The Rise of Applied Artificial Intelligence & IoT

Opportunities for Innovation Through Collaboration Between Japan, India & North America

By Sanjeev Sinha, Manish Singhal, Umakant Soni & Prashant Pathak

AI Winter Turning to Spring


Author Sanjeev Sinha


Author Manish Singhal


Author Umakant Soni


Author Prashant Pathak

Artificial Intelligence (AI) is the intelligence exhibited by machines, especially those exhibiting human traits such as "learning" and "problem solving". The term is frequently applied to the project of developing systems endowed with the intellectual processes characteristic of humans, such as the ability to reason, discover meaning, generalize, or learn from past experience. While Artificial General Intelligence (AGI) — with which machines can perform anything a human could do — is said to be years away, a more practical form of it is what we refer to as AI, in which machines demonstrate reasonable human-like traits through the use of reasoning, perception and language.

AI has been in "winter" for decades. For a long time since its formal start at a conference at Dartmouth College in 1956, despite a lot of research into the area, results were far from practicable. The way we humans learn and behave was very different from the supervised or semi-supervised algorithms being used for AI. Thus the term "AI winter" was born to describe periods when, because of a mismatch in expectations and reality, funding and resources would dry up. But determination has paid off and the field is now showing promise as two significant factors come together: unprecedented computing power and readily available data.

Things started to change in 2005, when Prof. Geoffrey Hinton, now a distinguished emeritus professor at the University of Toronto, realized that neural networks, trained with the availability of faster computing power at much lower cost, made unsupervised learning possible. Unsupervised learning is the closest to the way we human beings learn in real life. Thus a new approach to AI, called deep learning, was born. Today deep learning powers not only the way you are guided by Google maps, but also speech recognition, face recognition and extracting meaning from texts offered by companies such as Facebook or Google. Today Facebook can recognize faces (DeepFace) with up to 97.3% accuracy, almost as close as a human can, and the same level of advancement has occurred with speech recognition.

As these advances in accuracy show that "machines have started to learn" like the way humans do, there is a hope of an "AI spring". So unlike earlier approaches where the focus was on modelling the world, today the focus is on modeling the mind. Today, 99.5% of data that gets produced is never analyzed, as it is beyond human capability to process. But learning machines built on a model of the human mind can now get to that data and unlock its impact on businesses in a big way.

This shift is being accelerated by some of the most fundamental advances in AI being accessible to all. Over the past year or so, all the major global tech players have started to make their core AI research efforts available for others to use. For example, TensorFlow was originally developed by researchers and engineers working on the Google Brain Team within Google's Machine Intelligence research organization for the purposes of conducting machine learning and deep neural networks research, but the system is general enough to be applicable in a wide variety of other domains as well. So, recently Google opened it for up for everyone to use and profit from. Similarly Facebook opened up its BOTs framework powered by wit.ai, similar to the recent move by Microsoft *(Table)*.

With the rapid growth of data capture, storage, processing and transfer capabilities, the world has become very intricately connected. There is now also an increased, irreversible and critical dependency on data; in particular, we expect to see data growing by almost 50 times through the use of connected devices from 2009 to 2020 *(Chart)*. Maturity in Deep Learning architectures combined with these data capture, storage, processing and transfer capabilities is leading quickly to the phenomenon of self-learning by machines,

TABLE

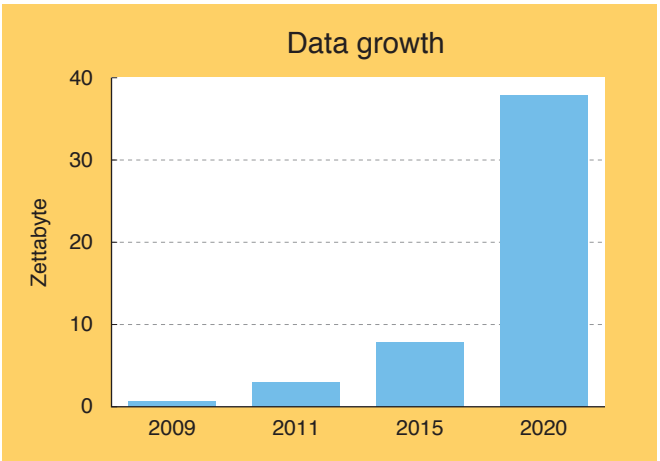
Companies & their AI frameworks & platforms

Company	Core AI on tap	Tools Type
Google	Tensorflow	Software Library for Machine Intelligence
Facebook	Torch, wit.ai	Compute Framework
Microsoft	DSSM	Deep Learning Framework
IBM	Watson	Platform
Collective	OpenAI	Open AI Gym
Amazon	DSSTNE	Deep Learning Framework

Source : pi Venture Research 2016

CHART

Exponential data growth (50x) 2009-2020



Source: IDC Research

without which we would be overwhelmed by this kind of data growth. AI will play a critical role in creating meaning out of data, to turn it into insights that can be further turned into actions. This in turn would lead to predictive businesses and extreme personalization through a virtuous cycle.

With regard to the Internet of Things (IoT), the T part, through the development of physical technology, especially around portable energy management (e.g. batteries for drones), material engineering (e.g. lighter and stronger materials) and nano-technology, is now a bigger challenge than the I part, which is further enhanced by AI. This critical dependency on data also makes the world very vulnerable to cyber attacks on AI and IoT-based systems. With the terrorist truck attack in France fresh in mind, just imagine a world of autonomous driving where automobiles are driven via a central or cloud-based system of data, analysis and instructions. Any mal-intentioned manipulation of the system could easily create havoc on a much larger scale. This makes cyber-security very critical in the new world of IoT.

The recent acquisition of Britain's Arm Holdings by Japanese Internet giant SoftBank for $35 billion underlines the importance of the T part of IoT. Given the predicted growth in cyber physical systems, which will be driven by AI, this is another step in the direction of turning everyday appliances suddenly into intelligent, thinking and analytical machines.

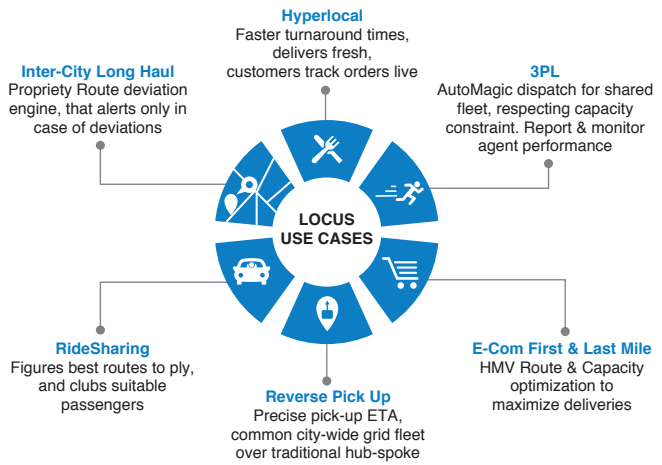
Japanese Companies & Their Technology Ecosystems

Japan has for decades been known as a superpower in electronics manufacturing. Companies like Renessas and Tokyo Electron have been providing essential technology and components for electronics around the world. The ergonomics of Japanese household electronics made by the likes of Sony and Panasonic, automobile electronics from Denso and Aisin, and industrial automations from TDK and Fanuc are all well known. Japanese companies like Komatsu had already implemented IoT-type features in its construction and mining equipment since a decade ago to collect performance data as well as to optimize repair work and maintenance, while Near Field Communications-based Fintech systems popularly branded as Suica and Pasmo in Japan are domestically widespread and constitute the world's largest integrated public Fintech system. Furthermore, the Japanese Ministry of Internal Affairs and Communications envisaged a plan for a Ubiquitous Network Society around 10 years ago and this has already seen significant implementation.

But with its homogenous society, huge domestic economy, high levels of work-place integrity and almost zero rates of sabotage, Japan has been used to a generally safe and trustable environment. This has prevented it from thinking outside the box on a global scale and from anticipating how to prevent criminal usage of its technology. With the advent of IoT and AI on a larger scale this becomes an imperative. By contrast, India, with its huge diversity and global networks, such as among business leaders in Silicon Valley which in turn leads global IT, is in a very strong position to anticipate global cyber-security trends.

From an economic perspective, Japan is struggling to maintain its cost competitiveness in electronics manufacturing while India faces a huge trade imbalance due to its lack of electronics manufacturing at home. India and Japan already have a strong cyber security agreement, and cyber security and IoT could serve as the new foundations of collaboration on a project dubbed the Make Electronics in India by Japan Initiative (MEIJI), initiated by Sanjeev Sinha, beginning with telecom equipment and the core components of IoT.

Photo 1: Locus.sh - 2016



Locus logistics automation platform

India: Big Market with Dynamic Startup Ecosystem

Fundamental shifts in technology, demographics and consumer behavior, as well as government activism have created an unprecedented opportunity to digitize workflows and drive new efficiencies across virtually every sector of the Indian economy. Sample some numbers: India today boasts more than 1 billion phone users (20% smartphones) and 450 million Internet users, with another 200 million to be added by 2020. The government has invested in enabling policies and infrastructure, the most compelling of which is the Aadhaar platform that opens up citizen identity data (with consent) to power a range of services. In just the last five years, more than 1 billion people now have a digital identity. This is faster than Whatsapp adoption. More mobile wallets have been created than there are bank accounts in the United States. With 4,000 registered startups and counting, India has become a global digital powerhouse, with a strong potential to capture the future. These startups are changing India rapidly, while spreading the adoption of technology.

Rise of Applied AI & Possibility of New Category Leaders

The availability of core AI frameworks on tap means a level playing field for startups. Now startups can leverage decades of research, apply it to data, and pipe the results directly into two major directions — extreme personalization and predictive businesses — built on intelligent process automation and forecasting. These technology leaps will make businesses more efficient in operations and effective in understanding customers' needs and fulfilling them in much better ways. These startups would be leveraging and creating combinations of three types of data to create business value:

a. Big Data — This data flows in large enterprise applications and will be further reinforced by data sensing in industrial IoT devices. It will map to systems in supply chain planning, operational systems, customer relationship management, etc.

b. Small Data — This data set is created when we interact with our personal devices, like smartphones, health monitoring devices or even smartwatches and gives out powerful cues about our context.

c. Dark Data — Through IoT devices and sensors we are bringing to life things which either used to have no data flow or for which data flow was not available for contextualization and analysis in real time.

Over the next few years in India these data creating and combining startups will have a chance to create new leaders, as they have the power to disrupt traditional businesses, which are currently based on heuristic based approaches, by automating business decisions based on machine learning. The business value generated would be so large and consumer experience so compelling that these startups would gain massive market share and the data moat created by these three types of data sources would help them protect their lead. The young population in India, hungry for new experiences and adoption of new workflows, would create a positive spiral for these new vertical leaders, which could then act as templates for spreading AI-driven businesses across Southeast Asia, the Middle East and Africa, or what is termed as the next 6 billion population.

Early Examples & Disruptive Startups

Logistics is one big area of focus and application for AI & IoT. We are starting to see young India growing fast and it is estimated to be the second-largest economy by 2030. Startups are creating a big and disruptive shift in the economy by leveraging technology. Here are a few examples:

Locus is a state-of-the-art logistics automation platform. They have proprietary algorithms for solving several NP-hard problems, like Knapsack, the Travelling Salesman (Thief) Problem, Bin Packing, both separately and together. They have built a set of infrastructure services around them to offer a complete technology stack in the form of a platform as a service *(Photo 1)*.

Opinio, a similar fast-growing hyperlocal logistics company, allows local merchants, online commerce and restaurants to use its on-demand shared service to deliver more than 15,000 orders per day, using AI in assignment algorithms to bring in efficiency in

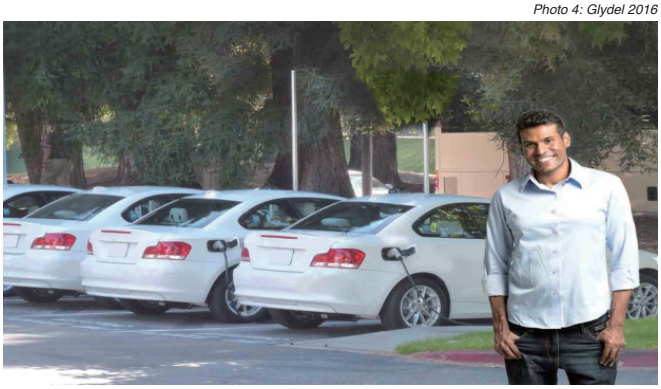
Photo 2: Opinio - 2016

Hyper local delivery platform

Photo 3: Witworks - 2016

Blink Smartwatch based on Marvin OS

Photo 4: Glydel 2016



One of the taxi drivers using Glydel

operations. The routing technology optimizes the best route for delivery riders and provides a sequence for deliveries, thereby saving time and effort *(Photo 2)*.

Witworks is a consumer IoT company building a smart wearable device+platform called Blink. The product is designed to provide the most contextual information and services on-the-go based on the user's personal behavior. Blink runs Marvin OS, Witworks' voice-operated platform capable of integrating varied third-party applications *(Photo 3)*.

Glydel, a company that offers an IoT platform for connected cars to transform intercity taxi markets in India. Their technology marries business process automation with IoT-based car analytics to improve efficiency and create new revenue opportunities for hundreds of car fleet owners. Even the small fleet owners can now provide a safe and relaxed experience for their passengers. The center point of the IoT platform is the 2G sim-based OBD2 device streaming live location, driver behavior, engine health and fuel data back into the analytics platform, made available when and where it is needed most *(Photo 4)*.

Threats & Opportunities in AI

AI will bring its own level of challenges as it begins to overlap and replace human decision making. Especially with the upcoming revolution in autonomous robots, we will see more and more automated workflows. Facebook has come out with an algorithm that learns to teach other algorithms. The recent death case involving a self-driving Tesla car in the US, though exact liability is still being investigated, is an early warning of the threat that lies within. In Asian countries, there would have to be a different way of developing autonomous vehicles, as most roads are mixed lanes, especially in India, and we are still sometime away from such scenarios, when technology can be self-reliant in all cases. In the interim, a strong policy regime may be required for where AI can be commercially used and where not.

Along with policy guidelines, we also need reinforcement from industry in the form of an ethical framework for AI. For example, some regulatory guideline is needed for autonomous driving and drones. This also opens up a new world of opportunities for startups to solve the problems that are key to bringing these technologies into our lives in a safe and meaningful way. As such, initiatives like OpenAI for AI safety become more important.

To reap the rich rewards from the big markets available in India, we need to create an effective ecosystem of funding, talent and cross-border collaboration. This is where the initiatives of global corporations, especially from Japan with its rich heritage in manufacturing and deep domain background in automotives, supported by governments can be very effective. Some of the leading research in AI is happening in Canada, especially in areas such as deep learning, while big markets for such technology lie in India, Southeast Asia, the Middle East and Africa. By creating a cross-border ecosystem, where research, development and deployment of technology can happen at scale, a huge change can be brought about. This will bring about innovation and change in a synergistic fashion and create better outcomes for the world.

Conclusion

We are at an important juncture today. Rich data is hitting businesses from all sides, advances in computation power have made making sense of this data in real time for predictive decisions a reality, and businesses the world over are competing hard to differentiate themselves. It is a real pot-pourri of several factors coming together to build a pathway for applied AI and IoT to hit mainstream adoption. With Japanese technology and manufacturing muscle, and the large domestic market of India, the potential is immense for making a substantial leap in these fields with a close Indo-Japanese collaborative effort. JS

Sanjeev Sinha, a graduate of the Indian Institute of Technology (IIT), came to Japan in 1996 for R&D in AI at GenTech Corp. He later worked with Goldman Sachs, Mizuho Securities and as chief representative in Japan for Tata Asset Management, and is now president of the India Japan Investment Partnership.

Manish Singhal and Umakant Soni, both graduates of IIT, are founding partners at pi Ventures, which focuses on Machine Learning, AI and IoT. They have previously built products and startups related to hardware and AI.

Prashant Pathak, also a graduate of IIT, is CEO of Ekagrata Inc. and an appointee of the government of Canada on the Board of Business Development, Bank of Canada.