



ARTIFICIAL INTELLIGENCE FOR DIGITAL TRANSFORMATION - GENESIS, FICTIONS, APPLICATIONS AND CHALLENGES

CMA (Dr.) Paritosh Basu

Senior Professor
NMIMS School of Business Management
Mumbai



Genesis and Evolution of Artificial Intelligence

Man kind is fascinated since many centuries about ideation and creation of devices which can imitate actions of a human being. The thought of enabling non-living objects to be in functional mode like that of an intelligent being had always intrigued scientists' mind. History reveals that ancient Greeks had illusions about robots, and Chinese and Egyptian engineers had built automatons. Technology evangelist Gill Press (December 2016) traced genesis of the first such thought in 1308 in a book of Catalan poet Ramon Llull. He has quoted about sixty-five instances of rudimentary to advanced form of artificial intelligence (AI) between 1308 to 2016¹. Genesis of AI, therefore, can be traced in centuries old literatures.

Scientists such as Alan Turing, Marvin Minsky and John McCarthy had advanced theoretical and technological underpinnings of AI. 'The History of Artificial Intelligence'² (December 2006), authored by Chris Smith et. al. indicated that John McCarthy was the first scientist in 1956 to christen the technology, behind a computing machine trying to attain the cognitive capability of a human being, as artificial intelligence. The paper revealed that. " in Vannevar Bush's seminal work 'As We May Think' (1945) he proposed a system which amplifies people's own knowledge and understanding. Five years later Alan Turing wrote a paper on the notion of machines being able to simulate human beings and the ability to do intelligent things, such as play Chess"

Human civilisation is presently on the cusp of an exponential growth phase of AI, and RPA (Robotic Process

Automation) applications because of quantum leap in computing power and ever declining costs of storing humongous data. Organisations are gradually appreciating that there is a drop of oil in every unit of data which will drive prosperity in digital era. According to a published report (May 2019)³ in India by 2021, AI will be the most impactful enabler in doubling the rate of innovation driven value enhancements (2.2 times) and employee productivity benefits (2.3 times).

AI and More - Demystified

Artificial Intelligence

There are many perceptions and narratives about AI. The author's interactions with some professionals reveal a certain degree of mysticism and fictional feeling. There is a need, therefore, to demystify such misgivings. Etymological meaning of AI, as per Oxford Dictionary, "... is the study and development of computer systems that can copy intelligent human behaviour." Merriam-Webster Dictionary defines AI as "The ability of a machine to imitate intelligent human behaviour." The simplified definition could be that AI is a data-oriented digital technology-based computing system which "... can perform tasks, normally requiring human intelligence, such as visual perception, speech recognition, decision making, translation between languages, etc."

Artificial intelligence, at a theoretical plane, is all about machine performing the functions of knowledge reasoning and representing, which briefly is called as KR and KKR. "Knowledge of real world plays a vital role in intelligence and same for creating artificial intelligence. Knowledge plays

an important role in demonstrating intelligent behaviour in AI agents. An agent is only able to accurately act on some input when he has some knowledge or experience about that input.⁴ The components of an AI based system has six elements, viz., perception, learning, KR, KKR, planning and execution. The following graphic represents various types of knowledge that digital scientists are trying to handle with the help of computer programming and algorithms:



Source⁴

Machine Learning

Machine Learning (ML) is a member of the AI's extended family of technologies. It uses statistical techniques to allow the machine to learn without being explicitly programmed. In a supervised ML environment machine learns from a data set that contains inputs and known outputs. A functional model is built that makes it possible to predict what the output variables will be for new unknown outputs. ML in a non-supervised environment is not expected to give the correct answer. The system learns from the given dataset of only input variables. The algorithm is encouraged to discover the new pattern of data that facilitates decision making.

Robotic Process Automation

Robots and Humanoids are the next important members in AI's ranch. Robots are essentially programmable machines, often built in a human shape as humanoids. These are usually able to carry out a series of autonomous or semi-autonomous actions. The following are the four important features of a Robot:

- Can interact with the physical world via sensors and actuators,
- Are programmable,
- Can be powered with artificial intelligence, and
- Are usually autonomous or semi-autonomous.

Cognitive Intelligence

In a wider sense AI is synonymously christened as

Cognitive Intelligence (CI). This is because the computing system is essentially trying to imitate certain cognitive abilities of a human being. Deloitte in a paper⁵ on Cognitive Intelligence has referred CI as a "... software programmed to augment human cognitive functions. These technologies are becoming better through machine learning and human feedback through interactions".

Stages of AI

AI has three major stages in course of its capability development of a computing system:

- ANI: Artificial Narrow Intelligence - Capability in a specific context, e. g., weather forecasting,
- AGI: Artificial General Intelligence - Capability to perform cognitive functions at equal level of a human being across wide variety of domains; and
- ASI: Artificial Super Intelligence - Entering the stage of science fiction when AI will surpass all hitherto seen human intelligence.

It is a worldwide accepted position that combined applications of AI, RPA and IoT are helping humanity live a better life. Senior citizens in developed countries can now live more independently yet safely at home. But the larger question is:

- Will AI be able to substitute the wisdom of human beings by mimicking the way their brains work for dealing with issues involving emotional intelligence?
- Will that stage of ASI ever come when AI will overtake human intelligence and wisdom?

There are conflicting views about the present stage of development of AI as a technology. It has crossed the milestone of ANI, but most certainly millions of miles away from AGI. Facebook's Director of Research Yann LeCum said, "Despite these astonishing advances we are a long long way from machines that are as intelligent as humans – or even rats. So far, we have seen only 5% of what AI can do." Readers will immensely be benefitted by reading a research paper titled 'Debunking the Myths and Realities of Artificial Intelligence'⁶

Adoption of AI for Digital Transformation

One of the most amazing applications of AI was published in The Independent. It reported that, "Working with programmer Noah Rubin, Damien Riehl built software capable of generating 300,000 melodies each second, creating a catalogue of 68 billion 8-note melodies. The melodies were then copyrighted and released into the public domain in the hope of stifling litigious musicians.⁷ Another startling information is about 63,000 artificially intelligent robots handling 'Measurable, Repeatable, Predictable and Transaction' jobs at Accenture's operations. Their leadership team does not want any human being to handle such MRPT jobs.

AI and CI and Robots are being extensively applied in almost all industry sectors. For health care the critical

areas of applications are diagnosis and treatment, surgery, patient engagement and behavioural compliance, medical service administration and stoppage of fictitious billing. In the Journal of the Royal College of Physicians Davenport and Kalakota (June 2019)⁸ wrote that, “.... algorithms are outperforming radiologists at spotting malignant tumours, and guiding researchers in how to construct cohorts for costly clinical trials. However, for a variety of reasons, we believe that it will be many years before AI replaces humans for broad medical process domains.”

AI is a powerful tool to perform predictive analytics. Meteorology professionals extensively use AI for collaborated analytical study of voluminous complex data from worldwide geographical regions. They develop insights about nature's behaviour and predict to forewarn about weather conditions and natural calamities. It has time and again been proved that such predictive analyses have helped minimising furies of destruction, loss of life and assets.

Corporate houses across industry sectors are using AI for multifarious applications. Predominantly the purpose is to reverse map business strategies from market to the drawing board for planning operations, designing execution tactics and then go back to market for implementation, In other words this is called Physical-Digital-Physical Loop (PDP Loop) for enhancing effectiveness of marketing, CRM and CXM.

The following is a list of high-end applications of Cognitive Intelligence by digital giants:

- An engine called 'The DeepText' is used by Facebook to appreciate and interpret millions of texts posted by users and their emotional and sentimental thoughts embedded therein. They also use DeepFace engine which can identify any specific user in a photo shared through Facebook platform.
- Amazon uses AI for predicting what customers may need and recommending products for buying even before they think of it, and at times shipping to selected customers. CI is also used for preparation of bills without customers checking out through a billing counter. This is done based on images of products they put into bag, as snapped by cameras fitted all around, when they shop in Amazon stores. Customers know how much to pay when they leave the store.
- Apple uses AI for multiple applications such as Face ID, coordination between Apple phone, AirIpad and watches, helping customers with the assistance of Siri and recommending songs for customers using Apple Music.
- Google uses AI for self-driving cars. Google Assistant and Duplex use natural language processing for AI and Voice inter-face to enable a machine executing instructions.
- IBM started with 'Deep Blue Computer' that defeated a world chess champion. They is now working on 'Project Debator' which is an engine. It will compete by formulating arguments and counter arguments like a professional debater.
- Baidu uses their own AI based cognitive technology

called 'Deep Voice. It can clone any voice in about 3.7 seconds. Baidu has also created an automated device that can read books in author's voice with no recording studio.

- Alibaba uses natural language for conducting predictive analyses of what customers would like to buy categorised as per region, city and individual store, and accordingly arrange for inventory at the shop. They also use this their City Brain Project aimed at reducing traffic jam in smart cities.
- JD.com of China uses AI to run their retail delivery infrastructure with the help of Drone and RPA.
- BFSI sector across the world are using Chatbots and Robots for responding to customers' queries during online service delivery and handling customers at the physical contract points. Robots and Humanoids are also being used for providing knowledge and advisory services for investments and wealth management.
- Almost all large corporates are using AI based software, developed by security service providers as a secret weapon embedded in their computing systems, for proactively detecting and handling cyber-attacks and malware.
- Manufacturing units are using artificially intelligent Robotic-workmen and RPA for in-plant and in-warehouse operations, in collaboration with human workman, particularly for assembly line and supply chain functions. Artificially intelligent IoTs are also being used for monitoring performance of machines and identifying need for breakdown and preventive maintenance.

The list can continue for hundreds of similar such applications. But readers might have got glimpses of how AI and other related applications are being extensively used to develop various products and processes which help generating businesses and / or optimising costs.

It will be interesting at this stage to note some statistics on 'Government Artificial Intelligence Readiness Index, 2019' published by Oxford Insights and the International Development Research Centre.⁹ According to their findings "Artificial intelligence (AI) technologies are forecast to add US\$15 trillion to the global economy by 2030.... as might be expected, the governments of countries in the Global North are better placed to take advantage of these gains than those in the Global South." Singapore topped their AI Readiness Index with a score of 9.185. The USA was in the fourth position with 8.804. Surprisingly India with a score of 7.515 came at the 17th position before China which was at the 20th position with 7.370.

AI and Future of Humans – Risks and Challenges

Pew Research Centre and Imagining Internet Centre of Elon University, one of the top 100 Universities of the USA, jointly published a research report in December 2018¹⁰ based on 979 participants expressing their views about future till 2030. One of the most critical set of questions for the research was: Is it most likely that advancing AI and related

technology will enhance human capacities and empower them? Will most people be better off than they are today? Or, is it most likely that those will lessen human autonomy and agency to such an extent that most people will not be better off?

Barring 25 participants, who did not respond, “...about 63% said most people will mostly be better off. 37% said that people will not be better off. The report included views of Analysts who expect that people will become even more dependent on networked AI in complex digital systems and will continue to be in the historic arc of augmenting lives with mostly positive results from wide range implementation of such tools.”¹⁰ Increasing dependence on AI and related systems is likely to result in widespread difficulties.

Critical concerns and challenges that emerged from the responses are:

- *“Human Agency: Decision-making on key aspects of digital life is automatically ceded to code-driven, “black box” tools. People lack input and do not learn the context about how the tools work
They sacrifice independence, privacy and power over choice; they have no control over these processes. This effect will deepen as automated systems become more prevalent and complex*
- *Data Abuse: Most AI tools are and will be in the hands of companies striving for profits or governments striving for power.”¹⁰*

The challenge before digital scientists, corporate CXOs and government officials is how to address these concerns and mitigate risks. Objective of the aforesaid report published by Oxford Insight was to encourage governments to achieve a state of readiness as far as possible to help citizens being benefitted through automation, while protecting them from associated risks. In the same report they have cautioned about the following two risks:

- Countries in Global South could be left behind by the so called fourth industrial revolution.
- The danger which is looming large is widening of global inequalities due to unequal implementation of AI based technologies in southern part of the world that may result in unequitable distribution of benefits from automation.

Recommended Standard of OECD Council

OECD Council in their ‘First Intergovernmental Standard on Artificial Intelligence’¹¹, published in May 2019, recommended the following guidelines based on consensus of 36 OECD Countries:

- Aim to foster innovation and trust in AI,
- Promote responsible stewardship of trustworthy AI, and ensure
 - Respect for human rights and democratic values,
 - Inclusive growth, sustainable development and well-being,
 - Human-centred values and fairness,

- Transparency and ability to explain,
- Robustness, security, safety and accountability.

Other non-OECD countries such as Argentina, Brazil, Colombia, Costa Rica, Peru and Romania have adhered to the above standards for adopting AI.¹²

AI and RPA - Ethical and humane issues for solution designing and applications

Artificial Intelligence can create mayhem if not judiciously managed while both designing and applying solutions. Computing systems, particularly in an ML environment, must be updated with relevant and contemporary data before taking any decision based on results thrown up by the AI tool. Again, if AI falls in the hands of people with ulterior motives, results can be disastrous. This is no longer an apprehension but reality. Researchers have established that cyber criminals have used AI ahead of time for designing tools to penetrate the target computing systems, spawning malwares for hacking data and extracting ransoms.

Many researchers have cautioned about the evil effects unregulated applications of AI. Taddeo and Floridi (August 2018)¹³ concluded that introducing a set of regulations containing ethical principles for developing and applying AI based solutions is of utmost importance. Such ethics-oriented regulations will play a pivotal role in ensuring that the power of AI is harnessed for the benefit of humanity, keeping to the minimum its applications by people with ulterior motives. It would help understand how to responsibly use the power of this technology.

It is, therefore, an imperative for all solution designers to keep all perceivable ethical and humane dimensions in view while using AI and RPA for solution designing. At this stage it will be useful to briefly revisit the following dimensions and impacts of AI from perspectives of all stakeholders before dealing with some of the emerging major issues to be considered for solution designing with AI and their applications:

1. What is AI: It is a combination of datasets, models and predictions all of which can have bias or fairness and hence demands stakeholders’ transparency, accountability, interpretability, and abilities to explain and remediate.
2. What AI is made to do: Human-AI interaction and collaboration, planning and decision making by government agencies and business professionals, cyber-security and safety, privacy of information, surveillance, controlled use, malicious use by cybercriminals, etc.
3. What AI Can be: Human-like cognitive abilities can threaten human beings because artificially intelligent robots can claim singularity and right to function independently. This will happen at that time and level of its sophistication when the user is left to the mercy of the computer programme and become dependent on the result processed out by the AI based programme and / or the SOP for RPA. Robots may also claim right to life, i.e., power supply to it should never be switched-off.

4. What AI impacts: Effectiveness of business decisions, automation vs. human resource engagement, civil rights in democracy and collaboration between human and robotic resources.
5. Ethics and morality of AI: Ethical and moral quality of predictions, inferences drawn, and / or end outcomes derived from results thrown up by AI tools may not always be what are desirable. All those at times may adversely influence ethical, moral and emotional qualities of impacts on business results and finally human beings at large.
6. How AI can harm: Prediction and / or end outcomes from AI tools may negatively impact an individual's ability to establish her / his rightful identity and right to representation. This in turn can adversely impact her / his ability to get services or access resources allocated / to be allocated to him / her.

Remaining alert about the above dimensions of AI, RPA and the related issues will help digital scientists to address the consequential questions with more positive mindset and impactful results.

AI and RPA - Ethical and humane issues for solution designing

Keeping in view the above the following questions have been designed for all stakeholders directly and indirectly associated with AI and RPA. Answers to such questions may help them to achieve success while using one of the most powerful tool of the present digital era:

1. Directionless - What happens if there is no directional guidance and regulation?
2. Legal authority - What happens if users suffer losses due to advices from robots or humanoids?
3. Unemployment - Will AI be able to generate new jobs with more thinking content?
4. Collaboration - What happens if RPA and robots fail to collaborate with human beings?
5. Transition - How to ensure transition with painless change management?
6. Inequality - How to distribute the wealth created by AI, RPA, robots and humanoids?
7. Humanity - How to ensure that human beings do not become slaves of networked AI?
8. Biasness - How to limit the bias from artificially intelligent robots, humanoids and chatbots?
9. Security - How to deal with challenges and mitigate risks from cybercriminals who use AI tools?
10. Evil genies - How to safeguard stakeholders' interests against unintentional outcomes?
11. Singularity - How human resources can stay in control of complex and intelligent AI based systems?
12. Robot rights - How to define and ensure ethical treatment for and by robots and humanoids?
13. Artificial stupidity - How to safeguard against blunders of artificially intelligent computing systems?

Affirmative answers to the above questions with needful clarities are essential for achieving success from applications of artificially intelligence, RPA, chatbots, robots and humanoids.

Conclusion

Mankind is presently at its fourth stage of evolution. First, we became human beings from apes, and then became civilised. In the third stage we learnt to conduct industry, trade and commerce in a structured and regimented manner. The fourth evolution is towards digital transformation. Scholars dealing with predictive ascensions are of the view that soon this will directly or indirectly touch every single human being under the sun and continue to change the way of living. The objective of this paper will be well served if it could generate alertness amongst stakeholders about the issues to be tackled for meeting success while developing and applying AI based solutions with the goal to serve humanity. **MA**

Acknowledgement

The author acknowledges contributions of Ms. Rajashree Basu in writing this paper.

Webliography

Only webliographical references have been quoted below for economy of words and space.

1. <https://www.forbes.com/sites/gilpress/2016/12/30/a-very-short-history-of-artificial-intelligence-ai/#5f64eb396fba>
2. <https://courses.cs.washington.edu/courses/csep590/06au/projects/history-ai.pdf>
3. <https://news.microsoft.com/en-in/artificial-intelligence-rate-of-innovation-microsoft-idc-study/>
4. <https://www.javatpoint.com/knowledge-representation-in-ai>
5. <https://www2.deloitte.com/content/dam/Deloitte/lu/Documents/technology/lu-cognitive-intelligence-when-intelligent-machines-learn-to-venture-into-the-business-world.PDF>
6. <https://www.forbes.com/sites/cognitiveworld/2019/04/22/debunking-the-myths-and-reality-of-artificial-intelligence/#2ea0fb8043b5>
7. <https://www.extremetech.com/extreme/306575-new-tool-generates-every-possible-melody-for-public-domain-use>
8. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6616181/>
9. <https://ai4d.ai/index2019/>
10. http://www.elon.edu/e-web/imagining/surveys/2018_survey/AI_and_the_Future_of_Humans_credit.shtml
11. <https://www.humane-ai.eu/humaneai-oecd/>
12. <https://legalinstruments.oecd.org/en/instruments/OECD-LEGAL-0449>
13. <https://science.sciencemag.org/content/361/6404/751.full>

Paritosh.Basu@sbm.nmims.edu