ARTIFICIAL INTELLIGENCE
Grand Challenges for India

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INTRODUCTION

Over the years, research in artificial intelligence (AI) in India was largely carried out at the Indian Institutes of Technology (IITs). Deepak Khemani (2012), professor of computer science at IIT Madras, offers a glimpse into the state of AI research in India prior to the current policy efforts of the government. He details how AI research in India has significantly lagged in comparison to Western democracies. According to him, it was limited to societal needs, focused on machine translation, natural language, and text- and speech-related applications to tackle linguistic challenges related to diversity. Apart from the civilian research focus at the IITs, there was also limited focus on defence applications within the Centre for Artificial Intelligence and Robotics (CAIR), a unit of the Defence Research and Development Organisation (DRDO).[1] While these disparate efforts saw some AI-focused activity in India, there was no national strategy or coordinated policy focus till 18 months ago.

In response to global developments in the field of AI, the Indian government has now undertaken a series of steps towards the articulation of a national strategy for AI over the past 18 months. These steps come after significant strides are being taken by nations, such as the United States and China, in the field of AI. The Indian response, while belated, has been on multiple fronts and encompasses both public and private efforts. From the Artificial Intelligence Task Force set up by the Commerce Ministry to the National Strategy for AI Discussion Paper by Niti Aayog, there have been fervent efforts at kick-starting a national focus on AI.

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This period also saw the launch of the Wadhwani Institute for Artificial Intelligence, a first-of-its-kind private effort with an Indian focus dedicated to AI. This article examines the focus of these efforts and identifies some of AI's grand challenges of relevance and strategic significance to India.

STATE OF AI IN INDIA: RECENT HISTORY

The Indian consumer, far ahead of the Indian state in the use of AI, was unknowingly the country's biggest beneficiary of recent advances in AI, thanks largely to the digital economy (Vempati, 2016). Policymakers, meanwhile, lagged behind in taking note of the significance that AI held for national security, public services, and other areas of priority.

More importantly, unlike the challenges faced by corporations that dominate the space, Indian academics, public researchers, labs and entrepreneurs working on AI face challenges of an entirely different nature. This is because the infrastructure necessary for an AI revolution in India had been neglected by policymakers over the years. For example, most of the cloud-computing infrastructure, capable of storing vast amounts of data—the massive amount of computing power required by AI—continued to reside largely in servers beyond India's borders. The recent effort by the Reserve Bank of India in the area of data localisation is perhaps the first concerted response of the Indian state in rectifying this situation. Moreover, the absence of a large, native-installed base of on-demand cloud-computing infrastructure in India had put the most recent advances in AI out of reach of government-funded research labs. The recent efforts by multiple agencies of the government and the Indian state must be seen in light of addressing these challenges.

In India, privately-funded research in AI has been relatively modest and recent in its origin, as earlier observed (ibid.). In stark contrast is the scale and ambition of China's model of publicly-funded AI development. Pan Jianwei, professor of quantum physics at the University of Science and Technology of China, in a speech to the National People's Congress, had called for China's adoption of a US-like Defence Research funding model (Defense Advanced Research Projects Agency [DARPA]) that prioritised engagement with the private sector and universities (ibid.). An example is the joint efforts by Chinese e-commerce giant Alibaba and Professor

Pan's team in quantum computing and AI, intended to create a programme designed to replicate and surpass Google's DeepMind.

It would be noteworthy to examine the scale of public investment by the United States and the European Union (EU) in this context. Much of the public funding for AI in the past decade has come from DARPA's Cyber Grand Challenge, a competition with prize money, and the EU's EU–FP7 technology funding programme. The BRAIN Initiative (Brain Research through Advancing Innovative Neurotechnologies), created in 2013, was a 10-year, multi-billion dollar fund for AI research in the United States, while the EU's Human Brain Project is estimated to spend around 1 billion euros on AI over the decade. Keeping pace with both is Korea—which has also committed significant public investment towards the development of AI while working in tandem with the private sector—with a $840 million investment in a platform being jointly developed with six private corporations.

PUTTING AI ON THE NATIONAL AGENDA

The multiple efforts over the past 18 months to evolve a national strategy on AI follow directly from Prime Minister Narendra Modi's efforts at raising public awareness on AI. While the Economic Survey 2018 called for leveraging AI by recognising India's potential as a world leader, the Union Budget saw the finance minister, in his speech in Parliament, speak of a national programme to encourage AI development with a focus on rural India. The most extensive remarks by the prime minister on AI came from 'Mann Ki Baat', his monthly radio address on All India Radio. In its 41st episode that aired on 25 February 2018,[2] the prime minister referred to the launch of the Wadhwani Institute of Artificial Intelligence earlier in the month, and the promise of AI for India's development. Laying out grand challenges that AI could address with an India-specific focus, the prime minister, in his monologue, had called for AI that could: (i) enhance the abilities of the specially-abled; (ii) help better predict the likelihood of natural disasters; (iii) improve crop yields for farmers, and; (iv) simplify and revolutionise the delivery of healthcare services.

In what were the first substantive comments by the political leadership of India in putting AI among national priorities, the prime minister, recalling an innovative application that converts text

to speech, called for harnessing the power of AI for the greater good. In his speech at the launch of the Wadhwani Institute, he had called for making AI work for India. This speech was also remarkable for its focus on the fears surrounding AI and on how ancient Indian thinking had always striven to maintain harmony between the advance of science, and the ethical, moral considerations of humanity.[3] Laying out an ethical framework for the development of AI, he had called for creating AI that is less about making humans redundant and more about enhancing human abilities and expanding human capacities. Significantly, he called for the march of technology that would not be at the expense of further increasing the difference between societies over access to technology.

Following on these remarks, the past few months have witnessed a slew of Memoranda of Understanding (MoUs) signed between India and other nations, such as Korea and Japan, for collaboration in AI. Most significant of these is the creation of an AI bridge with the United Arab Emirates (UAE) which is expected to generate $20 billion in value through economic activities.

The road ahead for AI development in India through the agencies of the Indian state can be gleaned from the reports of the various task forces set up by the Ministries of Commerce and Defence, and from the National Strategy discussion paper on AI, released by Niti Aayog.

AI IN COMMERCE

The task force on AI set up by the Commerce Ministry[4] set out with a goal of establishing a five-year roadmap for specific government and industry research programmes on AI, while also attempting to address related policy and legal issues. Amongst its recommendations is the creation of a ₹1,200 crore fund for the establishment of a National Mission for Artificial Intelligence, a cross-industry technology and regulatory framework for AI, specifically in the areas of data sharing, design standards, public incentives for development, skilling and training for manpower development, and international relationships for global standards.

The task force also identified what it calls 'grand challenges relevant to India', amongst which was data management infrastructure—a weak spot—and called for data protection laws and enabling technology framework. It also identified cybersecurity

as another flaw that could hinder AI deployments in India, while expressing concerns on the impact of autonomous systems on jobs and public safety. It identified improving Manufacturing Profitability and Jobs, Healthcare Quality and Reach, Agricultural Yields and Productivity, and Delivery of Public Services as some of the grand challenges for encouraging large-scale use of AI in India.

A significant exercise undertaken by the task force was to map the various Ministries and Departments of the Government of India into 10 domains of focus based on the recommendations of the task force, to ensure ownership of projects in each domain, and to make certain of their implementation, followed by eventual adoption. The task force also recommends specific enablers for AI adoption in domains of relevance to India. Amongst these are common data exchange standards, and a network of centres of excellence, drawing on the Canadian experience with a pan-nation AI strategy. It also identified the need for frameworks on ethical use of health data and health advice from AI systems. Most significant amongst its recommendations on key enablers is the need to integrate the National Intelligence Grid (NATGRID), Human Behaviour and Machine Intelligence (HUMAINT), Signal Intelligence (SIGINT), Communications Intelligence (COMINT), and data from assorted sources of surveillance to a unified platform for National Security that can provide need-based, real-time information. While examining inhibitors and likely roadblocks, the task force highlighted the absence of industrial standards for robots in India. Looking ahead at new avenues for job creation, the task force identified the training of machines and advisory services around man–machine collaboration.

The crux of the task force's advice to the government is on viewing AI as a problem-solver at scale, rather than a driver of economic growth. This overarching view has influenced the specific recommendations of the task force. A key recommendation is the establishment of a network of alliances between academia, government and start-ups with focus-specific geographical corridors/clusters. Building on this recommendation is the creation of a national fund that will put out grand challenges around specific problem statements similar to the model adopted by DARPA in the United States. Taking a cue from the Japanese approach to AI, the task force has recommended establishing six centres, each focused

on a problem of national importance along the lines of the RIKEN Center for Advanced Intelligence Project.

AI IN DEFENCE

A separate task force, led by N. Chandrasekharan,[5] examined the impact of AI in National Security and Defence. While its recommendations are not in the public domain, the focus appears to be on dual-use technologies with both civilian and military applications. Significantly, the task force recognised the need to engage the private sector, and more specifically start-ups, in building AI capabilities for National Security.

NATIONAL STRATEGY FOR AI

Released by Niti Aayog,[6] the discussion paper on the National Strategy for AI is, perhaps, the most comprehensive view emerging from the government. It is ambitious in its aspiration, hoping to put India on the global AI map, in contrast to the task force's relatively modest goals to leverage AI to solve India's problems. The discussion paper also aims at leveraging what it calls the 'late mover's advantage'. Its recommendations in some respects are similar to those of the task force on establishing centres of excellence to focus on primary research and on applications through a network model. The paper stands out in its focus on Intellectual Property (IP), an area on which the task force did not much dwell. It specifically speaks of the creation of Intellectual Property Facilitation Centres (IPFCs), so that AI research and applications that take place out of India secure rights within the global patent regime. The paper strikes a tone distinct from that of the task force in its emphasis on the potential of AI to add to India's economic growth. It also lays out the global ambition for India in AI by calling for the creation of an AI Garage in India that builds for India, and is able to create an addressable global market within developing and emerging economies.

Advocating an incremental approach, sector and application-wise, labelled 'AI + X', the paper calls for combining AI with sector-specific technologies for immediate impact. It then goes on to list specific application areas by sectors, ranging from Healthcare to Agriculture and beyond, and how AI can impact societal challenges in India. Incentivising research emerges as a key recommendation while identifying several gaps in the research ecosystem and

benchmarking where India stands vis-à-vis global leaders. Emerging from this is the framework for promoting AI research in India, with an emphasis on an agile network model of centres distributed along two focused tiers: on core and applied research. Drawing on the example of the French experience with the PaRis Artificial Intelligence Research Institute (PRAIRIE Institute), the paper calls for the creation of a network of institutes focused on applied research in collaboration with the private sector and academia. The discussion paper also imagines a cloud-based data platform, AIRAWAT (AI Research, Analytics and KnoWledge Assimilation plaTform), which could act as a sandbox of sorts, where core and applied research can take place. Reiterating the concerns around IP, the paper calls for AI-specific modifications to the IP regulatory regime.

The discussion paper also stands out in its recommendation on the creation of large foundational data sets that are annotated and enriched to facilitate core and applied research in AI. This is significant foundational capability in addition to AIRAWAT for spurring AI development in India. While the paper dwells at length on the need to create market places for AI, it may well be a case of putting the cart before the horse. When weighed against the recommendations on building foundational capabilities, the proposed market places seem ahead of their time and of limited short- to medium-term value. Crowdsourcing annotation to enrich the data set for foundational activities is another recommendation that stands out.

GAPS AND CHALLENGES AHEAD

The recommendations of the task force and the discussion paper released by Niti Aayog constitute the two most substantive documents in the public domain that will shape how India advances its AI journey in trying to realise the vision laid out by Prime Minister Modi. Where the task force is modest in its ambitions, the discussion paper does not shy away from stating its global ambitions. While the former views AI primarily as a problem-solver, the latter is far more expansive in its view of AI as a driver of economic growth. Both documents envision a network approach towards developing AI capabilities at the intersection of academia, the private sector and the public sector. The task force was more focused on the role of various departments and ministries in taking ownership of

sector-specific projects. In contrast, the discussion paper was more specific on the mandatory foundational capabilities that need to be in place before India can develop any AI applications of serious global or national impact. Both devote extensive space to the need for skilling for AI and addressing privacy and security issues. Where the discussion paper stands out is in its emphasis on the IP regime. However, both documents are muted on the risks to India and on the width of the capabilities gap. The risks to India—from AI advances globally, opaque technology, the heavy dependence on IP, from data regimes that are currently beyond Indian jurisdiction—need serious analysis and require a focused mitigation plan in the short to medium term, while the proposed long-term measures put India on an equal footing. While the discussion paper speaks of the so-called 'late mover's advantage', it does not quite spell out how, specifically, India may leverage this advantage. In fact, neither document proposes India take a quantum leap in AI. Rather, both advocate treading the path of incremental evolution that flows from building foundational capabilities first, followed by applications, and thereon. Both documents are essentially linear in their approach, albeit with varying emphasis on the specific steps to be taken within this incremental approach. It would be in order to point out that at the pace at which technology is evolving, for India to play catch-up is in reality a game of moving goal posts. While there is a primary conventional track that is linear in its approach and foundational in its focus, there is need for a secondary unconventional track that skips the incremental steps and invests in ideas that could give us a quantum leap. It is on such an unconventional track that one could potentially look to leverage the late mover's advantage which remains elusive in both the task force recommendations and the discussion paper.

CONCLUSION

The opportunities for India from AI are immense, and the risks to India from widening global capabilities gap are real. To ensure long-term sustainable capabilities within India based on AI, and to address societal and sectoral problems as well as to drive economic growth, foundational capabilities are required to be put in place, as earlier recommended. However, the long lead time associated with this incremental evolutionary approach raises the concern

if the vision laid out by Prime Minister Modi could be achievable within a reasonable time frame and within acceptable costs, without incurring any of the likely geopolitical risks. As an emerging economy that is playing catch-up, India needs to hedge its bets on AI with a secondary unconventional approach to AI that has the potential to give the nation a decisive strategic advantage by taking a quantum leap ahead of its global peers. Policymakers shaping the national strategy for AI would do well to explore this secondary approach in addition to the primary approach that has emerged from the recommendations of both the task force and from Niti Aayog. This is the single major grand challenge from an AI perspective that India must prioritise.

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NOTES

1. Defense Research and Development Organisation, 'Center for Artificial Intelligence & Robotics (CAIR)', Ministry of Defense. https://www.drdo.gov.in/drdo/labs1/CAIR/English/indexnew.jsp?pg=homepage.jsp.
2. http://www.pmindia.gov.in/en/news_updates/pms-mann-ki-baat-programme-on-all-india-radio-11/?comment=disable.
3. https://www.narendramodi.in/prime-minister-narendra-modi-inaugurated-wadhwani-institute-of-artificial-intelligence-at-the-university-of-mumbai--538994.
4. https://www.aitf.org.in/.
5. http://pib.nic.in/newsite/PrintRelease.aspx?relid=180322.
6. http://niti.gov.in/writereaddata/files/document_publication/NationalStrategy-for-AI-Discussion-Paper.pdf.

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