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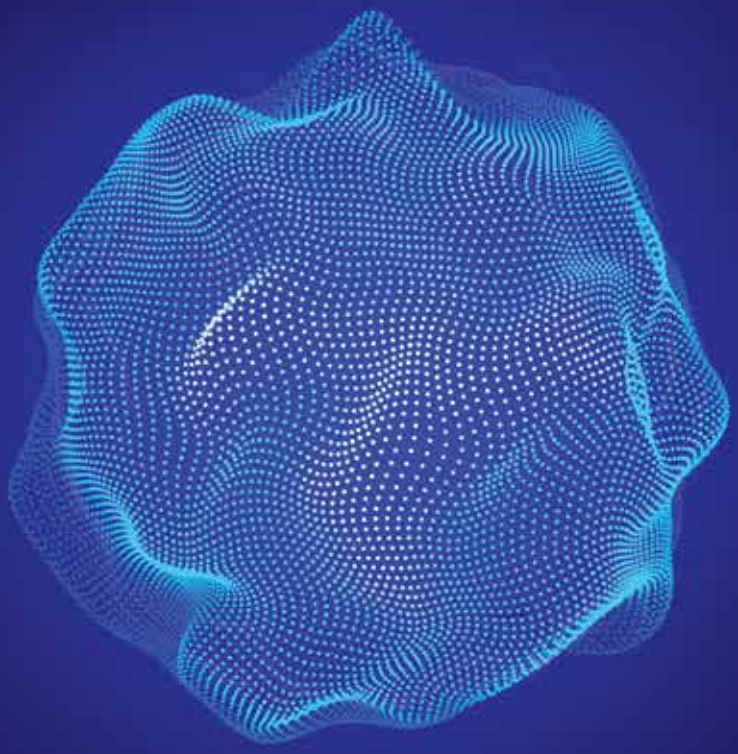
The Artificial Intelligence revolution: A new era for the government



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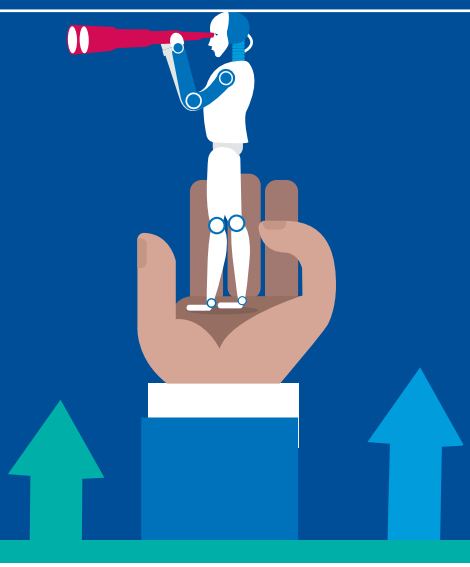


Klaus Schwab, the founder of World Economic Forum, in his book 'The Fourth Industrial Revolution' (2016), wrote: "When assessing the impact of the fourth industrial revolution on governments, the use of digital technologies to govern better is top-of-mind. More intense and innovative use of web technologies can help public administrations modernise their structures and functions to improve overall performance, from strengthening processes of e-governance to fostering greater transparency, accountability and engagement between the government and its citizens[1]."

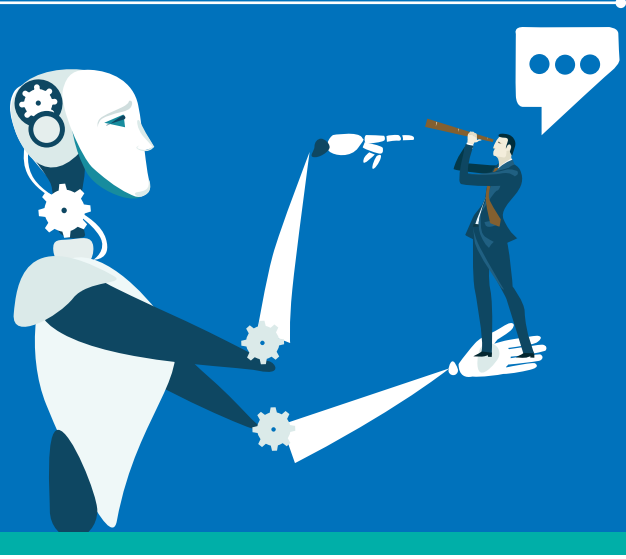
Schwab observed that the fourth industrial revolution encompassed several current trends in automation, data exchange and manufacturing technologies and denoted a fundamental change in the way business is conducted in the present world. New technologies and devices, coupled with increased connectivity and the ability of machines to think like humans, are reimagining the way business ecosystems work. Artificial intelligence (AI) is a constellation of technologies that enable machines to act with higher levels of intelligence and emulate the human capabilities of sense, comprehend and act. In fact, Alan Turing, AI theorist wrote in 1950 - "A computer would deserve to be called intelligent if it could deceive a human into believing that it was human." AI-driven change is increasingly being observed across consumer demand, business landscape and even in a company's internal functioning.

As low storage cost and ever-increasing computing power triggers an inevitable shift from basic digitisation to AI-led innovation, not just businesses and industries but also stakeholders such as government, society and even citizens, have been forced to re-examine the way they work. Demand for AI-led transformation has accelerated in the wake of the COVID-19 pandemic that has restricted physical contact.

An explosion in smart devices, internet connectivity and data flow has led to the emergence of a data economy across the world, enabling an AI-led economic reorganisation. Out of the total global population of 7.75 billon, 5.19 billion have unique phones/devices (67 per cent of the population), 4.54 billion are internet users (59 per cent) and 3.8 billion are active social media users (49 per cent)[2]. In India, as of January 2020, there were 1.06 billion mobile connections (78 per cent of the total population), 400.0 million social media users (29 per cent of population, growing 48 per cent between April 2019 and January 2020) and 687.6 million internet users (50 per cent of population, increasing 23 per cent between the years 2019 and 2020)[3]. With the second largest digital consumer base in the world[4], India is well positioned to adopt emerging opportunities in AI.

1. The Fourth Industrial Revolution, Page 66, Klaus Schwab, World Economic Forum, 2016
2. "Digital 2020 Global Digital Overview," report by Datareportal , Hootsuite & We Are Social , January 2020
3. "Digital 2020: India, report by Datareportal , Hootsuite & We Are Social , February 2020
4. India's Trillion Dollar Opportunity, Page 11, report published by Ministry of Electronics and Information Technology, Government of India, February 2019

Artificial Intelligence: an overview



While the interpretation of AI varies across contexts, AI generally refers to the ability of machines to perform cognitive tasks like thinking, perceiving, learning, problem solving and decision making. It enables computer systems to carry out tasks on their own that otherwise require human intelligence.

These cognitive capabilities are enabled through machine learning (ML). ML algorithms process data and experiences (rather than rely on explicit programming instruction), to detect patterns as well as to make predictions and recommendations. Algorithms also adapt in response to new data and experiences to improve efficacy over time. Deep learning is based on artificial neural network and can process a wider range of data resources. Deep learning reduces the need for preprocessing of data by humans and can often produce more accurate results than traditional ML approaches of supervised learning, unsupervised learning and reinforcement learning.

The major building blocks of AI, encompassing the cognitive capabilities of 'sense, comprehend and act', are technologies such as machine vision, speech recognition, natural language processing (NLP), information processing, learning from data, planning and exploring agents, image generation, handling and control, and navigation and movement. There are proven use cases wherein AI models display greater accuracy such as those involving data in form of image, video, text and audio.

AI is also categorised in many ways, from Weak AI – systems without consciousness to Strong AI- actual thinking abilities; from Narrow AI- systems with limited task performing abilities to General AI- systems performing wide set of activities; or super intelligent systems which display the capabilities of both Strong and General AI. While major progress has been achieved in artificial narrow intelligence, we are still a long way from the emergence of General AI.

We can see that areas of AI are wide in scope and diverse in nature with varying degrees of capabilities and maturity. The right application of AI in the context of government and society requires a comprehensive understanding of the entire ecosystem, availability of the required resources, broad guiding principles and a roadmap for the successful adoption of AI for social good.

Evolution of digital technologies in government

According to a UN e-Government Index report published in 2018, India has a high e- Government Development Index (EGDI)[5] score. This has been enabled through Jan-Dhan, Aadhaar and Mobile (JAM) infrastructure to facilitate direct benefit transfer, as well as several projects within the National e-Governance Plan and other large-scale initiatives like the National Optical Fibre Network (NOFN) aimed at ensuring connectivity across 6.5 lakh villages.[6] India has witnessed widespread adoption of basic IT services enabled through our global leadership in IT and ITeS market during 2000s, largely driven by private enterprise based in India. However, India lagged in adopting the innovation necessary to ride the first wave of digital era starting from late 2000s driven by Social, Mobile, Analytics and Cloud (SMAC) technologies. India ranks 48th on the World Digital competitiveness index according to the IMD World Competitiveness Center. The ranking is based on the extent of the impact of digital adoption measures undertaken by countries in the economic transformation of their businesses, governments and wider society. India's position on the World Bank's Global Digital Adoption index is also in sync with the IMD World Competitiveness Center's rankings[7].

India's large and thriving IT ecosystem, enabled through the government's Digital India initiative, has kept its digital journey on track; and the country is now well-placed to shift to a higher gear through the rapid adoption of AI. India's improved ranking on the Digital Adoption Index, growing at the second fastest rate from 2014 to 2017[8], is a testament to this potential. Artificial Intelligence Index Report by reputed global university in 2019 also ranks India among the top countries along with China and the U.S. on most AI adoption indicators such as the volume of research papers published, hiring and skill penetration in AI specific technologies. While India has emerged as one of the leading adopters of AI, it still has a long way to go to fully realise the benefits of AI for social good.

5. UNITED NATIONS E-GOVERNMENT SURVEY 2018, Page 229, United National, 2018
6. "All 6 Lakh Villages To Be Connected With Optical Fibre In Next 1,000 Days: PM Modi On I-Day" article published in www.outlookindia.com,15 August 2020
7. World Bank -Digital Adoption Index ranking , 2016 and World-digital-competitiveness-rankings-2020, October 2020
8. India's Trillion Dollar Opportunity, Page 17, report published by Ministry of Electronics and Information Technology, Government of India, February 2019

Enabling governance through AI

The core tasks of modern government can be broadly classified into the following areas – policy design and implementation, public engagement and service delivery, regulatory functions and law enforcement. Prominent AI technologies such as natural language processing, machine vision, speech recognition, machine learning, deep learning and intelligent automation have the potential to enable greater efficiency in governance.

Policy design and implementation

After Abhijit Mukherjee and Esther Duflo were awarded the Nobel Prize in Economic Sciences in 2019 for their experimental approach to alleviating global poverty, the area of evidence-based policymaking has gained prominence in the broader policy and developmental debate. However, the utility of such an approach traverses the realm of development economics. AI's capability to mine and harness data, can augment an inclusive policymaking ecosystem.

The 'real world' is constantly changing and this has resulted in the movement towards the greater use of evidence in policy design and its implementation. Prominent economist Jeffrey Sachs, in his book *The End of Poverty: How We Can Make It Happen in Our Lifetime,* had proposed ending poverty and improving development outcomes through homogeneous large-scale government intervention programmes. This is achieved through pumping in large sums of money funded by global multilateral agencies and respective state and national governments. This approach has achieved some success in alleviating global poverty and other developmental outcomes, for e.g. educational outcomes or health outcomes at an overall level. However, the lack of targeted intervention in this approach has meant that vast swathes of the population have remained untouched despite large-scale interventions. This finding has been affirmed by Mukherjee and Duflo in their work with Jameel Action Poverty Lab (JAPL)[9].

Even in India, despite various schemes and budgetary allocations year-on-year to improve education, healthcare and agriculture by the State and Centre, the outcome-based metrices in these sectors have not been encouraging. Annual Status of Education Report (ASER) report by an NGO working in the education space shows that learning outcomes have still not improved over the years. In the ASER 2019 report, it is observed that today only 16 per cent of children in Class One across 26 surveyed rural districts can read text at the prescribed level, while almost 40 per cent cannot even recognise letters[10]. In healthcare too, though we have seen improved results in outcomes (e.g. mortality rates, sex ratios, and immunisation levels), a wide gulf still exists in comparison with high-middle income groups and developed economies. As per NITI Aayog's Healthy States, Progressive India 2020 report, there are sizeable disparities in various health outcomes across states and UTs. Even within agriculture, India has one of the lowest productivity rates in the world despite having one of the most resource intensive farming ecosystems. Though precision farming with the use of optimal pesticides and irrigation, has been discussed for years, it is yet to be scaled. The excessive usage of fertilisers and pesticides have significantly distorted the food ecosystem, with several adverse health outcomes. There emerges, therefore, a need for designing a concerted evidence-based and AI-enabled policy ecosystem.

9. "Poor Economics" – Book by Abhijit Banerjee and Esther Duflo, April 2011

10. "Annual Status of Education Report flags poor learning outcomes in schools" -Article published in The Hindu, January 15, 2020

AI can enable an evidence-and outcome-based policy paradigm to address outcome disparities across sectors. Many corporations have already moved towards data-driven decision making where machines process big data and prescribe interventions based on ML models which, in turn, enable decision making. Governments, especially in resource scarce nations like India, stand to gain from similar policy design paradigms, leveraging AI to facilitate targeted spending and better measurement or prediction of outcomes.

AI technologies and algorithms have several applications, one of which is explained in the following case study that examines how the Andhra Pradesh government has reduced school dropouts. They can enable evidence-based policy design and its implementation, leveraging core AI capabilities like ML and deep learning. This enables targeted intervention to achieve the desired outcomes, in stark contrast to an unnecessary one-size-fits-all approach, thereby reducing costs too.

Case study: Andhra Pradesh (AP) government uses ML and analytics to predict dropouts[11]

The AP government has orchestrated coordinated efforts to reduce the school dropout rate in the state. It has tied up with a global technology corporation to address this perennial challenge. Based on various socio-economic parameters like gender, demographics, academic performance, school infrastructure and teacher skills, an-AI based application has been developed to find predictive dropout patterns and take preventive measures to reduce school dropout rates.

With these data insights, the district education officials are intervening and helping students who are most likely to drop out. A variety of programmes and counselling sessions are conducted for these students and their parents to prevent dropouts. The Andhra Pradesh government, enabled by prescription based on ML models, identified about 19,500 probable dropouts from government schools in Visakhapatnam district for the academic year 2018- 19 and took preventive and remedial measures. This is also helping AP Government to better formulate its education policy and devise targeted interventions to reduce dropout rate across the state's schools.

Public engagement and service delivery

Drafting policies, acts, guidelines and procedures is one of the most vital governance functions. However, it is increasingly observed that these are being drafted in silos and are non-feedback seeking. Even if feedback is sought, the state lacks the technological capacity to evaluate and incorporate all the feedback. This is where AI can enable analysis of feedback from several stakeholders, given its ability to process and gain insights from vast sets of structured and unstructured data. This also extends to government agencies, which provide services to and engage directly with citizens. These engagements include customer service interactions such as applying for a driving license, direct benefits or a passport. One of the prominent forms of citizen engagement is seeking feedback from the public on draft rules and notifications. Natural language processing (NLP)-based engines can vastly enable the analysis of millions of feedback bits.

NLP encompasses a broad umbrella of technologies used for computationally studying large amounts of text and extracting meaning - both syntactic and semantic information. It enables capabilities like sentiment analysis, text categorisation, text clustering, named entity recognition and feedback analysis, among others. Some of the core applications leveraging NLP are speech-to-text conversion, text-to-speech conversion, text processing, natural language generation (NLG), chatbots and machine translation.

11. "Govt ties up with Microsoft to check dropouts"- Article written by Umamaheswara Rao published in The Times of India on April 22, 2018

The Ministry of Environment, Forest and Climate Change (MoEFCC) recently proposed a draft Environment Impact Assessment (EIA) notification 2020 and released it on online portal for public feedback. The MoEFCC had received nearly 17 lakh comments[12], objections and suggestions. The officials of EIA division under MoEFCC were tasked with analysing the large volume of comments. AI tools might help government officials of the environment ministry in executing this overwhelming task through a methodology that helps in the identification of duplicates, screening of relevant comments and the summarisation of overall comments, thereby significantly reducing the need for human resources as well as improving the quality of the rule-making process. NLP, along with algorithms like Latent Dirichlet Allocation (LDA), can enable citizen engagement through a constant feedback loop previously unimagined. This is explained in the following case study that examines how the U.S. Federal Communications Commission (FCC) has adopted AI-powered sentiment analysis to enable its 'notice and comment' rule making process. The U.K. government also uses NLP to better understand public comments on GOV.UK and improve its public services.[13]

Case study: U.S. FCC's notice and comment enabled by AI-powered sentiment analysis[14]

The U.S. FCC adopts its rules by a process known as 'notice and comment' rule making. Under that process, the FCC gives notice to the public that it is considering adopting or modifying rules on a subject and seeks comment. The FCC considers the comments received in developing final rules. FCC's proposed net neutrality regulation received nearly 20 million comments. A significant number of these comments included misleading personal information or were part of an astroturfing campaign, or, were submitted at the same time. As many as 2 million comments were found to be fake. NLP was further used to analyse comments on the proposed net neutrality rule.

A key component was a sentiment analysis of submitted comments in order to extract their most salient features. Sentiment analysis is especially challenging as human language constructs often rely on contrasting sentences or sarcasm. Consultants at the FCC found that only 8 per cent of more than 21 million comments were unique, and the top 10 and 100 most prevalent comments accounted for 66 per cent and 89 per cent of the total comments, respectively. To measure overall comment sentiment, the FCC employed a hybrid text mining approach consisting of manual sentiment assignment, keyword matching, and NLP. This phased approach enabled the FCC to first manually assign the 500 most prevalent comments into groups based on whether they supported or opposed the proposed net neutrality rule. It then used simple keyword and phrase matching rules to assign majority of the remaining comments to a group, validating the results by manually verifying a random sample. The FCC applied NLP classification only to the final 1 per cent of comments. After multiple iterations, the NLP model reached an overall accuracy of 95.2 per cent.

Voice assistant-based technologies with localisation capabilities for language, accent and tones can exponentially increase the reach, usage and engagement of government services. With voice becoming predominant mode of search, government needs to massively upgrade its voice-based citizen service delivery capabilities. India is home to 22 scheduled languages[15] and hundreds and thousands of dialects. Delivering public services in local languages, with text-to-speech and speech-to-text capabilities of AI, can make services more inclusive and accessible.

13. "Environment ministry says 17 lakh comments on draft EIA notification" -Article written by Jayashree Nandi published in HindustanTimes, August 11, 2020

14. "Natural Language Processing in Government" by Matt Dray published in Dataingovernment.blog.gov.uk, 14 June 2019

15. Adapted from Government by Algorithm: Artificial Intelligence in Federal Administrative Agencies by Stanford Univ, Page 59, David Freeman Engstrom, Stanford University, Daniel E. Ho, Stanford University, Catherine M. Sharkey, New York University, Mariano-Florentino Cuéllar, Stanford University and Supreme Court of California, 2020

One such initiative is the Government of India's plan to launch a voice assistant for its Unified Mobile App for New-Age Governance (UMANG) app. This effort aims to improve access to government services such as bill payments, provident fund balance, income tax filings among others. Voice assistant is based on the AI technology of speech recognition. Speech recognition is the ability of a machine or an algorithm to listen to human speech, process the generated analog speech signals, extract and recognise features. This allows it to differentiate between similar sounding words and finally identify the words or phrases; and enables functions like translation and transliteration. This technology has gained popularity in recent years with the emergence of various voice-based tools for consumers. Though lot of work needs to be done for the creation of corpora for every Indian language, real-time speech-to-speech translation can be a game changer in the Indian context, helping the country overcome the linguistic barriers that come with its immense diversity.

Regulatory functions

Another major duty of the government is to ensure that laws and regulations are fairly and effectively implemented and enforced. Strong rule of law requires that the extant regulations and administrative provisions of the land are enforced effectively without improper influence of public officials or private interests. AI can play a pivotal role in enabling officials of relevant departments to enforce regulatory mandates more efficiently. The regulatory functions of departments of state and central governments span several areas, including ensuring market efficiency, providing workplace safety, ensuring non-discriminatory health care access, environmental protection and many more.

One such example is the potential of AI in enabling officials of the Ministry of Corporate Affairs (MCA), Government of India. The vision of the MCA is to be the facilitator of world class corporate governance through the administration of the Companies Act, 2013; the Insolvency and Bankruptcy code, 2016; the Competition Act, 2002 and certain other allied statutes. One of the important regulatory functions of the MCA is building a system for the timely detection of matters related to non-compliance with these acts and rules, thereby enabling investigation and effective enforcement by officials for prevention of serious corporate fraud. There are more than 60 lakh filings by companies annually through the system developed by MCA namely MCA-21[16].

MCA now envisages implementation of version 3 of MCA-21 by introducing artificial intelligence that will enable officials in executing the enormous task of screening through the filings to detect any non-compliance. It will also further enhance the online platform to bring simplification, efficiency and transparency to facilitate ease of doing business. One of the highlights of version 3 of MCA21 is automated identification of non-compliant companies through the establishment of an online compliance monitoring system based on data analytics of e-filings in MCA21. In many cases, these e-filings are lengthy and necessitate regular reviews from large number of officials. This process is more prone to human errors as well as inefficient in terms of time and human resources. There is a wider case for applying advanced ML techniques to detect anomalies in filed reports, as elucidated in the following case study that examines how the U.S. Securities and Exchange commission (SEC) leverages AI for regulatory enforcement.

16. Website of Ministry of Corporate Affairs

17. Government by Algorithm: Artificial Intelligence in Federal Administrative Agencies by Stanford Univ, Page 23, David Freeman Engstrom, Stanford University, Daniel E. Ho, Stanford University, Catherine M. Sharkey, New York University, Mariano-Florentino Cuéllar, Stanford University and Supreme Court of California, 2020

Case study: Leveraging AI for regulatory enforcement at the U.S. SEC[17]

Regulatory enforcement at the Securities and Exchange commission (SEC) of United States Federal Government is handled using a ML-enabled corporate issuer risk assessment (CIRA) dashboard, with around 200 KPIs used to detect anomalous pattern in financial reporting of filers. The ML tool is trained on historical datasets of filings and uses a model known as 'random forest' that splits the data into several random overlapping bundles and trains a decision tree based on each bundle of data. This approach allows the SEC to forecast possible misconduct using indicators such as earnings restatements and past enforcement actions. The SEC further scrutinises the financial reports of suspect issuers manually as well as on a range of other metrics and materials. SEC staff acknowledges that CIRA's ML-based algorithmic component improves the allocation of scarce enforcement resources.

Law enforcement

Law enforcement is one of the primary responsibilities of the Government. The chief role of police forces is to uphold and enforce laws, investigate crimes and ensure security for people. While policing is a State subject constitutionally, the Central Government also maintains its forces to assist states in ensuring law and order. However, law enforcement presents several challenges in India, which faces a huge resource scarcity in terms of police personnel. According to a report by Bureau of Police Research and Development (BPRD)[18], State police forces alone had vacancies of around 5.5 lakh policemen (24 per cent of the sanctioned strength).

Given the resource constraints, AI can be a game changer in the law enforcement space. Investment in AI can address capacity constraints and offer insights for predictive policing to reduce rising crime rates. India's National Crime Records Bureau (NCRB) is already at the forefront of computer vision-based AI adoption where they are building an AI-based Facial Recognition System (AFRS). Computer vision enables machines to 'see' and understand the content of digital images such as photographs and videos and enables capabilities like object recognition, identification, detection, optical character recognition and facial recognition. The NCRB is seeking to create a missing person's database and integrate it with state and central databases, capturing live CCTV footage at prominent locations and thereby actively monitoring the images and video to search for missing persons. Once live, this system will be transformative in enabling the prevention or detection of crime as well as the solving and settlement of such cases by police and courts through the availability of evidence. NCRB is also planning to use advanced NLP algorithms for classification of its FIRs, being received through their crime and criminal tracking network systems (CCTNS)[19]. Application of AI on rich data available in CCTNS system can be paradigm for technology-led smart policing.

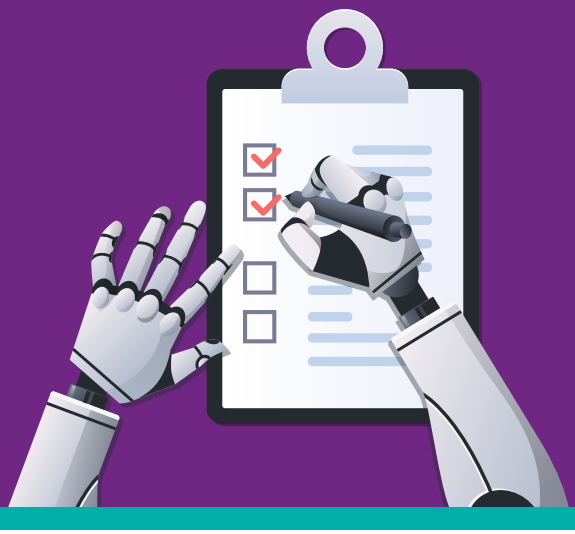
The following case study from China on leveraging computer vision-enabled AI to identify missing children is a good example of the potential of AI in core law enforcement functions.

Case Study: AI based Facial Recognition for identification of missing children[20]

China's Baidu has implemented a system Baidu AI Xunren to identify missing children. The system can identify missing people from old photos. It can find people who went missing a long time ago, even if their appearances have changed significantly. In one of the cases, a boy was lost at the age of four and he was identified at 25 years of age through this system, which has so far reunited 10,000 missing persons with their families.

18. "Police reforms in India "policy discussion paper on www.prsindia.org
19. RFP by NCRB for Selection of Agency for Development & Implementation of ML & NLP Based Analytics on FIR data
20. "How China's Baidu is uniting missing persons with families" – Article published in Outlook on 13 Jan 2020

Making AI work for government



While the enablement potential of AI-led technologies cuts across sectors, the adoption of AI requires a concerted strategy and roadmap. Although the benefits of AI in government processes are well established, especially in terms of solving specific problems for citizens at a large scale, there remains a significant gap in the capacity of government institutions to deliver these AI-enabled services. The following section discusses the specific interventions that are needed, to usher in changes in mindsets and approaches for the effective adoption of AI by government departments, agencies and other administrative stakeholders.

Mindset change

AI represents not only a technological shift but also it represents a change management exercise focussed on people and teams that fundamentally alters the mindsets of government officials. Transitioning from traditional e-governance services to data rich AI-based prescriptive government services will require a mindset shift in government officials across hierarchies, wherein they are encouraged to collaborate rather than work in silos and to apply design thinking principles in understanding the real needs of end – users.

The success or failure of AI in any government process can only be measured against clear objectives based on the understanding of real requirement of end-users. Objective setting and measures of success will require government employees to deeply appreciate the need for the introduction of AI and have a clear understanding of the problems it solves. Government employees need to be reassured that AI is not here to replace them and should be sensitised to the power of AI as an enabling tool, which can help perform certain tasks, thereby freeing up bandwidth for more creative work. External AI experts also play a vital role in the process of changing mindsets, helping public servants understand what AI is capable of, and what it is not.

Building AI specific cloud computing infrastructure

Several of the IT systems utilised in government are obsolete for AI-led governance. Most of the legacy systems were designed to process individual transactions rather than process data at scale.

AI solutions require increased processing power as they generally require the processing of a huge number of calculations quickly. The requirement for AI specific computing, understood mostly as linear algebra operations, is addressed mostly by GPU and TPU servers and is different from high performance computing infrastructure addressed by CPU servers. The development of ML solutions typically has a two -step process - (a) Training and (b) Testing. Hence, it requires increased computing resources particularly processing power owing to the iterative nature of optimisation in AI algorithms. While the government has the facility to provision high performance computing resources (e.g. GI-Cloud MeghRaj), it still relies on third-party solutions for AI-specific computing resources. The lack of availability of these resources is one of the major hurdles in the creation of a vibrant ecosystem for research in AI in academic institutions of India. The building of an indigenous computing facility (e.g. the Government of India's AIRAWAT) is expected to not only reduce the reliance on third-party solutions but also create a centralised facility to support both small experiments as well as grand challenges.

Such an AI computing technology platform will act as a catalyst for researchers, corporates, startups and government organisations in sparking an AI revolution in India.

Enabling the marketplace model for the AI value chain

A common platform in form of a marketplace, as mentioned in NITI Aayog's National Strategy for AI, will accelerate adoption of AI at scale, as it connects AI solution developers to relevant buyers. This needs to be enabled for each of the steps of the AI value chain, starting from data capture to data cleaning and annotation to training and testing of the ML model on new data to the eventual deployment of AI solution. The Government of India has constituted an expert committee that issued a draft report on the non-personal data governance framework[21] for public feedback where it mandates businesses to share some forms of non-personal data, if there is a request for data sharing from other businesses or the government. Such a non-personal data governance framework, which allows sharing of data, will enable the proposed marketplace mechanism, thereby easing the adoption efforts for all participants – private enterprises, PSUs, governments, startups and academia.

AI literacy enablement for government and citizens

Government employees, as discussed earlier, require a basic understanding of AI in order to have the ability to identify potential uses of AI in their workplace. The realistic potential of AI in improving citizen service delivery can be understood through dedicated workshops for government employees, bureaucrats and even ministers.

Academia can accelerate basic appreciation of AI among citizens as well. Some of the leading global and research universities in the U.S. are at the forefront of the AI-related research. India also needs to collaborate with its leading technical universities such as IISc, IITs, NITs, IIITs etc. in order to build a dedicated AI programme to cater to its developmental problems. There is a need to have a dedicated AI department in these institutes. The recent introduction of AI as an elective subject in class 11 and 12 by CBSE, along with the introduction of coding from class six as per the new national education policy are welcome steps . NITI Aayog in its National Strategy for Artificial Intelligence has also recommended establishing a Centre of Research Excellence for AI (CoRE for AI) in leading educational institutes. This should be aggressively pursued and implemented by the Ministry of Education to address the shortage of AI-enabled professionals in market.

Responsible AI

Given the non-transparent and black-box nature of AI, particularly deep learning modelling, there have been calls for greater transparency in data acquisition processes and for ensuring processes are not extractive in contravention of the extant laws and procedures of the land. The discussion of Surveillance Capitalism has entered mainstream consciousness, and concerns have been raised about how artificial intelligent systems generate a huge behavioral surplus that can be fabricated into prediction products that anticipate what people will do now, soon, and later. The recent documentary released on popular over-the-top media services (OTT) platform, The Social Dilemma, puts the spotlight on such areas of concern in the broader debate around AI and its very intrusive nature. The government needs to be sensitive of the implications of AI-led systems and should ensure a fair balance between providing intelligent public services and people's rights to privacy. This can be achieved through consultative processes, taking feedback from a wide range of stakeholders from industry to citizens to academia. Such an all-inclusive approach will enable a trust-based AI order, which is required for its long-term sustenance and social acceptance.

21. Report by the Committee of Experts on non-personal Data Governance framework, July 2020

22. "New Education Policy: Students to learn coding from Class 6 "-Article published in The Quint, 30 July 2020

Conclusion

AI is truly a once-in-a-generation opportunity. Though it is not new and has been around from 1950s, its adoption at large scale has only been made possible recently, with the growth of devices, connectivity and computing power at a scale unparalleled in human history. The levers of growth in the first industrial age were access to physical capital like machine, human resource and entrepreneurial capital. Digital capital is set to be the primary lever of growth in the AI-led Industry 4.0. Those firms and governments able to generate maximum insights through digital capital will emerge as winners in this new economy.

AI has tremendous potential to generate insights which were hitherto not possible. However, the adoption of AI will require a top-down as well as a bottom-up approach. In the top-down approach, central government agencies with large data banks become early adopters and showcase its usefulness. This will serve as a proof of concept for State Governments and local governments for large scale adoption. NITI Aayog has also recently come up with a Data Governance Quality index[23] with the objective of building a comparative scorecard for data preparation levels of various ministries after assessing their respective management information systems. NITI Aayog also highlights the need for every ministry in central government to institutionalise a data strategy, thereby enabling the AI ecosystem through the widespread generation of data, improved quality of data, use and dissemination of data, and data security, among other factors. Similar data strategies can also be adopted by departments of state governments as well as local government.

The bottom-up approach consists of enabling capacities in the state government and departments, through constituting a State Artificial Intelligence Unit (SAIU). This SAIU will work together as the core AI implementation team in the respective States. Local government also has AI-based proof of concepts, particularly in the domain of smart cities, enabled by the creation of an urban data exchange which should be disseminated in line with best practices across State governments and Central government.

The complexities that enable exciting opportunities in AI also pose significant governance challenges. The government will need to formulate clear policies and guidelines on the various dimensions of AI, including but not limited to data governance, data sharing frameworks, as well as accountability and transparency through explainable AI models and interfaces. This will help address the ethical and moral implications of adopting AI.

AI is opening new frontiers and promises to usher in an era of growth built on knowledge and insights. Many businesses and startups in India have successfully harnessed AI to solve critical problems in areas such as agriculture, healthcare, education, smart mobility and transportation, and natural language processing. With the government also intensifying its digital push, AI has the power to unlock the true potential of India and establish the country as a global leader in this growing space.

23. "Survey report on Data Governance quality index"-article on Press Information Bureau,2 Oct 2020

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