Technology to be biggest enabler for Singapore going forward

The industrial revolution 4.0 is being enabled by new advances in technology and the Republic needs to be on top of them in order to remain an economic centre not only for Asia but the world.

By Amit Roy Choudhury, Oct 3 2016
Moderator: Amit Roy Choudhury, The Business Times.

Dr Vivian Balakrishnan, looks at an unmanned aerial vehicle developed at NUS. Photo: Zaobao

Over the next 50 years, Singapore will a face myriad of challenges, including an ageing population and a mature economy. Technology will be a big enabler to navigate through these challenges. It will be used not only to keep the quality of life intact for seniors but actually improve on it. Technology will also ensure that new growth areas are available for the economy. As Singapore moves to become the world's first Smart Nation, The Business Times, brings together a panel of experts to discuss various technologies, like robotics, machine learning, self-driving cars, artificial intelligence and big data analytics that will usher in profound changes over the next few decades.

Amit Roy Choudhury:
As Singapore moves towards SG100, it faces a challenge of both an aging population and the need to take the economy to the next level in which sustained growth can be maintained. Technology would be the enabler for both goals. Can you give your views on how technology can help to build Singapore over the next 50 years?

Prof. Tan Hwee Pink: Singapore's population is set to age rapidly over the next 15 years – in fact, by 2030, one out of five residents in Singapore (or approximately 900,000) will be over the age of 65. Indeed, in Singapore's Infocomm Media 2025 roadmap released a year ago, the infocomm media sector is poised to play an especially important role to support an ageing population. To relieve the reliance on limited healthcare and assisted-living facilities, healthcare professionals and live-in domestic help, the notion of ageing-in-place – the ability to live in one's own home and community safely, independently, and comfortably, regardless of age, income and ability level – becomes particularly important.

The Singapore government adopts a multi-agency approach to tackle the multi-faceted requirements of ageing-in-place: key examples include (i) promoting lifelong learning and active ageing through Centre for Third Age; (ii) flexible and lifelong retirement payout schemes through CPF, (iii) creating elderly-friendly neighbourhoods with infrastructural improvements, incentivised home visits and other initiatives through the Ageing Planning Office.

Prof. Tan Hwee Pink. Associate Professor of Information Systems (Practice); Academic Director, SMU-TCS iCity Lab, School of Information Systems (SMU)

These initiatives are complemented by technologies that are in place, or are being rolled out in pilots, in preventive, social and community care. Examples of such technology pilots include (i) telegeriatrics (Khoo Teck Puat Hospital and St Joseph's Home) – which enables medical professionals to directly provide diagnosis, monitoring and prescription of treatments without requiring either the patient or the doctor to travel long distances using assisted video-link technology; (ii) telehealth (Sata CommHealth, 60 seniors in Chai Chee for six months) – remote monitoring of vital sensors to track chronic medical conditions and (iii) elderly monitoring and alert systems (Project SHINESeniors) – unobtrusive in-home monitoring system that can trigger a response from next-of-kin or community carer in the event of an emergency or prolonged inactivity while at home.

Jurgen J.Meerschaege: Singapore already has a great focus and vision with regards to its infrastructure. That focus, combined with the growing technological capabilities should dramatically improve the quality of life of Singapore's residents. Add on top of that a layer of open source data, API's and apps which will allow us to optimise all sorts of things. Finally, it's not just about improving the quality of life of its citizens, but also allowing Singaporeans to use these capabilities in a thriving start-up scene.

Jurgen J.Meerschaege. SVP, Head of Business Analytics, DBS Bank

Francis Fong: Catering to the needs of an aging population while also sustaining economic growth will require Singapore to focus on being more productive, especially in support of care giving for the elderly as well as providing a vibrant and innovative Smart Nation to sustain talent within a graceful society. We will increasingly need to rely on a variety of sophisticated analytics driven technologies that include machine learning and cognitive intelligence.

With that, we are observing well thought-out initiatives by the government to progressively build public sector capabilities in analytics as well as to increase the adoption of analytics by government agencies. For instance, Singapore's pioneer transport operator, SMRT, deploys SAS Visual Analytics to provide a single overview of all datasets available while allowing individual business units to track KPIs and performances.

Francis Fong, Managing Director, SAS Singapore

Elsewhere, analytics also has the ability to ensure responsible allocation of funds as well as improve social welfare services, such as the Ministry of Social Development (MSD) in New Zealand. Armed with data-driven insights, the MSD was better able to focus on identifying and targeting high-risk groups as well as save US$1 billion in four years with better investment approaches.

These examples have shown that collected data sets can be tapped on to create new approaches that can be elaborated on a national level, so as to improve the quality of what a nation provides beyond just at a municipal level.

Chwee Kan Chua: Technology will be driving automation, taking over some of the low-value manual labour efforts and jobs. In addition, cognitive and AI (artificial intelligence) solutions will become prevalent in all aspects of systems in one form of another; as such, enabling highly cognitive assistive systems to provide support in many social and economic areas.

Such intelligent automation technology will help address labour costs and shortage and allow Singapore to focus on high value work and innovations, and at the same time providing a high standard quality of life.

Chwee Kan Chua, AVP, Big Data & Analytics and Cognitive Computing, IDC

Amit Roy Choudhury:
Coming to specifics of technology can you give your assessment on what are the major technologies or trends that Singapore needs to develop into a world class centre of excellence of?

Prof. Tan Hwee Pink: According to the latest Infocomm Media roadmap, technology innovations in big data and analytics, IoT, cognitive computing and advanced robotics, future communication and collaboration, cyber security and immersive media are key to Singapore's ability to address its key national challenges of improving productivity growth, creating highly-skilled jobs, supporting an ageing population and fostering a cohesive society.

In my view, we should leverage on Singapore's unique strength to bring together an ecosystem of private-public-people partnerships to focus on (i) training or re-training our people to understand the underlying concepts of the above technology innovations and (ii) providing large-scale test-bedding opportunities to build applications based on key technology innovations to meet real needs.

Jurgen J.Meerschaege: I'm very excited about the developments in autonomous cars. The size of Singapore makes this the ideal test-bed for this technology. I am thrilled to see the first real prototypes on the road already. This is far more than just about a "driverless car" though. Apart from the obvious safety concerns, there are so many design challenges to be solved before this technology will become mainstream. Think concepts such as shared car ownership, insurance and liabilities, what happens when your car goes off to drive for Uber for a couple of hours, how do you interact with your car when you think it missed your exit, etc.

When speaking to people about these new technologies I find that these design challenges often get underestimated. So apart from investing in technology, Singapore should ensure it has enough design thinkers to make these new technologies get integrated as smoothly as possible.

Chwee Kan Chua: Singapore needs to embrace cognitive and AI technology. With over US$1 billion in investments this year just in AI, it is a trend that will continue to grow as AI drives the next industrial revolution.

Very soon, there will be ethical concerns about AI technology which will need to be addressed. For it is only with the deep understanding and expertise in AI, will Singapore be able to ensure progressive growth of the nation using AI, avoiding potential minefields and missteps when innovation outleaps socio-economic needs.

Francis Fong: Some of the major technologies that Singapore needs to embrace should closely mirror those identified as part of the Fourth Industrial Revolution – mainly big data, advanced analytics, the Internet of Things, (IoT), advanced robotics, learning machines and 3D printing.

As Singapore's Smart Nation ambitions will be built upon the collection of data and the ability to gather insights from it, big data and advanced analytics will play a major role. And in that regard, Singapore is well on its way to establishing itself as a global data and analytics hub, as seen in the strong presence and growth of data centre parks to focus on real-time data analytics and big data initiatives; meting out clear legal frameworks to govern the proper collection and usage of personal data, as well as the rolling out of government-led training initiatives to alleviate the shortage in skilled ICT workers. All of this is paramount to providing a foundation to position Singapore as a data-enabled and data-driven Smart Nation.

Amit Roy Choudhury:
Singapore has committed $450million to the National Robotics Programme over the next three years. In an aging society with labour shortage, robots and automation can be a boon, particularly in labour intensive sectors such as construction. Can you discuss how robotics can help boost productivity?

Prof. Tan Hwee Pink: Beyond the deployment of robotics technology in traditional sectors such as manufacturing for automation of repetitive jobs, we are beginning to see their use in retail (for example, robot waiters in restaurants), in libraries (shelf-scanning to locate missing or out-of-sequence books) and in hospitals (HOSPI autonomous delivery robot at Changi General Hospital). These applications are primarily aimed at "taking the manual out of" existing operations, driven by a shortage of low or unskilled manpower in these sectors.

Apart from robots for automation, social robots are also emerging, in the form of robot receptionists (for example, Nadine at Nanyang Technological University) and robot carers (for example, Eric the robo-dog by Singapore Polytechnic for elderly rehabilitation and Hugler the pet robot) to tackle the manpower crunch in the social and care sector.

However, my view, especially in the care sector, is that the human touch is still needed, and should not be replaced by a robot!

Jurgen J.Meerschaege: I personally don't see robots leaving the factory halls in the short term. Bringing in robotics for manual labour such as construction work requires very complex motor skills. We see far more advancements in white collar work. Executives today should be far more anxious of losing their jobs to the machines. There have been tremendous improvements in medical diagnostics and legal work with the help of AI for instance.

Chwee Kan Chua: It is not just robotics alone that will boost productivity. Industrial robotics is only part of the equation. What is needed is AI-enabled robotics. Robotics without AI will not maximise the potential of high productivity levels. Take for example, in Japan; the manual laborious effort to sort cucumbers was replaced by a far better system using AI trained machines that was previously not possible. The sorting machine has intelligent "eyes" to be able to discern and improve in its sorting performance.

Jing Bing Zhang: With the continuous improvement in capability and affordability, robotics will have a big role to play in Singapore's economy, helping alleviate the problem of ageing and labour shortage. In addition to the traditional and more mature applications in automotive and metal industry, robotics has great application potential in other manufacturing sectors such as electronics, semiconductor, pharmaceutical, and food and beverage; as well as, increasingly in non-manufacturing sectors such as construction, logistics, e-commerce and retail, healthcare, and hospitality.

Robots are very good at supplementing and augmenting human labour in carrying out hazardous and repetitive tasks. Being intelligent and autonomous machines, robots can literally work 24×7 and do not require break time, sick leave or annual leave. Take a typical three-shift, five working-day scenario, this means that one robot can be as productive as 4-5 human workers, if just based on working hours and efficiency. Robots are by design reprogrammable, versatile and flexible, which make them critical enablers for the current global transformation to industry 4.0 – characterised by mass-customisation, high-mix and low volume.

Jing Bing Zhang, Research Director, IDC Worldwide Robotics, IDC Asia/Pacific Manufacturing Insights

With the advancement of artificial intelligence, computer vision, natural language processing technologies, we are seeing a growing trend and interest in the deployment of a new generation of service robots. Examples include, service robots for child education, elderly support, home companion, event ushering, greeting and guidance.

Francis Fong: Robotics will fundamentally change the nature of manufacturing jobs and task oriented activities, especially in an industry that is often the worst hit in the event of an economic slowdown due to its demand drivers being "fluid" and "brittle". Human manufacturing tasks – such as heavy lifting, precision positioning and visual quality control – when transferred to or supported by robots, will not only improve efficiency and effectiveness, but also help workers better navigate an industry that will become more complex and sophisticated. More intelligent robotics are on the horizon and will in future be able to "see", "sense" and respond with greater dexterity and better complement the tasks involved in a service economy in Singapore. They provide a better solution to address an increasing society that is always on 24/7 and one that literally never sleeps.

With increased reliance on robots, it is even more critical to reduce downtime through predictive asset maintenance solutions. By harnessing the power of big data, companies are afforded with the capability to proactively anticipate events that trigger disruptions and allow assets to be operated at full throttle to optimise cost.

Amit Roy Choudhury:
Machine learning and predictive analytics is also earmarked to be the "next big things" for analytics. How can this help to transform Singapore into the world's first Smart Nation?

Prof. Tan Hwee Pink: Machine learning and predictive analytics are important tools that can transform Singapore from a reactive to an anticipative nation. In the context of public transport (which is a hotly discussed topic these days in Singapore, particularly with the spate of train breakdowns), imagine that we have powerful algorithms that can learn and correlate past breakdowns with a variety of sensor data, such that by monitoring the data, we can predict, with some level of confidence, the likelihood of an impending breakdown. This can potentially enable pre-emptive, rather than reactive maintenance. This can regain the public's confidence on public transportation, and may also help reduce maintenance costs in the long run.

With the IoT, largescale and fine-grained data collection is now possible, and when used in conjunction with machine learning and predictive analytics, the notion of anticipate services can be multiplied in other public service domains.

However, the notion of "garbage-in, garbage out" brings out the importance of often-trivialised and unglamorous grunt work of making sure that what's collected is accurate and reliable. This can only be achieved if data scientists have a good understanding of how the data comes about, and don't just fixate on the glamorous aspects of machine learning and predictive analytics.

Another important reality check on the tendency to "over-engineer" our solutions can be taken from Linus Lee, Head of Twitter's data science team in Singapore: "… don't try to do the fancy stuff first, like 80 per cent of the insights you can get by just using your arithmetic … and maybe some nice graphs!"

Jurgen J.Meerschaege: A lot of this goes back to the design challenges I was referring to earlier. Telepresence robots are here already for instance, but interacting with them is still clunky. These are areas where AI can help bridge the communication between man and machine.

Machine learning will also allow us to solve a whole lot of optimisation challenges that can have a dramatic impact on people's quality of life. Take the autonomous car for instance: your (probably shared) vehicle will arrive at your doorstop precisely when you need it, it will take the most optimised route to the office, it will tell you that you should probably take that conference call or finish that presentation on the way home in order to prevent getting stuck in a traffic jam 30 minutes from now. Today there is still a tremendous challenge ahead of us connecting all of the data we have: if I tell my car to take me to the zoo, but the zoo is already at 95 per cent capacity that day, I probably want to know that before I leave.

Another exciting area is personalisation. I still can't tell my phone to "book one of my favourite restaurants for tonight, let my wife know, and book me an Uber to pick me up". We've been successfully hacking away at natural language processing, but there's still a big task out there around creating context and personalisation for these digital assistants to really mimic human intelligence.

Chwee Kan Chua: Simple. Smart Nation is the result of intelligent actionable insights from data that is captured from various devices or systems. The phenomenal amount of data cannot be manually processed or by existing models/algorithms. As such, machine learning is required to analyse these data, train on these data and eventually deliver the predictive analytics that makes the "smart" in a Smart Nation. In addition, it is only possible with machine learning that the "smart" continues to improve as new data being generated is being processed to fine tune and deliver better insights.

Francis Fong: Singapore's push towards being a Smart Nation will certainly see increasing volumes and varieties of data being collected. However, all that data is meaningless if it is merely collected without being utilised to guide better decisions and smart actions in real time. Machine learning and predictive learning will, therefore, become imperative as it encompasses algorithms that iteratively learn from data, allowing for hidden insights to be discovered without having to explicitly programme computers on where to look. The very essence of machine learning we can see coming to life on our roads soon is the introduction of driverless cars. In adding the ability to automate the decision making process, weak artificial intelligence systems are created to interact with the everyday citizen in real time and this ultimately opens up a world of opportunities for everyone in the Smart Nation journey.

Amit Roy Choudhury:
Talking about Smart Nation, Singapore has already won several international accolades for its vision and implementation. In your view how would living in Singapore be like, in say 2025 or 2030 when new "smart" technologies would be a part of our daily lives. Would this make Singapore a better place to live in and a more inclusive society? What are the technologies that we would take for granted in this new smart nation?

Prof. Tan Hwee Pink: By 2030, I'd imagine that pervasive connectivity and smart devices can be taken for granted – everyone will carry a smart device (be it a smart phone, a wearable or nearable) which is perpetually connected, collecting data, which will be aggregated (and anonymised) and analysed to create anticipative applications to make Singapore a better place to live in.

From an individual's perspective, by continuously collecting data as you go about your daily lives, the applications can learn your behaviour and preferences and, accordingly, make decisions autonomously or recommendations for your selection.

However, even today, we are already distracted by the abundance of data (from social media, wearables such as FitBit, and over-the-top (OTT) messaging apps, to list a few). The volume and variety of data can only grow, and hence, there should be some form of intelligence in applications to help filter this big data, so that only the most useful information requires our attention!

Jurgen J. Meerschaege: I've mentioned autonomous cars a couple of times already. I honestly believe that my 2-year old daughter will not know the concept of a driver's licence anymore.

IoT is another obvious candidate. Think smart buildings that collect, analyse and optimise energy consumption, think optimised waste collection from sensors built into our bins, think connected everything. The first connected fridges are out there. Who needs large scale supermarkets in prime real estate anymore if our appliances are going to do the majority or our grocery shopping for us?

Very exciting times ahead! I'm a big believer in this Bill Gates quote: "Most people overestimate what they can do in one year and underestimate what they can do in 10 years."

Chwee Kan Chua: Buildings will become smart, whether it is an office building, a factory or an apartment. Smart technologies will deliver not only energy efficiencies, but also cognitive capabilities that serve as "butlers" to the citizens of Singapore. This will improve society's quality of life and it helps balance work life needs and at the same time ensures that the nation continues to deliver high value productivity from the workforce.

We are already taking many of the cognitive AI capabilities for granted today. Just look at voice-enabled assistants on the mobile such as Siri and Google Now. Voice search and dictation is faster than us typing. Pretty soon, almost all forms of cognitive/AI capabilities will be the norm in everyday life.

Gerald Wang: I think the point about smart cities and robotics is about driving better automation (via smarter cognition and streamlined processes to reduce resources use redundancies) and creating intuitive innovations of how humans interact with technologies today so as to communicate ideas, interact, and transact regardless of their physical distances.

Ultimately, as we prepare for the silver tsunami of the "baby boomers" (in their 60s and above now), it is about providing technologies that are design-by-default-to-use/needs. Technology for technology's sake as we know is ultimately pointless. For example, the hype of using tablets in education has reached its peak of wider spread adoption due to the lack of content generated for tablet use as well as preference of students and teachers to interact and engage via other platforms/devices.

Gerald Wang, IDC's Head, Asia Pacific Government and Education

Technologies of tomorrow need to continually empower global individuals, not hinder them. By building more intelligent solutions, we can first of all fill the gap of skills shortage in the future; ensure sufficient knowledge, work experiences and skills are sustainability retained and passed on; as well as create "super thinking" machines that computes complex decision making probabilities and then provides targeted resolutions to city transformation challenges.

Of course, there are ethical concerns and policies to be debated upon with regard to the collection, analysis, use in decision making and retirement of data/information.

Also, while baby boomers aren't digital natives, they need to be sufficiently equipped to leverage ICTs (Infocomm Technology) so as to participate in coming smart city and/or robotics initiatives. Notably, the life spans of humans are increasing too – we need to take into account the 20-40 years more of living after the average retirement age of 60+ years old (depending on their citizenship) and how these new technologies will change the way they create intuitive interfaces, participate in "assisted living" social welfare and healthcare conditions, and set the stage for lifestyle ecosystems of the next-generation's "live, work and play" situations in cities.

Francis Fong: Undoubtedly, exciting times are ahead of us as technology is increasingly harnessed to gather insights from data to formulate solutions that aid in improving the lives of citizens. We must not take for granted that the push towards being a Smart Nation is meant to empower people and businesses to be more participatory through the contribution of innovative ideas and solutions formulated from data-driven insights. We see machine learning and cognitive computing allowing us to better interact and utilise intelligent systems that are trained by data.

Therefore, to truly realise the Smart Nation vision of realising the purpose of data, initiatives to increase data literacy and data engagement to enable the rise of the citizen data scientist should also be considered. Furthermore, in order to keep the momentum of analytics usage and growth going in Singapore, technologies like blockchain which offers real time data protection and trust will fundamentally disrupt and make a sharing economy truly shareable by all citizens and provide greater inclusiveness.

Finally, how we humanise "smart" technologies to provide a better quality of life and an even distribution of wealth to citizens will look to set Singapore apart.