagate's Nov'14 Global Customer Insights survey amidst various industry verticals of 1100 participants reported that Banking and Finance industry accounted for 21% of the VA market, the largest in the video surveillance segment.
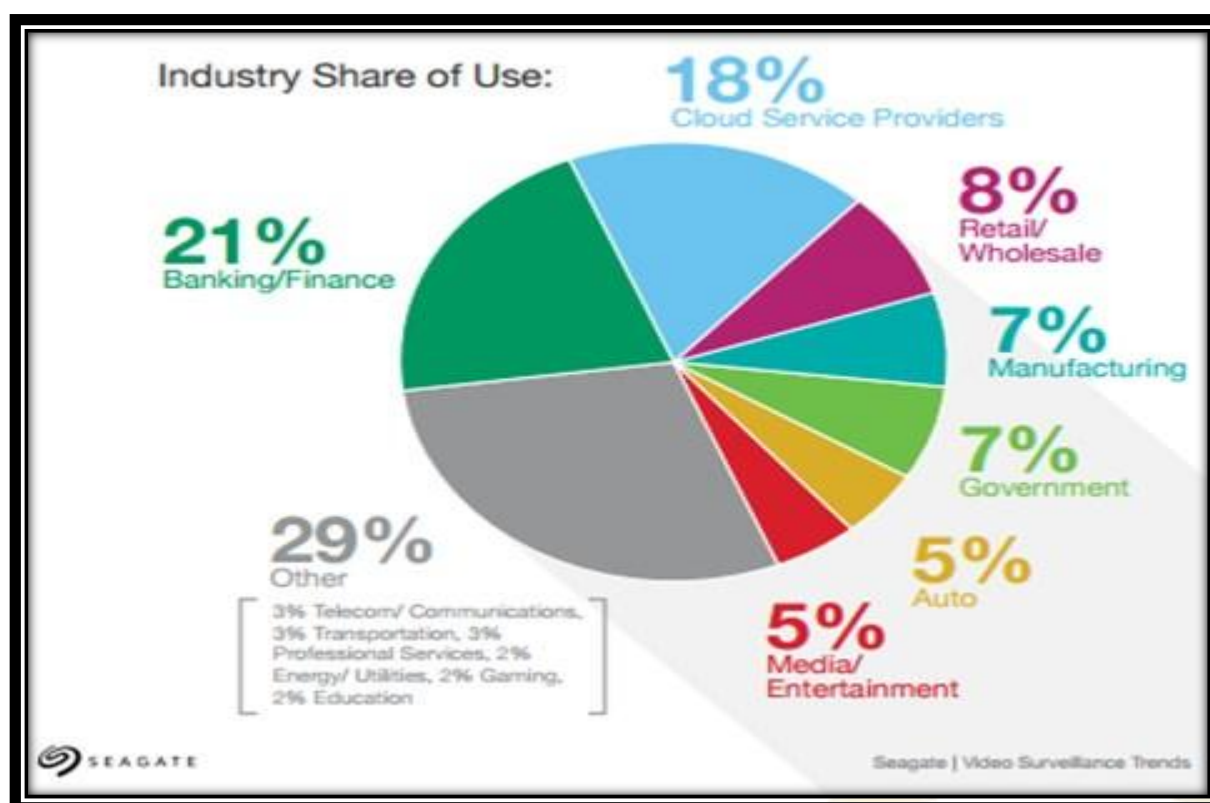
85% of industries were noted to use VA for safety & security, while 53% used it for optimising workflows. Further, 74% of the participants expected an increase in the importance of VA in the coming years.
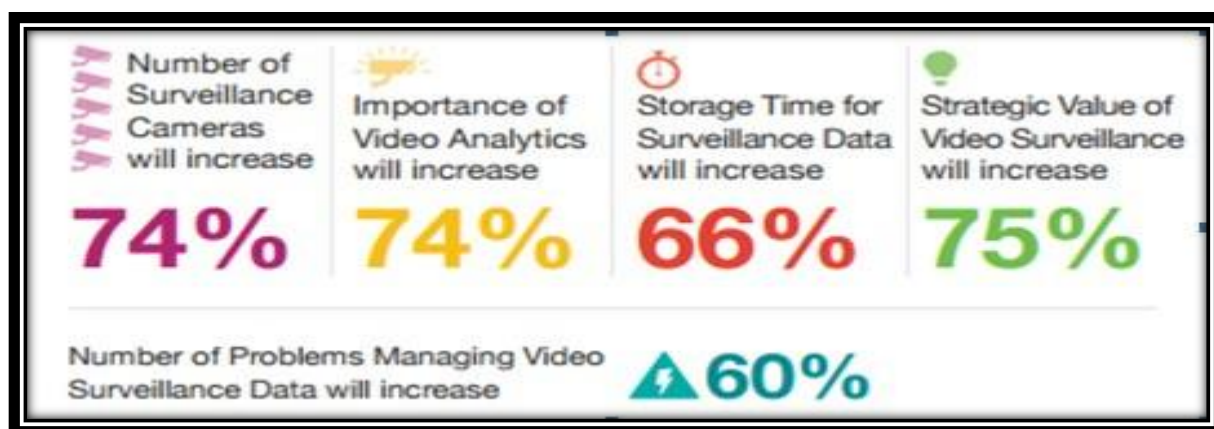
By offering real-time processing and greater accuracy across multiple sources, VA delivers better business insights than traditional surveillance cameras, and are considered as the most innovative of IoT apps by McKinsey.

For land based casinos, the need for VA & ToF cameras has now taken crucial precedence. With rigid regulatory constraints and competition from online gaming markets, achieving increased revenues in a capped casino table game market, while optimising traditional models is expensive. ToF helps the market achieve newer and better revenue streams by offering critical, time sensitive information at a granular level through big data automation, in a cost efficient way.

Currently, the artificial intelligence (AI) market is used for functions such as image recognition, object identification, detection, and classification, as well as automated geophysical feature detection.

CB's research director Aditya Kaul also highlighted that image recognition, algorithmic securities trading and healthcare patient data management will have huge scale potential in the AI domain, as well as in areas such as business services, consumer products, industrial robotics, advertising, finance, media and defence.

For an omnichannel business, AI holds the key to determine customer behaviour, user experience, product and service utility, along with their relevant trends. This facilitates a proactive approach to customer's needs & a tactical business revenue model, whilst offering the personal touch of mom-and-pop stores.
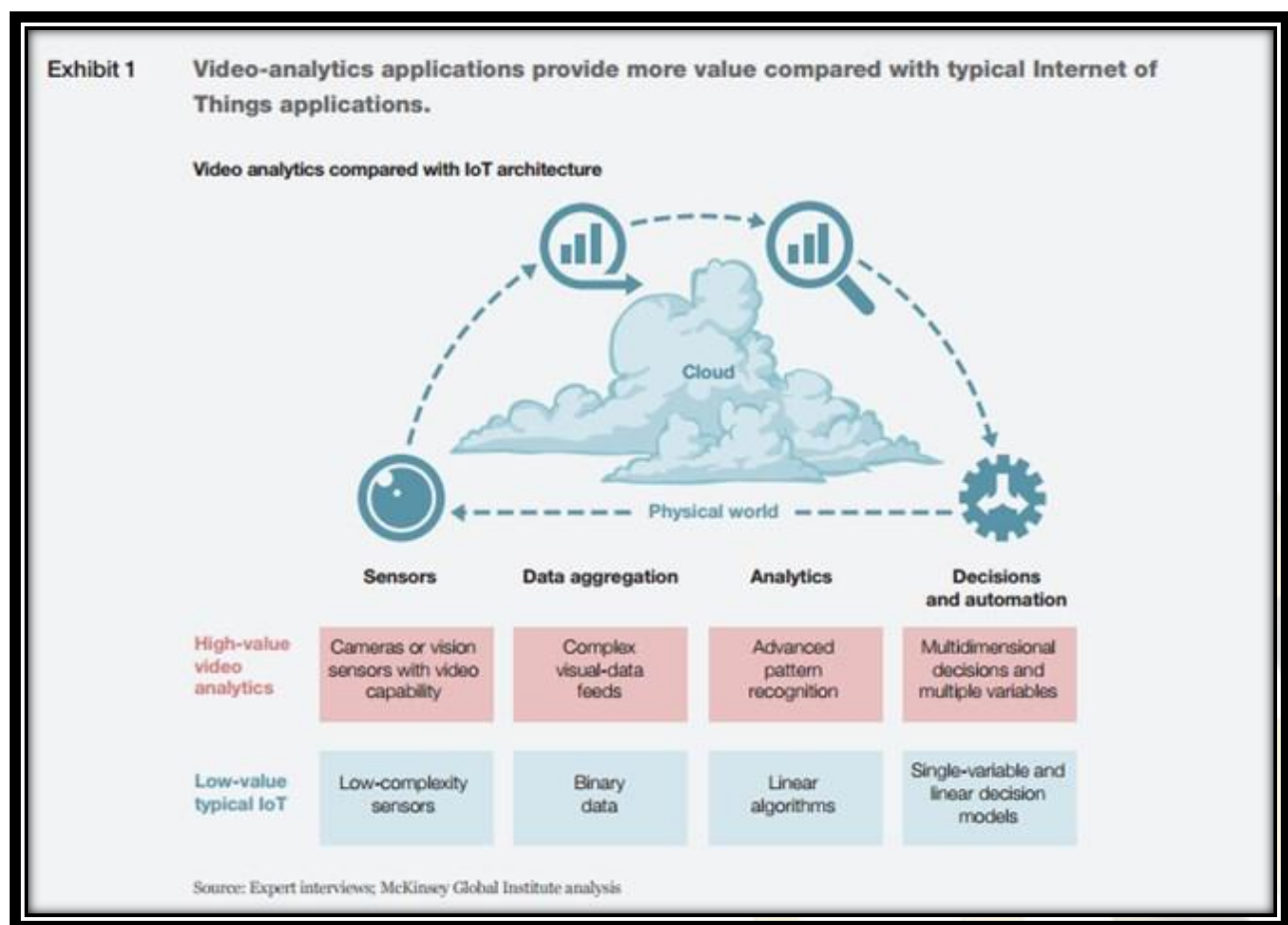
As per a Teradata research, companies in the top third industry tier, which capitalise on data for business decisions, deliver 5% higher productivity & 6% more profits on an average. For instance, the American video streaming company Netflix claims that their personalised recommendation engine aids them in retaining more than $1 billion in revenue annually.

The question of integration:

The recent advances in VA tech like real time data, greater accuracy, detailed insights, better business nuance and innovative test cases has put VA at the top of the value chain.

Earlier, any movement could be tagged as a threat, but current functionalities recognizes and disregards motions that previously triggered false alarms, such as the falling of a leaf. Additionally, it also lets users to program detection of specific visual patterns, such as retail theft or fire. However this data would be highly beneficial if VA is interlinked with the related streams of IoT, AI & ML.

Incorporation of video analytics in IoT devices is in fact regarded as a better value addition, for such integration offers advanced data based decisions because of the wider range of inputs. (See image below)

Exhibit 1: Video-analytics applications provide more value compared with typical Internet of Things applications.

In the McKinsey December 2016 report 'Video meets Internet of Things', observation was also made to correlate revenue generation in various IoT segments based on VA integration. It

showed two contrasting results based on the product niche:

a) better revenue model for software and application development, while
b) lower revenue for solutions integration and hardware.

It shows that the application, interaction and interchangeability of IoT-VA, AI-ML should be decided keeping in mind what best suits the business, and the end purpose.

Then, now and the future: an AI–IoT journey

For now, the market size of IoT-VA apps is relatively small, but a huge potential will propel the market forward in the immediate 5-10 years, opening doors to business and consumers alike to fulfil the yawning gap between demand and supply. The market is soon expected to cater to wider range of use case and settings, offering increased growth potential, and the revenue of Global Video analytics is expected to reach USD$3.0 billion by 2022.

While the Video analytics industry is still in its infancy, and first mover advantage is key, VA applications are expected to have a compound annual growth rate of greater than 50 percent over the next five years, reports McKinsey in its 'Video Meets the Internet of things' December 2016 article.

As for Machine Learning, London's Royal Society set about to research ML's role in global advancement, along with UK's role in orchestrating it through a Machine Learning Project, and published a report in April'17.

Laying emphasis on the need for careful stewardship in AI tech to reap dividends, it has recommended the following measures, namely: skill upgradation, an enabling governance, creation of opportunities and a data laden environment.

The RS-ML project also went on to trace the history of ML right from 18th century & DartMouth's Workshop to IBM's Watson winning the US quiz and the recent Poker win by system Libratus.

Even in the 2013 CB Insights report, it had mentioned that VC firms showed much interest in in-store tracking for retail even before they became the global buzzword. Tracking & analysis of consumer activity using mobile WiFi addresses, video feeds, and sensor technologies had become popular & VC investors had showed keen interest in backing them.

If we see, currently, the deep learning technology has achieved the following feats in the visual category, such as giving color to black & white images, sound effects to silent movies, automatic game playing, translation, and handwriting generation, classifying objects in photograph, generation of caption and character texts - proving to show how computers can pick up learning without programming aid.

Confusion still remains however if IoT, AI & ML will replace human functions and human jobs. Interestingly, career portal Paysa reported a recent finding that top US companies are currently allocating over $650 million in annual salaries to fund the 10,000 plus potential jobs in the AI niche.

With McKinsey's June 2017 discussion paper 'Artificial Intelligence - The next digital frontier' estimating the 2016 global tech giants spend to be $20-$30 billion on AI, it correlates well with this potential influx of newer jobs in the market, reflecting the global economic need to re-skill our workers.

While that keeps the debate open, Alphabet's Eric Schmidt points out the crucial help that these technologies offer us. He has remarked, "The deep learning algorithm was able to screen for the disease [diabetic retinopathy] just as accurately as doctors in the field", whilst drawing further attention to how there aren't enough doctors to diagnose patients on time.

If an AI tech like Google's Deep Learning can assist us, millions of people can save their vision, which will not be possible otherwise. Truly, if better utilisation of the technology will richly reward the society by bridging gaps, saving lives, and in bringing the world together, then corresponding measures to counter privacy and security issues, backed with governmental regulations would suffice to silence the qualms surrounding the debate.

As for the intelligent transportation systems, these new age technologies are looking to expand the realm of the industry, giving commuters options such as automated cars to buses and next-gen ride-sharing. Not only do they offer safer and easier options, but also cheaper economies of scale.

Australia's Department of Infrastructure and Regional Development reports that as much as $16.5 billion could have been saved in 2015, had they avoided congestion in capital cities. On an average, this could climb to $30 billion by 2030. Tesla's Elon Musk rightly comments:

"Since most cars are only in use by their owner for 5% to 10% of the day, the fundamental economic utility of a true self-driving car is likely to be several times that of a car which is not."

In an article by Vodafone, it talks about a future-leaning method, where through AI, IoT and related sensors, the car-connected devices themselves could suggest routes for public transport, offering real-time assistance and solutions for avoiding road hassle.

For example, Mercedes-Benz City Pilot project did a successful 20km autonomous test drive in the city of Amsterdam, using GPS coordinates, sensors, and 12 cameras for navigation. This autonomous ride could efficiently cut running and maintenance costs, apart from offering a safer commute.

Case Study:The SenSen story

This is where SenSen Networks, a patented Australian technology company specialising in Video Analytics & Artificial Intelligence, comes into the picture.

In the 'Video Meets IoT' McKinsey report, it mentions that though advanced surveillance apps have improved detection capabilities & higher accuracy, the tech is still fraught with many limitations. It suggests the need to develop greater video-compression capabilities to ease transmission and storage demands, and better integration with other IoT systems. Such as detecting fire in a video stream and notifying another IoT device to resolve the issue, say like activating sprinkler system or calling for firefighters.

The SenSen platform can already control actuation devices like relays, alarms, etc., and capture data from different kinds of IoT devices, thereby placing itself as the forerunner in this field.

As a Video Analytics & Automation supplier, SenSen's USP is its data fusion. It tactfully integrates the camera data using video analytic algorithms with other sensory data, thereby offering exclusive data insights to better business productivity, safety and revenue streams.

The patented data fusion technology is highly accurate, and combines enterprise video and sensor data from IoT devices, along with computer vision, machine learning and Artificial Intelligence algorithms into its SenDISA platform. This highly scalable and rapidly reconfigurable solution integrates well with all enterprise business applications.

Even the AI-ML ambition of Google, wherein Sundar Pichai talks about identifying restaurants and their ratings in his I/O '17 keynote speech, follows a technology that SenSen is already offering its clients under a different setting.

Called as 'Sign auditing', it helps city councils track, maintain and detect traffic signage with accurate GPS coordinates. This fully automated solution is the first of its kind in the world, which is made available as a detailed report with individual photos for the different data points.

Find more about the product offering in the video link: https://youtu.be/nQn584Gxbqc

With LIDAR sensors playing an important role in the AI and automation fields, SenSen already employs a combination of cameras, centimetre accurate GPS, Lidar, Radars, timeservers, patented algorithms and cloud hosted back office software, for its Intelligent Transportations Systems (ITS) solutions - SenFORCE, SenSIGN and SenPARK.

This has resulted in safer and better parking in cities with over 10 x productivity gains and major increase in parking compliance.

Likewise, through its Time of Flight (ToF) cameras and patent pending AI algorithms, SenGAME offers accurate actionable insights for Casino gaming: about table occupancy, hands per hour, bet type and value for every bet placed on the gaming floor.

Sensen, with its most advanced video & sensor analytics based AI platform, that was built with over 200 man years of effort, triangulates not just quantitative data, but also qualitative information, where it decodes not just numbers and letters, but scenarios, patterns, environments; recognising various objects, geotagging their positions, and timestamping it.