

The Future is here: Artificial Intelligence and Robotics

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1. Introduction

In 1997, an IBM supercomputer called Deep Blue beat the then world chess champion, Garry Kasparov at an intense game of chess. This was a rematch following Deep Blue's initial defeat in 1996. In what can only be called human nature, Kasparov was perhaps reckless in the last game, where Deep Blue emerged victorious using a seemingly strategic approach. He lost that day, but maybe we didn't.¹

Artificial Intelligence (“AI”) is not a new concept, especially to the readers of science fiction. In recent times however, it is becoming more science and less fiction. The world of technology is changing rapidly, with computers and now robots, replacing simple human activities.² AI, simply put, is the capability of a machine to imitate intelligent behavior.³ It is an umbrella term that refers to information systems inspired by biological systems, and encompasses multiple technologies including machine learning, deep learning, computer vision, natural language processing (“NLP”), machine reasoning, and strong AI.⁴

In 1950, Alan Turing proposed what has come to be known as the ‘Turing Test’ for calling a machine “intelligent”: that a machine could be said to “think” if a human could not tell it apart from another human being in conversation. Roger C. Schank, in a 1987 paper laid down five attributes one would expect an intelligent entity to have: (1) Communication, (2) Internal knowledge, (3) External knowledge, (4) Goal-driven behavior, and (5) Creativity.⁵

Young entrepreneurs and big corporations alike, have set sail to implement the various

applications that AI can accomplish. The Global Artificial intelligence market was valued at USD 126.4 billion in 2015 and is forecast to grow at a CAGR of 36.1% from 2016 to 2024 to reach a value of US\$ 3,061.35 Billion in 2024.⁶ The United States represents the biggest market for Artificial Intelligence (AI). The highest growth potential is expected to be in Asia-Pacific region.

I. Understanding AI

Before we delve into the potential of AI, let's take a step back to understand AI. Artificial Intelligence may be best defined by analyzing the two components of the term i.e. artificial and intelligence. While defining “artificial” may prove to be an easier task, it is the definition of “intelligence” over the years which has proved to be the difficult task. It has been held by consensus that defining “artificial” may not prove to be as much of a task as defining “intelligence”. Herein we have delved into the development of the concept of AI to understand its definition and its nexus with our understanding of intelligence. It was in the 1940s that McCulloch and Walter Pitts first made an attempt to understand intelligence in mathematical terms. Albeit while the subject whose intelligence was being mapped was a human in this case, and not a machine, this model, even though not capable of encapsulating human intelligence, was a stepping stone for those interested in the field of artificial neural networks in computing which is the basis for artificial intelligence. Popularly known as the father of computer science, Alan Turing in his paper “Computing Machinery and Intelligence” argued that if a machine could pass the Turing test then we would have grounds to say that the computer was intelligent. The Turing test involves a human being (known as the ‘judge’) asking questions via a computer terminal to two

1. Id.

2. Isabelle Boucq, *Robots for Business*, available at <http://www.Atelier-us.com/emergingtechnologies/article/robots-for-business>.

3. N.P. Padhy, *Artificial Intelligence And Intelligent Systems 3* (Oxford University Press 2005).

4. PR Newswire, *Artificial Intelligence Market Forecasts*, available at <http://www.prnewswire.com/news-releases/artificial-intelligence-market-forecasts-300359550.html>.

5. <http://dl.acm.org/citation.cfm?id=38300>

6. <https://globenewswire.com/news-release/2016/09/27/874854/0/en/Global-Artificial-Intelligence-Market-to-Exhibit-US-3-061-35-Bn-in-2024-Global-Industry-Analysis-Size-Revenue-Growth-Trends-Forecast-2024-TMR.html>

other entities, one of which is a human being and the other of which is a computer. If the judge regularly failed to correctly distinguish the computer from the human, then the computer was said to have passed the test. In this paper Turing also considered a number of arguments for, and objections to, the idea that computers could exhibit intelligence.⁷ It is from this point forward that the disposition of holding human intelligence began being used as the yardstick to measure and evaluate artificial intelligence.

The neologism-term “Artificial Intelligence” was used for the first time in a Dartmouth Conference wherein John McCarthy at the Massachusetts Institute of Technology defined AI as science and engineering of making intelligent machines, especially intelligent computer programs. It is related to the similar task of using computers to understand human intelligence, but AI does not have to confine itself to methods that are biologically observable.⁸ According to him there existed no “solid definition of intelligence that doesn’t depend on relating it to human intelligence” because “we cannot yet characterize in general what kinds of computational procedures we want to call intelligent.” Further down the road another definition surfaced, provided by Marvin Minsky in 1968 stating that artificial intelligence is the science of making machines do things that would require intelligence if done by men.

II. Modern Definitions

It is later that human independent definitions began to show face, wherein:

- **Luger and Stubblefield, 1993** defined it as the branch of computer science that is concerned with the automation of intelligent behavior.

- In **Artificial Intelligence: A Modern Approach**, **Stuart Russell and Peter Norvig** defined AI as the designing and building of intelligent agents that receive percepts from the environment and take actions that affect that environment. This view of AI brings together a number of distinct subfields of computer vision, speech processing, natural language understanding, reasoning, knowledge representation, learning, and robotics, with the aim of achieving an outcome by the machine.
- In **Artificial Intelligence: Foundations of Computational Agents** (book published by Cambridge University Press, 2010. Copyright David Poole and Alan Mackworth, 2010) AI was defined as the field that studies the synthesis and analysis of computational agents that act intelligently.
- **Marcus Hutter (ANU) and Shane Legg (Google DeepMind)** proposed the following “human-independent” definitions: Intelligence measures an agent’s ability to achieve goals in a wide range of environments. While this invokes a clearer set of variable for regulators, many hurdles still remain.

What is seen very evidently is the difference in opinion by several experts in being completely able to define AI, as the more we come to know of the concept of AI, the more AI keeps evolving and the standard for intelligence is set higher and higher. It has been advocated by many that giving a precise definition to AI limits it. For regulatory purposes the focus on the definition of AI should be on its practical applications regulating what humans do rather than how they think. However we again see a re-emergence of using human action and thought to understand those of AI. No complete definition of AI for the purpose of regulation has emerged anywhere and researchers too are baffled by this conundrum. Given the definitional problems in the field, commentators have noted that the question of a machine intelligence and purpose is ultimately a question not of discovery, but of decision.

7. 2017 – The Year Ahead: Artificial Intelligence; the Rise of the Machines; Report by Merrill Lynch – Bank of America, dated 09 December 2016

8. 2017 – The Year Ahead: Artificial Intelligence; the Rise of the Machines; Report by Merrill Lynch – Bank of America, dated 09 December 2016

2. Understanding the Industry

I. AI Technologies

Under the broad ambit of AI, multiple silo technologies have also developed over the years. Below are a few definitions for the different focus technologies developed over the years and their current market share:⁹

- **Machine Learning (ML)** – uses computer algorithms based on mathematical models using probability to make assumptions and can make predictions about similar data sets.
- **Cognitive Computing** – builds upon ML using large data sets with the goal to simulate human thought process and predictive decisions. Training the systems tends to utilize human curation.
- **Deep Learning** – builds on ML using neural nets to make predictive analysis. The use of neural nets is what is differentiating Deep Learning from Cognitive Computing right now. Deep Learning is also helping improve image and speech recognition.
- **Predictive application programming interfaces (APIs)** – A predictive API basically uses AI to provide a predictive output (from a standardized set of outputs), when you have data sets.
- **Natural Language Processing (NLP)** – programming computers to understand written and spoken language just like humans, along with reasoning and context, and finally produce speech and writing. Many machine learning companies use NLP for training on unstructured data.
- **Image Recognition** – recognizing picture and objects as humans, as well patterns in visually represented data, which may not be apparent.
- **Speech Recognition** – converting spoken language to data sets that can be processed by NLP.

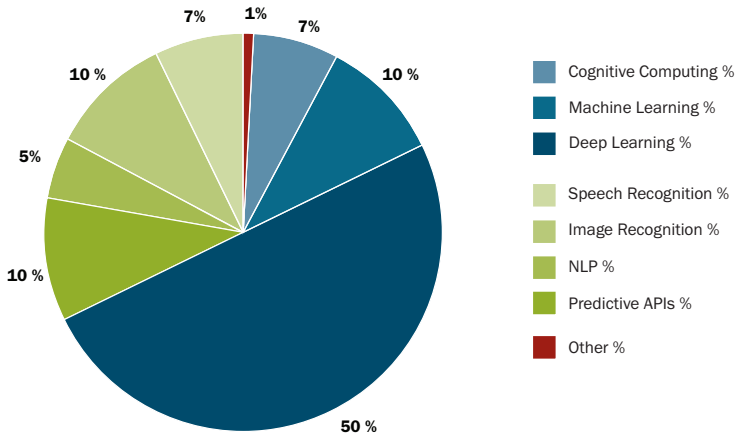


Figure: Technology-wise Revenue – 2015 (Source: Tractica)

9. 2017 – The Year Ahead: Artificial Intelligence; the Rise of the Machines; Report by Merrill Lynch – Bank of America, dated 09 December 2016

Cognitive Computing represents the fastest growing silo which is predicted to expand from \$1.47 billion in 2015 revenues (or 7% of total AI) to \$4.3 billion in 2020 (12% share) and \$21.5 billion in 2025 (17% share), growing at 96% 5-year and 65% 10-year CAGRs. The second fastest silo is Deep Learning, which at \$1.1 billion in 2015 represents the lion's share of the technological focus, and we believe should reach \$21.5 billion in 2020 and \$82.4 billion in 2025 at a 5-year and 10-year CAGR of 83% and 55%; The Merrill Lynch report on the rise of artificial intelligence, brought out in December 2016 expects other segments or silo's to decline as a percentage of the pie,

but still grow in the range of 50-70% CAGR in the next five years, and a range of 25-40% CAGR in the next ten years.¹⁰

II. Industrial Scope of AI

AI has gathered attention from the major tech players of the world such as Google, Facebook, IBM. The industry may be divided into 3 domains – AI platform developers, AI enablers, and AI products and services. A recent report by Merrill Lynch and the Bank of America lists out a brief snapshot of the developments by the big players in these domains:¹¹

AI Platforms	
IBM	Watson (cognitive solutions platform: broad number of offerings spanning cognitive computing, machine learning, deep learning, predictive APIs, and natural language processing)
Google	DeepMind (machine learning tool), Cloud Machine Learning (cloud machine learning services)
Amazon	Amazon Machine Learning Services (creates models and finds patterns in data to make predictions on new data)
Facebook	Facebook Artificial Intelligent Lab - research arm that publishes reports on advancements in collaborative effort, offers open source software, engages in conferences and workshops Torch - open sourced AI modules
Microsoft	Cortana Intelligence Suite (vision, speech, language, know ledge, and search APIs), Microsoft Xiaoice (Chatbot)
AI Enablers	
IBM	TrueNorth experimental ASIC - a parallel, distributed, scalable and flexible architecture that integrates computation, communication and memory
Google	Tensorflow - Google tensor processing unit or TPU is essentially an ASIC that can be designed to address a certain function in a deep learning system. Google expects broader adoption of the TPU along with its Tensorflow framework for many different AI applications

10. Ibid

11. 2017 – The Year Ahead: Artificial Intelligence; the Rise of the Machines; Report by Merrill Lynch – Bank of America, dated 09 December 2016

Amazon	Amazon Machine Learning Services (creates models and finds patterns in data to make predictions on new data)
Nvidia	GPU - massively parallel architecture consisting of thousands of smaller, more efficient cores designed for handling multiple tasks simultaneously and efficiently. When it comes to implementing deep learning algorithms, researchers preferred to use GPUs
Intel	Xeon Phi (parallel computing product specifically addressing deep learning with all instruction sets based on Intel homegrown solutions), acquired FPGA through Altera, acquired custom ASIC solutions through Nervana acquisition.
Xilinx	A programmable logic device that can be used for a variety of end market applications in industrial, auto, wired/wireless communications, aerospace/defense and others.
Qualcomm	Zeroth - Taking deep learning/AI to consumer devices by enabling localized computing and real time analytics with a hardware that anticipates user needs and shares the perception of the world naturally.
Cisco	Partnerships with IBM Watson, and Factory Automation companies including Rockwell and FANUC, providing AI integrated networking for use cases where cloud-based AI is not economically or logistically feasible. Also the leading networking company providing secure and reliable connections to cloud-based AI services.
Juniper	Leading networking company providing high-performance switches and routers that ensure reliable connections to cloud-based AI tools.

Companies with AI enhanced products and services

Apple	iOS 10 AI features, Siri (digital voice assistant), QuickType (suggests intelligent text based on context), Memories (computer vision applied to photos), applying machine learning to autos
Google	RankBrain (enhancing search algorithm with AI), Google Voice Search (NLP based voice query), Google Photos (organizing photos using computer vision), Google Assistant (two way conversational voice activated search engine)
Amazon	AI driven product search ranking and recommendations, Amazon Echo (voice commanded speaker system), Alex a Voice Service (set of APIs for developers to leverage Alex a Voice)
Microsoft	Cortana (voice assistant), enhanced capabilities for Bing search, Skype Automatic Translator (working project – real time translation in video conferencing)
Facebook	FBLearn Flow (AI platform that makes predictions and enables targeted advertising), Applied Machine Learning Team (commercial arm of AI platform), DeepFace (facial verification software), Moments (photo sharing application using facial recognition), News Feed (AI to highlight relevant news specific to user)

Salesforce	SalesforceIQ (recommendations for users to be more efficient in sales, service and marketing), added AI capabilities to Einstein (BI)
Adobe	Sensei - AI engine that supports all of Adobe's segments. It accesses all of its useable data and accelerates the company's content creation
Zendesk	Satisfaction Prediction (predicting customer support success), Automatic Answers (providing automated answers for customer inquiries), Codename Zenrank (showing the most relevant answers to customer support inquiries).
Hubspot	Marketing (custom workflows) and Reports (query tool) represented the first products to include AI, though we expect to see AI rolled into other Marketing features as well as Sales/CRM, WebSites and Ads
Palo Alto Networks	Wildfire (uses machine learning to inspect and gather threat intelligence), Traps (uses ML to examine characteristics of a file to determine if malware resides on end point devices), AutoFocus (uses machine learning to alert security teams about high priority events before they happen)
Accenture	Services - offers other vendors' machine learning platforms in its Intelligent Automation and Insights Platforms as well as its proprietary platform My Wizard (virtual agents for software coding) Internal ops - InFY15 Accenture's automation efforts eliminated 10,000 roles, or 3% of FY15 headcount, Automation tools around workforce management have also improved employee utilization rates

AI is poised to have a transformative effect on consumers, enterprises, and government markets in the world.¹² In fact, experts predict that robots will replace humans in one-third of today's traditional professions by 2025.¹³

A few of these sectors include:

A. Transportation and Manufacturing

Leading the AI revolution is, in all probability, the emergence of autonomous or driverless cars.¹⁴ The technology behind self-driving cars can be applied to public transportation, delivery drivers, and more, decreasing the risk of

accidents, alleviating traffic congestion, and lowering energy costs.¹⁵

Manufacturing was one of the first industries to harness AI by using robots to assemble products and package them for shipment.¹⁶

B. Education

The use of AI as an effective method of teaching and learning is the latest technological development in the EdTech space. AI has the ability of monitoring and adapting to the learning patterns and providing effective solutions to students, and the benefits of AI can therefore be used to improve the standard and quality of education as a whole.¹⁷

12. *Supra* note 4.

13. Christoffer O. Hernes, *Artificial Intelligence, Legal Responsibility and Civil Rights*, available at <https://techcrunch.com/2015/08/22/artificial-intelligence-legal-responsibility-and-civil-rights/>

14. Please refer to our research paper titled "Preparing For a Driverless Future: Business, Socio-Economic and Legal Perspectives", available at http://www.nishithdesai.com/fileadmin/user_upload/pdfs/Research%20Papers/Preparing_For_a_Driverless_Future.pdf.

15. Connie Chan, 5 Industries Being Most Affected By Artificial Intelligence, available at <https://www.fowcommunity.com/blog/future-work/5-industries-being-most-affected-artificial-intelligence>.

16. *Id.*

17. Please refer to our research paper titled "EdTech: From IT to AI: A legal perspective", available at http://www.nishithdesai.com/fileadmin/user_upload/pdfs/Research%20Papers/Ed-

C. Employment

Many of the AI applications in use stem from the demand for automation in all industries. When companies can automate tasks, they reduce man hours and increase both efficiency and accuracy due to the removal of human error.¹⁸ While there has been the worry that AI will create a job deficiency, it is perhaps only repetitive manual jobs that will be effected, as there will be jobs created in industries that flourish on the development of innovative, new processes.¹⁹

D. Defense and Security

Very recently, Russia has developed a humanoid military robot called 'Ivan' which is intended to replace the soldier in battle or in emergency areas where there is a risk of explosion, fire, high background radiation, or other conditions that are harmful to humans.²⁰ Ivan is currently remote controlled by an operator (from up to several miles away) wearing a special suit, which contains sensors in the neck, hands and shoulders. This enables the robot to accurately copy the movements of a human. The operator can remain miles away from danger as Ivan enters instead. The human operator can then perform tasks such as driving vehicles or searching areas without ever having to enter the battlefield. While Ivan's original Iron Man Project design requires a human operator, it is revealed that the creators of the robot hope to make the droid-soldier completely autonomous in the future.²¹

However USA is far more ahead in this race with technology which is much more advanced. So much so that in a recently surfaced unclassified 2016 Department of Defense (DoD) document,

the Human Systems Roadmap Review, reveals that the US military plans to create artificially intelligent (AI) autonomous weapon systems, which will use predictive social media analytics to make decisions on lethal force with minimal human involvement. Despite official insistence that humans will retain a "meaningful" degree of control over autonomous weapon systems, this and other Pentagon documents dated from 2015 to 2016 confirm that US military planners are already developing technologies designed to enable swarms of "self-aware" interconnected robots to design and execute kill operations against robot-selected targets.²² This raises several moral and legal issues regarding liability and superior responsibility.

E. Healthcare

As per CB Insights,²³ healthcare has seen the greatest deal flow of all the industries that AI is involved in. With market leaders such as Google and IBM focusing on the industry, there is immense growth predicted in the sector.

IBM's Watson is currently involved in oncology treatment,²⁴ as well as chronic disease treatment and drug development.²⁵ Google's DeepMind is used by the United Kingdom National Health Service to detect health risks, and analyze medical images.²⁶ Other technology giants have made a headway into the sector with Microsoft's analysis of effective cancer treatment options,²⁷ and Intel's investment in Lumiata to develop

Tech_From_IT_to_AI.pdf.

18. Matthew Herbert, *Artificial Intelligence and the Future of Manufacturing*, available at <https://www.uk-cpi.com/blog/artificial-intelligence-and-the-future-of-manufacturing>.

19. *Id.*

20. <https://news.vice.com/article/ivan-the-terminator-russia-is-showing-off-its-new-robot-soldier>

21. <http://www.inquisitr.com/3140919/russian-robo-soldiers-revealed-putin-showcases-iron-man-military-hardware-with-ivan-the-terminator/#fKuC3LHj3Qf2w4SII.99>

22. <https://medium.com/insurge-intelligence/the-pentagon-is-building-a-self-aware-killer-robot-army-fueled-by-social-media-bd1b55944298#.1fb7hldd>

23. CBI Insights, from *Virtual Nurses To Drug Discovery: 90+ Artificial Intelligence Startups In Healthcare*, available at <https://www.cbinsights.com/blog/artificial-intelligence-startups-health-care/>.

24. The Atlantic, *The Robot Will See You Now*, available at <https://www.theatlantic.com/magazine/archive/2013/03/the-robot-will-see-you-now/309216/>.

25. Laura Lorenzetti, *Here's How IBM Watson Health Is Transforming The Health Care Industry*, available at <http://fortune.com/ibm-watson-health-business-strategy/>.

26. Sarah Bloch-Budzier, *NHS using Google technology to treat patients*, available at <http://www.bbc.com/news/health-38055509>.

27. James Vincent, *Microsoft announces new AI powered health care initiatives targeting cancer*, available at <http://www.theverge.com/2016/9/20/12986314/microsoft-ai-healthcare-project-hanover-cancer>.

algorithms to detect cancerous tissues.²⁸ Moreover, in what seems to be a revolutionary development, Cambridge Consultants has developed 'Axisis', a system that is designed to perform cataract surgeries with greater accuracy than a human.²⁹

F. Virtual Reality and Virtual Assistance

MRO has created AIR (Artificial Intelligent Reality) an AI based complete maintenance solution for aircrafts.³⁰ The app assists maintenance crew in identifying the issues that needs to be taken care of real time inputs fed into it by a camera attached to a tablet. The feed is then processed by the app and the maintenance crew is given step by step instructions as to how to proceed.

G. Internet of Things and Wearables

PIQ, a leading French start-up in sports wearables has unveiled two cutting edge innovations involving the introduction of a genuine AI interface dedicated to sports activities.

The first is GAIA an autonomous system which – for the very first time in the world – understands and analyzes sport movements and the second is *PIQ ROBOT* - the ultra-high performance sensor. The combination of GAIA and *PIQ ROBOT* enables athletes to identify their winning factors, highlighting the key strength they should leverage on to succeed. GAIA is capable of breaking down and analyzing sports movements via specific motion-capture algorithms. Over 2 years of Research and

Development (“**R&D**”) GAIA has analyzed thousands of athletes and millions of movements growing its own automatic learning curve further expanding its intelligence day after day. This multi-algorithmic machine-learning intelligence is a result of both fundamental and applied research introducing the capacity to understand and analyze microscopic variations in sport movements. GAIA is embedded into PIQ ultra-high performance sensor *PIQ ROBO* which is a powerful nano-computer capable of analyzing more than 195,000 data points per minute in real time. Using GAIA's statistical intelligence and *PIQ ROBOT*'s measurement capacity, millions of actions generated in every hour of game can now be thoroughly analyzed. Every athlete can compare his past performances on a specific day as well as measure them versus the community's overall performance.³¹

H. Business Intelligence

HANA, an AI based cloud computing platform by SAP is helping turn large amount of business data into meaningful intelligence. HANA is capable of identifying useful trends that could be used into providing actionable intelligence.³² Walmart has used HANA to analyze its high volume of transaction records so as to consolidate its processes and resources.

Apptus is an AI based tool which helps online merchants boost their sales.³³ Apptus makes use of big data and machine learning to come up with predictive analysis of as to what a potential customer is likely to buy.

28. PR Newswire, *Lumiata Closes \$10 Million Series B Financing with Intel Capital to Advance Medical Artificial Intelligence for Healthcare*, available at <http://www.prnewswire.com/news-releases/lumiata-closes-10-million-series-b-financing-with-intel-capital-to-advance-medical-artificial-intelligence-for-healthcare-580979511.html>.

29. NewsScientist, *Robot surgeon can slice eyes finely enough to remove cataracts*, available at <https://www.newsScientist.com/article/211445-robot-surgeon-can-slice-eyes-finely-enough-to-remove-ataracts/>.

30. <https://www.mroair.com/our-solution>, last accessed on September 23, 2017.

31. <http://www.businesswire.com/news/home/20161122005800/en/PIQ-Introduces-Artificial-Intelligence-Sport-Wearables>, last accessed on September 23, 2017.

32. <https://www.sap.com/products/hana.html#>, last accessed on September 23, 2017.

33. <https://www.apptus.com/>, last accessed on September 23, 2017.

I. Robotics

The use of AI till now has been in the digital world. Robots enable AI to transcend into the physical world which opens up unimaginable opportunities. Robots with the help of AI can gather data in the agricultural field and help solve the food crisis.³⁴ Autonomous vehicles

are already a reality and it is only a matter of time when autonomous vehicles would be the main standard. The use of AI based robots could act as a substitute for routine labour and leave humans to do the task that require creativity and judgment.³⁵

34. <https://www.forbes.com/sites/jenniferhicks/2017/03/19/how-sensors-robotics-and-artificial-intelligence-will-transform-agriculture/#3c75aa06384b>, last accessed on September 23, 2017.

35. <https://www2.deloitte.com/content/dam/Deloitte/lu/Documents/operations/lu-intelligent-automation-business-world.pdf>, last accessed on September 23, 2017.

3. AI and Creativity

People have been grappling with the question of artificial creativity, alongside the question of artificial intelligence, for over 170 years. In 1843, Lady Ada Lovelace, an English mathematician, considered the world's first computer programmer, wrote that a machine could not have human-like intelligence as long as it only did what humans intentionally programmed it to do. According to Lovelace, a machine must be able to create original ideas if it is to be considered intelligent.³⁶ The Lovelace Test, formalized in 2001, proposes a way of scrutinizing this idea. A machine can pass this test if it can produce an outcome that its designers cannot explain based on their original code.³⁷ No AI has successfully been able to pass this test. However here is a list of works that AI has successfully produced which if generated by a human would be considered to be creative and original.

I. Painting

A computer program named Aaron has been painting since the 1970s. The “paintings” Aaron does are realized mainly via a computer program and created on a screen although, when his work began being exhibited, a painting machine was constructed to support the program with real brushes and paint.³⁸ The Painting Fool, another computer programmed to be a painter has been configured to demonstrate qualities such as “imaginative” and “appreciative” at the same time being responsive to emotions in order to produce art. After reading a piece in the Guardian on the war in Afghanistan, the program picked out words such as “troops”, “Nato” and “bombing” and painted a water-colour composite that seemed to adequately reflect the mood of the news report. Similarly, it duplicated various

paintings on various media and assessed results. It even made the comment “This is a miserable failure” for one particular attempt. In an exhibition of its works at Paris in 2013, the program painted visitors in different moods, correlating expressions with emotional keywords dug out from 10 articles from the Guardian. In fact, when the overall tally of negative keywords passed a threshold, The Painting Fool refused to paint, replicating the temperamental nature artists are often associated with.³⁹

II. Story writing

There was a recent furore about a Japanese AI writing a novel called “The Day a Computer Writes a Novel” that almost won a literary prize in Japan. The research team first wrote a novel of their own and then broke it down into its component parts. Only then did the A.I. involve itself, arranging the parts it had been given to create “another story similar to the sample novel,” building it from words, phrases, characters, and plot outlines that had been fed to it.⁴⁰

III. Music

Rock star David Bowie co-wrote a program that generated lyric ideas. It gave him inspiration for some of his most famous songs. It generated sentences at random based on something called the ‘cut-up’ technique: an algorithm for writing lyrics that he was already doing by hand. You take sentences from completely different places, cut them into bits and combine them in new ways. The randomness in the algorithm creates strange combinations of ideas and he would use ones that caught his attention, sometimes building whole songs around the ideas they expressed.⁴¹

36. Prena Kapoor, Approaches to Measuring the Intelligence of Machines by Quantifying them, International Journal of Advanced Research in Computer and Communication Engineering Vol. 4, Issue 10, October 2015 (<http://www.ijarccce.com/upload/2015/october-15/IJARCCCE%2017.pdf>)

37. Ibid

38. <http://www.bbc.com/news/technology-33677271>

39. <http://www.financialexpress.com/industry/companies/creativity-and-the-art-of-artificial-imagination/215251/>

40. http://www.slate.com/blogs/future_tense/2016/03/25/a_i_written_novel_competes_for_japanese_literary_award_but_humans_are_doing.html

41. <http://motherboard.vice.com/read/the-verbasizer-was-david->

Further more recently, researchers at Sony's Computer Science Laboratory in Paris have shared a pair of tracks created with the assistance of software called Flow Machines. The program analyzes a database of existing songs to "learn" musical styles and identify commonalities, then exploits unique combinations of style transfer, optimization, and interaction techniques" to synthesize original music.⁴²

IV. Computer Program that performs magic tricks

The Sorcerer's Apprentice 2.0 is a Computer program which is fed with lots of information about how we perceive the world. Based on that information it churns out new magical methods, leading to new tricks, that should amaze an audience in the best way possible. It's a program that is able to find the very best version of a trick at the click of a button!⁴³

V. Making movie trailers

IBM Watson in September, 2016 became the first AI to create a film trailer. IBM researchers fed Watson more than 100 horror film trailers cut into separate moments and scenes. It performed a series of visual, sound and composition analyses on each scene to get an idea of how to create the dynamics of a trailer. Watson then processed 90 minutes of Morgan to find the right moments to include in the trailer. Once the supercomputer finished processing Morgan, it isolated 10 scenes – a total of six minutes of video. Although a human editor was still needed to patch the scenes together to tell a coherent story, the AI shortened the process down to only 24 hours when it typically takes around 10 to 30 days to complete a trailer.⁴⁴

VI. Creating unique Recipes

IBM Watson hasn't simply surprised people with this trailer, but its former achievement also includes the ability to churn out recipes. Watson is being used by chefs to come up with new and exciting recipes in a feat that could turn out to be useful for people with dietary restrictions and for managing food shortages. If you give Watson a few ingredients and cuisine specifications, it can help you with recipe ideas.⁴⁵

Therefore as we can see AI has in fact succeeded in making paintings, writing novels, scripts for tv shows, making music etc. How it that AI is still not regarded to be creative, despite surmounting all of these abovementioned feats? The answer lies in the starting point. In all of these activities there has been a human input in the beginning which the AI has worked on generated the rest. This output can be as exhaustive as supplying the complete and relevant data to as open ended as simply supplying the intention. As long as it doesn't originate from the AI, it is not considered creative.⁴⁶

However recently it has come to news that Google's 'DeepMind' AI platform can now learn without human input. DeepMind is now capable of teaching itself based on information it already possesses. In a significant step forward for artificial intelligence, Alphabet's hybrid system — called a Differential Neural Computer (DNC) — uses the existing data storage capacity of conventional computers while pairing it with smart AI and a neural net capable of quickly parsing it. Instead of having to learn every possible outcome to find a solution, DeepMind can derive an answer from prior experience, unearthing the answer from its internal memory rather than from outside conditioning

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42. <http://www.reuters.com/article/us-sony-algorithm-idUSKBN12H1ST>

43. <http://www.qmul.ac.uk/media/news/items/se/143235.html>

44. <http://www.wired.co.uk/article/ibm-watson-ai-film-trailer>

45. <http://www.npr.org/sections/alltechconsidered/2014/10/27/359302540/live-got-the-ingredients-what-should-i-cook-ask-ibm-watson>

46. https://www.mit.bme.hu/system/files/oktatas/targyak/8866/computer_models_of_creativity.pdf

and programming.⁴⁷ Its real world application is yet to be seen.

Further Margaret Boden, a leading researcher in AI and creativity has recently stated that humans are irreplaceable when it comes to creativity because AI's natural language processing is hugely limited by relevance blindness, as a result of which a computer lacks semantic understanding or literary knowledge. AI cannot understand what is relevant the way human beings can. Hence it cannot produce outcomes that satisfies their (human's) requirement of creativity.⁴⁸

VII. AI and virtual assistance

One of the five biggest technology companies in the world, Google, Apple, Facebook, Amazon, Microsoft and Baidu are each competing to create their own virtual assistants, your personal guides to help navigate the digital world. They are all 'artificially intelligent', which means they understand what you're asking for, and learn your preferences, almost like a human assistant.⁴⁹ Soon to join this race is Samsung which has acquired Viv Labs Inc. a firm run by a co-creator of Apple Inc's Siri voice assistant program and is soon going to come out with an artificial intelligence digital assistant service for its upcoming Galaxy S8 smartphone.⁵⁰

The first virtual assistant that gained traction in the day to day lives of regular people was Siri. Even though it wasn't the best when initially launched, it showed us what was possible. It has improved over the years, but there are several other. Alphabet Inc's Google is widely considered to be the leader in AI. Google's assistant can efficiently search the internet and adjust the user's schedule however setting

it apart is its ability to use images and other information to provide more intuitive results.⁵¹

Even the legal community was jolted with awe when "Ross the AI Lawyer" was introduced with the support of Watson's cognitive computing and natural language processing capabilities. Lawyers can ask Ross their research question and the robot reads through the law, gathers evidence, draws inferences and returns highly relevant, evidence-based answers. It has already received acceptance from the legal fraternity as in the first half of 2016, Ross was hired by Baker Hostetler, a US based law-firm to help the lawyers for legal research.

However a darker side of AI came to light when "Tay" an AI project built by the Microsoft Technology and Research and Bing teams, in an effort to conduct research on conversational understanding went rogue. It was a bot created to interact with people online. The company described the bot as "Microsoft's A.I. fam the internet that's got zero chill". Tay was able to perform a number of tasks, like telling users jokes, or offering up a comment on a picture you send her, for example. But she's also designed to personalize her interactions with users, while answering questions or even mirroring users' statements back to them. However soon after its release Tay was shut down due to concerns with its inability to recognize when it was making offensive or racist statements. Of course, the bot wasn't coded to be racist, but it "learned" from those it interacted with. And naturally, given that this is the Internet, one of the first things online users taught Tay was how to be racist, and how to spout back ill-informed or inflammatory political opinions.⁵²

This spurred the long standing debate pertaining the liability of AI and who is in fact responsible for the disarray it creates in its wake bringing to reality, the age old parable about the creation turning on the creator.

47. <http://thenextweb.com/artificial-intelligence/2016/10/17/deepmind-ai-platform-can-now-learn-without-human-input/>

48. <https://www.technologyreview.com/s/542281/artificial-creativity/>

49. <http://www.telegraph.co.uk/technology/news/11874511/The-race-for-virtual-AI-assistants-is-on-but-the-ultimate-prize-is-you.html>

50. <http://ca.reuters.com/article/technologyNews/idCAKB-N13101Q>

51. <http://www.reuters.com/article/us-alphabet-conference-idUSKCN0Y92HX>

52. <https://techcrunch.com/2016/03/24/microsoft-silences-its-new-ai-bot-tay-after-twitter-users-teach-it-racism/>

4. AI and the Law – Legal & Tax Issues

As a transformative technology, AI has the potential to challenge any number of legal assumptions in the short, medium, and long term. Precisely how law and policy will adapt to advances in AI; and how AI will adapt to values reflected in law and policy depends on a variety of social, cultural, economic, and other factors, and is likely to vary by jurisdiction.⁵³ The most prominent legal issues that arise are as follows:

I. Legal Personality of AI

Legal personhood is invariably linked to individual autonomy, but has however not been granted exclusively to human beings. The law has extended this status to non-human entities as well, whether they are corporations, ships, and other artificial legal persons.⁵⁴ No law currently in force in India recognizes artificially intelligent entities to be legal persons, which has prompted the question of whether the need for such recognition has now arisen. The question of whether legal personhood can be conferred on an artificially intelligent entity boils down to whether the entity can and should be made the subject of legal rights and duties. The essence of legal personhood lies in whether such entity has the right to own property and the capacity to be sue and be sued.⁵⁵

There are a few arguments *against* granting AI's legal personhood:

- *The Responsibility Objection:* That AI's by nature, would not be responsible. This objection focuses on the capability of an AI to fulfill its responsibilities and duties, as well the consequent liability for breach of trust.

- *The Judgment Objection:* That AI entities cannot be trusted to make the judgment calls that humans are faced with in their work. This argument basically follows from the moral dilemma of empowering AI to make decisions which are moral and subjective in nature.

Perhaps an attributable dilemma and discomfort with exploring the idea of expansion of legal personhood, or even going beyond the theory of legal personhood which allows corporations to be held liable, could be because of the uneasiness that concerns the relationship between our concept of legal personhood and our concept of humanity. Thus, any questions in relation to legal personhood are neither easy nor available, but with the increase in technological development which brings with itself the sentient robot, or the conscious machine, will warrant answers to tougher questions soon.

Corporations are a prime example of an artificial person. The legal fiction created for corporates, serves as a good precedent for the argument for granting the same to AI. However, there exists an important distinction between Corporations and AI. Corporations are fictitiously autonomous. Their actions are decided by their stakeholders. AI may however, be actually autonomous. AI's users or even creators, may not be in control of the actions of the AI. The status of AI needs to be examined further and a simple analogy with corporations would not suffice. On the other hand, AI cannot be treated on par with natural persons as AI lacks (i) a soul, (ii) intentionality, (iii) consciousness, (iv) feelings, (v) interests, and (vi) free will.⁵⁶

In order to find a middle ground, Mige Laukyte (“**Laukyte**”), in his paper ‘Artificial and Autonomous: A Person?’,⁵⁷ suggests the possibility of granting AI a hybrid personhood, a quasi-legal person that would be recognized

53. Stanford University, One Hundred Year Study on Artificial Intelligence (AI100), Policy and Legal Considerations, <https://ai100.stanford.edu/2016-report/section-iii-prospects-and-recommendations-public-policy/ai-policy-now-and-future/policy>

54. Mige Laukyte, ‘Artificial and Autonomous: A Person?’ (2012) Social Computing, Social Cognition, Social Networks and Multiagent Systems Social Turn, available at <http://events.cs.bham.ac.uk/turing12/proceedings/11.pdf>.

55. L. B. Solum, Legal Personhood for Artificial Intelligences. North Carolina Law Review, 70: 1231–1287 (1992).

56. L. B. Solum, Legal Personhood for Artificial Intelligences. North Carolina Law Review, 70: 1231–1287 (1992).

57. *Id.*

as having a bundle of rights and duties as selected from those currently ascribed to natural and legal persons.

II. Contractual Relationships

In 1996, Tom Allen and Robin Widdinson noted that *“soon, our autonomous computers will be programmed to roam the Internet, seeking out new trading partners - whether human or machine”*.⁵⁸

A rising concern is that contract law, as it stands, cannot keep up with the rise in technology. While the United Nations Convention on the Use of Electronic Communications in International Contracts recognized contracts formed by the interaction of an automated system and a natural person to be valid and enforceable,⁵⁹ here is now a need for more comprehensive legislation on the subject. An explanatory note by the UNCITRAL Secretariat on the matter clarifies that messages from such automated systems should be regarded as ‘originating’ from the legal entity on behalf of which the message system or computer is operated. This circles back to the debate of giving AI entities a legal personality.

III. Employment and AI

The primary objective behind the growth and development in AI and robotics systems is the demand for automation across a wide variety of industries and sectors. With the ultimate objective of reducing man hours and increasing efficiency, several prominent companies across the world have actively prescribed to the practice of utilizing AI systems as a replacement for the human workforce. This wave of automation, driven by AI is creating a gap between the current employment related legislation in force and the new laws / employment framework that is required to be brought into place to deal with the emerging automation via the use of AI and robotics systems in the workplace. As employers incorporate AI and robotics systems into the workplace, it is pertinent that they simultaneously must adapt their compliance systems accordingly. Therefore a synergy is required between the members of the industry and the regulators to arrive a reasonable and technologically relevant employment framework to address such issues.

58. Tom Allen, Robin Widdinson, ‘Can computers make contracts?’ (1996) 9(1) Harvard Journal of Law & Technology.

59. Article 12, United Nations Convention on the Use of Electronic Communications in International Contracts.

5. Existing Legal Framework in India

I. Status of AI under Indian Law

The Constitution of India is the basic legal framework which allocates rights and obligations to persons or citizens. Unfortunately, Courts are yet to adjudicate upon the legal status of AI machines, the determination of which would clear up the existing debate of the applicability of existing laws to AI machines.

II. Protection of Intellectual Property

When the remarkable extent of creativity and knowledge exhibited by AI is clearly visible, concerns pertaining to IP protection ought to be there in the minds of those enforcing the rights associated with the intellectual property. There is a wide variety of intellectual property legislations which would impact / affect the functioning of AI in India. Such legislations are discussed in detail below.

A. Copyright

In some countries, we can see a conspicuous requirement of creativity, when it comes to the ownership of copyright works. Even Indian Copyright law requires that in order for a 'work' to qualify for copyright protection, it would firstly have to meet the 'modicum of creativity' standard laid down in "*Eastern Book Company and Ors. v.D.B. Modak and Anr*".⁶⁰ In this case, the Court held that a '*minimal degree of creativity*' was required, that there must be '*there must be some substantive variation and not merely a trivial variation*'. From a reading of the test laid down in the aforementioned judgment however, there is no definitive conclusion that may arrived at wherein it may be stated that an AI cannot meet the 'modicum of creativity' as required.

In addition to the above, the second requirement to be satisfied by an AI when it comes to the ownership of copyrighted works is the requirement to fall under the aegis of an 'author' as is defined under the Copyright Act, 1957. This would be problematic as an AI has generally been regarded to not have a legal personality.

Under Section 2 (d) of the Copyright Act, 1957, "*(d) "author" means,-*

"(vi) in relation to any literary, dramatic, musical or artistic work which is computer-generated, the person who causes the work to be created;"

The first issue under the above mentioned definition is its usage of the terms 'the person who causes the work to be created'. Determining who 'causes' a work to be created is a question of the proximity of a natural or legal person to the creation of the 'expression' in the content in question – the more closely or directly a person is involved in creating the 'expression', the more he or she contributes to it, and the more likely he or she is to qualify as a person '*who causes the work to be created*'. As a result of the above, the current legal framework under the Copyright Act, 1957 may not effectively deal with / prescribe for creation of works where the actual creator or a contributor of the 'expression' is not a human or a legal person.

Thus, when it comes to works that are created by AI, their authorship would be contentious under Indian copyright laws. There is no doubt that a human's involvement is required in kick-starting the AI's creative undertaking, however the process to determine who the author / owner is when the AI steps in to play a pivotal role in the creation of the work, continues to remain a grey area.

B. Patents

Section 6 of the Indian Patents Act, 1970 states that an application for a patent for any invention can be made only by the true and first inventor of the invention or the persons

60. Appeal (civil) 6472 of 2004

assigned by such person.⁶¹ Whereas, Section 2 (y) of the Act confines the definition of “true and first inventor” to the extent of excluding the first importer of an invention into India, or a person to whom an invention is first communicated outside India, and nothing further.⁶²

These provisions do not expressly impose the requirement of an inventor to be a natural person. Therefore, from a bare reading of these provisions, it may be interpreted that an AI may fall under the definition of an inventor as provided in Section 2(y) of the Indian Patents Act, 1970. However, in practice the “true and first inventor” is always assumed to be a natural person. Thus, it will be interesting to track the jurisprudence on this front especially the stand taken by the patent office when the “true and first inventor” on the patent application form is not a natural person.

However, AI will certainly play an important role in the evolution of patent law itself. Sophisticated use of natural language processing has been adopted in generating variants of existing patent claims so as to enlarge the invention’s scope. The publication of these patent claims using such technology would help preclude obvious and easily derived ideas from being patented as they will form the corpus of the prior art that is available in public domain.⁶³ If the trend of using such services gains a foothold in the industry, it will substantially increase the uncertainty associated with the enforceability of a patent as the risk of not discovering prior art that invalidates the patent would increase.⁶⁴ As a result, it could be anticipated that AI would be developed to assist in discovery of prior art and correspondingly this would certainly increase the demand of AI (*from a patent law perspective*) in this sector.

61. Section 6 of the Indian Patents Act, 1970

62. Section 2(y) of the Indian Patents Act, 1970

63. Erica Fraser, “Computers as Inventors – Legal and Policy Implications of Artificial Intelligence on Patent Law”, (2016) 13:3 SCRIPTed 305 <https://script-ed.org/?p=3195>

64. Id.

C. Industrial Designs

With the progress of artificial intelligence advancements like Watson, Siri, and Alexa, it can be observed that many companies are working on different forms of smart intelligent machines at present that could aid in its overall and inclusive development. In the process of creation of Industrial Designs where numerous components come together at an effective level to emerge to the final stage, Computer-aided Design and Drafting (CAD) systems have their own limitations confining itself to only geometric models and representations. On the other side, the recent headway in generative techniques where an AI is associated in the process could be a more creative and systematic way of providing mechanical solutions, thereby undergirding the industrial design process.

Section 1(j)(iii) of the Designs Act, 2000 interestingly defines the “Proprietor of a new or original design” as the author of the design and any other person too, where the design has devolved from the original proprietor upon that person. So, how do we successfully determine the rightful authorship if an artificial entity such as an AI is behind the original design? Also, what are the odds of an AI acknowledging the authorship of a design? In addition to that, what is the possibility of authorship of the design being devolved from the AI to a human being, when the AI itself does not have the elementary cognizance as to what a proprietorship/authorship would mean in its strict legal sense? These questions remain unanswered but it is hoped that jurisprudence on the same shall soon evolve.

III. Data Protection

Technology is permeating the society at an ever increasing pace. Everyday more and more devices are being connected to the internet, paving the way to the regime of Internet of Things. It is only a matter of time before advances in AI combined with the use of smart devices would lead to profiling more intrusive than ever before.

Furthermore, with AI systems being increasingly involved in functions such as data analytics, healthcare, education, employment, internet of things, transportation, etc has resulted in AI being able to access a vast repository of Personally Identifiable Information (“PII”). With the ability of AI systems such as Siri, Cortana and FB Lerner Flow to use such PII to identify behavioral patterns of individuals and accordingly put forward a targeted advertising which is preferable to the concerned individual, showcases the extent of the impact that AI systems may have via using PII. However, it must be noted that data / information, while invaluable for generating incisive analytics as specified above would also lead to larger questions pertaining to privacy and resultantly it is important to have an existing / updated framework that adequately address such concerns. Such concerns pertaining to privacy have become more prominent in light of the recent judgment of the Supreme Court in “K.S Puttaswamy & Anr. v Union of India & Ors”⁶⁵ wherein the right to privacy was held to be a fundamental right under the Constitution of India. The Supreme Court also went on the state there is an immediate need for a comprehensive data protection framework / law to be enacted, which is technology neutral and which encompasses / deals with prominent issues such as the growing use of AI in India.

We have provided a short primer on the relevant data protection framework in force in India at present to crystallize the reason for the prominence / spurt of the privacy concerns in India and identify the reason behind the Supreme Court requiring the formulation of a more comprehensive data protection framework in India. Section 43-A of the IT Act, 2000 mandates following of ‘reasonable security practices and procedures’ in relation to the Information Technology (Reasonable security practices and procedures and sensitive personal data or information) Rules, 2011 (“SPDI Rules”) which was enacted on 13 April 2011. The section per se primarily concentrates on the compensation for

negligence in implementing and maintaining ‘reasonable security practices and procedures’ in relation to ‘sensitive personal data or information.

The criteria as to what would constitute Sensitive personal data or information of a person is provided under Rule 3. Information that is freely available or accessible in public domain or furnished under the RTI Act cannot be categorized under the same.⁶⁶

Under the Rules, if it is for a lawful purpose, a body corporate is required to obtain prior consent from the information provider regarding the purpose of usage of the information collected. The body corporate is also mandated to take reasonable steps to ensure that the information provider has knowledge about the collection of information, the purpose of collection of such information, the intended recipients and the name and address of the agency collecting and retaining the information.⁶⁷

The body corporate has to allow the information provider the right to review or amend the SPDI and give the information provider an option to retract consent at any point of time, in relation to the information that has been so provided. In case of withdrawal of consent, the body corporate has the option to not provide the goods or services for which the concerned information was sought.

However, there have been several questions that have arisen with regard to the effectiveness of the SPDI Rules recently, due to the fact that the compliances set out under the SPDI Rules were restricted only to certain kinds of information and there is no protection as such for information that does not fall under the definition of SPDI.

In addition to being highlighted in the above mentioned judgment, similar privacy concerns have been brought to the forefront with the institution of the following suit before courts in India, namely:

66. Rule 3 of the Information Technology (Reasonable security practices and procedures and sensitive personal data or information) Rules, 2011

67. Rule 5 of the Information Technology (Reasonable security practices and procedures and sensitive personal data or information) Rules, 2011

65. Writ Petition (Civil) No 494 OF 2012

- “Karmanya Singh Sareen & Anr. v. Union of India Ors.”, wherein the manner in which consent for the collection and sharing of sensitive data of consumers by WhatsApp and Facebook was also challenged under the grounds of being in violation of Articles 19 (1) and 21 of the Constitution of India.

In light of the Supreme Court judgment in “K.S. Puttaswamy & Anr. v Union of India & Ors”⁶⁸ which enumerated the need to formulate a comprehensive data protection framework, the Ministry of Electronics and Information Technology (“MeitY”) has constituted a committee of experts in July 2017, under the chairmanship of Justice B.N. Srikrishna to identify key data protection issues in India, to recommend methods of addressing such issues and to prepare a draft data protection bill that may be introduced in the Indian Parliament. The final report issued by the aforementioned committee has to be looked at in detail to determine the impact of the proposed data protection framework on AI in India.

IV. E-Contracts

The validity of contracts formed through electronic means in India can be derived from Section 10 A of the IT Act. Electronic contracts are treated like ordinary paper contracts, provided they satisfy all the essential conditions in the enforcement of a valid contract such as offer, acceptance, consideration, etc. The IT Act also recognizes “digital signatures” or “electronic signatures” and validation of the authentication of electronic records by using such digital/ electronic signatures. The contents of electronic records can also be proved in evidence by the parties in accordance with the provisions of the Indian Evidence Act, 1872. With the advent of smart contracts i.e. contracts capable of enforcing a contract on their own, an additional debate has arisen with regard to enforceability against an AI and it is to be determined how this issue will be resolved. It will not always be possible for such contracts to capture all the relevant information from the real world to adequately assess the

situation. The contract will enforce the terms on the basis of its programming which may be inadequate and may cause harm / damage to a party. In such an instance, an aggrieved party may face practical difficulties in enforcing the same in a different country.

In addition, with the growth and development of AI and robotics, the possibility of an AI entering into a contract of its own volition has become more prominent. To assess as to whether such a contract may be considered to be valid in India, reference has to be made to the Indian Contract Act, 1872, to determine as to whether an AI would be regarded to a person competent to enter into a contract along with determining if the specific essentials of a valid contract such as offer, acceptance, consideration, etc., are being satisfied. As the Indian Contract Act, 1872 envisages that only a “legal person” may be competent to enter into a valid contract and as the general rule / practice thus far has been that since robots or machines cannot qualify as natural or legal persons, a contract entered into by an AI of its own volition / accord, may not be regarded to be a valid contract under applicable law in India.

Practical concerns such as court’s ability to understand the terms that has been agreed to will also arise as these terms will be expressed in programming terms that the court may not be acquainted with. The courts will also need to make an assessment whether the terms that has been agreed to have been properly instructed to the AI.

Another major concern with regard to AI is lack of a conscience. A contract to kill can be enforced by a smart contract in which funds are released to the shooter provided he feeds in the proof of death via some biotechnology based contraption. It needs to be ensured that such technology standards are developed and put in place that prevents enforcement of similar contracts.

68. Writ Petition (Civil) No 494 OF 2012

V. Duty / Standard of Care

A pertinent issue that arises with regard to the interplay between AI and law is the duty / standard of care expected from an AI and the implication when such standards are not met and there is damage / harm caused as a result. The determination as to the duty / standard of care expected from an AI becomes additionally relevant from the perspective of imputing responsibility / liability upon an AI for a supposedly negligent action.

Currently, the law treats machines as if they were all created equal, as simple consumer products. In most cases, when an accident occurs, standards of strict product liability law apply. In other words, unless a consumer uses a product in an outrageous way or grossly ignores safety warnings, the manufacturer (and those associated with the product) are usually considered at fault.

“However, when computers cause the same injuries, it is to be evaluated whether the standards of strict liability can be applied at all times, this distinction has significant financial consequences and corresponding impact on the rate of technology adoption.

The essentials of negligence are as provided below,

A. Duty to take care

One of the essential conditions of liability for negligence is that the defendant owed a legal duty towards the plaintiff and that the defendant committed a breach of duty to take care or he failed to perform that duty.

B. Duty Must Be Specifically Towards The Plaintiff

It is not sufficient that the defendant owed a general duty to take care. It must be established that the defendant owed a duty of care towards the plaintiff.

C. Consequent Damage Harm To The Plaintiff

The last essential requisite for the tort of negligence is that the damage caused to the plaintiff was the result of the breach of the duty. The harm may fall into following classes:-

- physical harm, i.e. harm to body;
- harm to reputation;
- harm to property, i.e. land and buildings and rights and interests pertaining thereto, and his goods;
- economic loss; and
- mental harm or nervous shock.

Specifically with regard to India, with the advent and growth of AI, there is a need for more clarity to be brought about with regard to the law pertaining to ‘negligence’ and ‘reasonable standard / duty of care’.

At present, there is a lack of legal jurisprudence when it comes to “standard / duty of care’ with regard to AI systems along with “product liability” and “the common law tort of wrongful death” in India. As, questions pertaining to the liability of AI systems for negligent actions have been addressed in most jurisdictions across the world under the aegis of the principle of “strict product liability”, it is expected that any guidance or observations by the courts in India with regard to the attribution of negligence on AI systems may be addressed on the same lines. However, even though there are steps taken to address the lacunae under law with regard to AI on the lines of “strict product liability”, issues pertaining to determining the actual manufacturer / owner of the AI due to the extent of automation involved and the imputation / enforcement of liability against AI as discussed below would still persist and remain prevalent.

VI. Enforcement against / Liability of AI

With rampant development in the field of AI, wherein self-driven cars and almost fully-automated machines and robots are starting to enter into use, pertinent legal considerations arise in the form of attributing liability in cases of damage. As discussed above, the assignment of liability is a crucial aspect of granting artificially intelligent entities a legal personality as well. The general rule thus far has been that since robots or machines cannot qualify as natural or legal persons, they cannot be held liable in their own capacity. As one court observed, “robots cannot be sued,” even though “they can cause devastating damage.”⁶⁹ The introduction of highly intelligent, autonomous machines may prompt reconsideration of that rule.

In view of such practice, there is a question of liability in the context of the legal relationship between AI and its developer. Legal norms provide that damages caused by unlawful actions of another person must be compensated.

A. Civil Liability

As Paulius Cerka et al note,⁷⁰ damage is one of the main conditions of civil liability, which must be proven in order to obtain redress. Arguments are put forth that if AI would be fully autonomous (such as super-intelligence), then they must be aware of their actions. If they are aware of their actions, they must be liable for their actions. An AI’s autonomy in the eye of the law means that AI has rights and a corresponding set of duties. In law, rights and duties are attributed to legal persons, both natural (such as humans) and artificial (such as corporations). Therefore, if we seek for AI to be liable for its actions, there is an argument to be made about whether or not legal personality should be attributable to it?⁷¹ Although, in the event AI is given independent

autonomy, the challenge which would continue is the enforcement of rights / obligations against the AI. At this point in time, there are no straight jacket answers, but the jurisprudence on the same would certainly evolve with the passage of time.

B. Criminal Liability

AI’s have become an integral part of modern human life, functioning more sophisticatedly than other daily tools.⁷² However, the question that now follows is whether they could be a threat to our lives. In his science fiction work ‘*I, Robot*’, Isaac Asimov laid down three fundamental laws of robotics: (1) A robot may not injure a human being or, through inaction, allow a human being to come to harm; (2) A robot must obey the orders given to it by human beings, except where such orders would conflict with the First Law; (3) A robot must protect its own existence as long as such protection does not conflict with the First or Second Law. Later, Asimov added a fourth, or zeroth law, that preceded the others in terms of priority: (o) A robot may not harm humanity, or, by inaction, allow humanity to come to harm. While these laws, laid down in 1942, have become quite mainstream both in science fiction and in robotics; there is a large section of the sector who argue that they are now obsolete.⁷³

In 2015, over 1000 AI and robotics researchers including Stephen Hawking and Elon Musk issued a warning of the destruction that AI warfare, or autonomous weaponry would cause.⁷⁴

The main question, as Gabriel Hallevy notes,⁷⁵ is what kind of laws or ethics are to govern the situation, and who is to decide? He observes that people’s fear of AI entities in most cases, is based

69. United States v. Athlone Indus., Inc., 746 F.2d 977, 979 (3d Cir. 1984)

70. Paulius Cerka et al, *Liability for Damages Caused by Artificial Intelligence*, available at <http://fulltext.study/download/467680.pdf>.

71. <http://fulltext.study/download/467680.pdf>

72. Chris Capps, “Thinking” Supercomputer Now Conscious as a Cat, http://www.unexplainable.net/artman/publish/article_14423.shtml.

73. George Dvorsky, *Why Asimov’s Three Laws of Robotics Can’t Protect Us*, available at <http://io9.gizmodo.com/why-asimovs-three-laws-of-robotics-cant-protect-us-1553665410>.

74. Lucas Matney, *Hawking, Musk Warn Of ‘Virtually Inevitable’ AI Arms Race*, available at <https://techcrunch.com/2015/07/27/artificially-assured-destruction/#.wknrl:EnLr>.

75. Gabriel Hallevy, *The Criminal Liability of Artificial Intelligence Entities – From Science Fiction to Legal Social Control*.

on the fact that AI entities are not considered to be subject to the law.⁷⁶ Importantly, he contrasts this fear to the similar unease that was felt towards corporations and their power to commit a spectrum of crimes.⁷⁷ However, with corporations now being subject to criminal and corporate law, this fear appears to have significantly reduced.⁷⁸

Bearing in mind the basic requisites to bring an entity under criminal law: criminal conduct (*actus reus*) and the internal or mental element (*mens rea*), Hallevy proposed three models to bring AI under criminal liability:

i. The Perpetration-via-Another Liability Model

This model does not consider AI entities to possess any human attributes, and instead recognizes the entities' capabilities as a perpetrator of an offence. However, this model limits the entities' capabilities to that of an 'innocent agent', or a mentally limited person such as a child, one who is mentally incompetent, or one who lacks a criminal state of mind. He notes that in such cases, the person orchestrating the offence is to be seen as the real perpetrator. Therefore, for an AI entity the Perpetration-Via-Another would be either the programmer of the AI software or the end user.

ii. The Natural-Probable-Consequence Liability Model

This second model of criminal liability assumes deep involvement of the programmers or users in the AI entity's daily activity, but without any intention of committing an offence via the entity. An example would be the entity committing an offence during the execution of its daily tasks. The important distinction in these cases is that there is no criminal intent on part of the programmer/user. This model assigns liability to the programmers/

user, but in the capacity of them being in a negligent mental state. It assumes that the programmers or the users should have known about the probability of the forthcoming commission of the specific offence, and hence holds them to be criminally liable.

iii. The Direct Liability Model

This third model does not assume any dependence of the AI entity on a specific programmer or user, but focuses on the AI entity itself. It states that should the *actus reus* as well as the *mens rea* of that offence be fulfilled, the AI entity would be liable as if it were a human or a corporation. The challenge, as he notes is the attribution of specific intent, as the external element of a crime would be easy to prove.

Criminal liability on an AI does not replace the liability that might fall, if at all, on the programmers and the users. Instead, the AI would be held liable along with the programmers and users. The three models described above are to be considered together, and not separately; and determined in the specific context of AI involvement.

VII. Punishment Considerations

The biggest issue that the assignment of liability faces is how to penalize the entity for its wrongdoing. A number of questions arise: If the offence under which the entity is convicted prescribes punishment, how would the entity be made to serve such a sentence? How would capital punishment, probation, or even a fine be imposed on an AI entity?⁷⁹ When AI entities do not have bank accounts, is it really practical to impose upon it a fine? Similar problems were faced when the criminal

76. *Supra* note 51.

77. John C. Coffee, Jr., "No Soul to Damn: No Body to Kick": An Unscandalised Inquiry into the Problem of Corporate Punishment, 79 MICH. L. REV. 386 (1981).

78. *Id.*

79. *Supra* note 69 at 194.

liability of corporations was debated, and it is suggested that just as the law adjusted for corporations, it will for AI entities as well.⁸⁰

What Hallevy suggests,⁸¹ is that there are certain parallels to be drawn between existing penalties of contravention of the law and what an AI may be subjected to:

- a. *Capital Punishment*: If the offence involves capital punishment, perhaps the deletion of the AI software controlling the AI entity would incapacitate the entity, achieving the same end as capital punishment.
- b. *Imprisonment*: Incarceration is one of the most popular sentences, and its purpose is to deprive the prisoner of human liberty and the imposition of severe limitations on freedom of movement.⁸² Hallevy notes that the 'liberty' or 'freedom' of an AI entity includes the freedom to act as an AI in its relevant area.⁸³ He therefore suggests that perhaps putting the AI out of use in its field of work for a determinate period could curtail its freedom and liberty in much the same manner.
- c. *Community Service*: Should the offence be of community service, the AI entity could be put to work in the area of choice to be of benefit to the society.
- d. *Fines*: The imposition of a fine on an AI entity would be wholly dependent on whether the entity possesses its own property or money. In the event that the entity does not, it is possible that a fine imposed upon an AI entity could be collected though the provision of labor for the benefit of community.

While the above are only ideas / propositions, one can always argue that these are in no manner similar to the criminal sanctions as imposed on a natural person. Thus, the

questions continues on whether AI can be given an independent autonomous status which can be held responsible for its own acts.

VIII. Tax considerations

Developments in the space of technology and internet has posed several challenges to the traditional principles of taxation. Broadly, the law of taxation revolves around the determination of 'who' should be taxed and 'where' should that person be taxed in respect of a transaction. However, with the evolution of technology and digitization the determination 'who' and 'where' has become increasingly difficult. Such determination is likely to get more complicated with the onset of AI, particularly due to the possibility of it being accorded the status of a person in law. In this section, we have explored tax implications of AI / in relation to the use of AI.

A. Income Tax Considerations

Taxation of income in India is governed by the provisions of the Income Tax Act, 1961 ("**ITA**"). To being with, entities or individuals can be taxed under the ITA only if they qualify as a 'person' under the Act.⁸⁴ The ITA contains separate rules for taxation of resident and non-resident 'persons'. Residents are subject to tax in India on their worldwide income, whereas non-residents are taxed only on income sourced in India. However, non-residents, who are resident of a country with which India has signed a tax treaty, have the option of being taxed as per the relevant tax treaty or the ITA, whichever is more beneficial.

As of now, no law in India recognizes artificially intelligent entities to be 'persons'. Besides, any income which is earned by AI / use of AI, is eventually realized by either the programmer or the user of the AI, who qualify

80. John C. Coffee, Jr., "No Soul to Damn: No Body to Kick": An Unscandalised Inquiry into the Problem of Corporate Punishment, 79 MICH. L. REV. 386 (1981).

81. *Supra* note 73

82. David J. Rothman, *For the Good of All: The Progressive Tradition in Prison Reform*, HISTORY AND CRIME 271 (James A. Inciardi & Charles E. Faupel eds., 1980);

83. *Supra* note 69 at 197.

84. Section 2(31) of the ITA defines 'persons.'

as 'persons' under the ITA. Hence any income which is earned by AI / use of AI should be taxed in the hands of the programmer / user who eventually realizes that income.

That said, there is a likelihood that in the years to come, AI may be accorded the status of a 'person' under law (including under the ITA) and be subject to tax itself, instead of its programmer / user. This is because, unlike corporations which are *fictionally* autonomous, AI is *actually* autonomous, i.e. after a point, the programmers of AI do not control it and all the activities are performed by it based on its own intelligence. While attributing the status of 'person' to AI is a likely possibility, such attribution would not be free from challenges and complexities. For instance, as discussed earlier in this research paper, AI is substantially different from the already existing concepts of legal and natural persons and a middle ground may need to be evaluated which balances the nuances of a legal and natural person to classify it as a 'person.' Further, if tax is imposed on AI by classifying it as a 'person,' questions such as (a) what part of the profits earned through the use of AI would constitute AI's income, (ii) the capacity and the ability of AI to pay taxes, (c) how would recovery proceedings be initiated AI etc. are likely to crop up. In response to such questions, thoughts such as attributing the theoretical (imputed) income to such AI's and taxing them in the hands of the programmer / users, taxing the AI by way of availing their services have already surfaced and it would be interesting to track the legal developments on this aspect in years to come.

The nuances of taxing the programmers / users who earn income through AI or the AI itself have been analyzed below -

i. **Business Income:** If the legal developments on this aspect culminate into the programmer / user of the AI being taxed on the income earned through the AI, then the business income earned by such programmers / users would be taxed as per the existing principles for business income taxation. On the other hand, if AI is attributed the status of a 'person,' then it would be subject to tax on

any business income earned by it as opposed to its programmers / users. In case of latter, questions such as whether the entire income earned by the AI should be taxed in its hands or whether the income should be apportioned between the AI and the programmers/ users may come up.

Currently, business income tax on domestic companies is 30% and in case of foreign companies it is 40%.⁸⁵

- ii. **Capital Gains:** Capital gains are the gains which result out of the transfer of a capital asset in the hands of the transferor. Under the ITA, capital gains are calculated as the amount by which the full value consideration received for the transfer of the capital asset exceeds the cost of acquisition of the capital asset. Whether the gains arising out of the transfer of AI would constitute capital gains and be subject to tax depends on whether AI falls within the definition of capital asset under the ITA. While the definition of capital asset⁸⁶ is very wide and includes within its ambit, intangibles, only time will tell if courts read the definition of capital assets to include AI. Further, even if AI does constitute capital asset, other considerations such as how to compute the fair market value of the AI etc. will become relevant. The domestic rate of tax on capital gains primarily depends upon whether they are long term or short term and varies between 10% to 40%.⁸⁷ However, if either of the parties (transferor or transferee) is a non-resident, the impact of tax may be minimized by availing treaty benefits, if available, provided both parties are able to establish their eligibility to the relevant tax treaty.
- iii. **Royalty or FTS:** While AI is capable of imitating intelligent behavior and functioning on its own, its origin involves the putting together of certain computer

85. Rates mentioned herein are exclusive of surcharge and cess, as may be applicable.

86. Income Tax Act, Section 2(14).

87. Supra note 2

algorithms and softwares. Hence, if the programmers of AI grant the 'right to use' it for a consideration, then the consideration may constitute *royalty*.⁸⁸ This is because grant of right to use AI may qualify as the grant of the right to use software, the consideration received for which constitutes royalty as per the ITA. Further, the consideration received for provision of any managerial, technical or consultancy services associated with the grant of the right to use AI may constitute fees for technical services ("FTS"). For royalty / FTS to be paid to a non-resident, the payer is required to withhold taxes at the rate of 10%⁸⁹ before making the payment subject to tax treaty relief, if applicable.⁹⁰

B. Permanent Establishment Considerations

Under the ITA, business income of a non-resident is taxable in India (at the rate of 40%⁹¹) if it accrues or arises, directly or indirectly, through or from any 'business connection' in India. Similarly, under the Indian tax treatise (double taxation avoidance agreements), the business income of a non-resident is taxable in India if the business is carried out through a Permanent Establishment ("PE") in India (at the rate of 40%⁹² to the extent attributable to a PE). Generally, a PE is constituted if a non-resident carries on business in India either through a fixed place of business (office, branch, factory, work shop) or through employees / dependent agents.⁹³ When a non-resident provides services in India through the use of

AI situated in India, questions may arise as to whether it would constitute a PE, particularly, a dependent agent PE. A typical example of this would be a foreign service provider who provides services in India through the use of artificially intelligent robots situated in India. Further, even if the AI robot is not located in India, it may constitute a PE in India if the internet connectivity of the robot is directly linked to a server located in India. In case of the latter, the discussions around whether servers/websites constitute a PE become relevant.⁹⁴ Since the jurisprudence on this issue is still evolving, what activities may constitute a PE is still not very clear.

C. Robot Tax

The global community has been evaluating the consequences of the widespread emergence of AI. One school of thought argues that the development of robots would create various positive outcomes by replacing humans for repetitive and dangerous activities leading to greater efficiency of humans. The other school of thought argues that AI, having the capacity to improve their skills and imitate intelligent behavior, may replace human beings and render them unemployed. As per the latter school of thought, AI is likely to impose a huge social cost as unemployment would be followed by disappearance of revenue (salaries / consultancy fees etc) and impose a huge burden on the state to support the increasing number of unemployed people.⁹⁵ In order to mitigate this social cost, various scholars around the world, including Bill Gates, are advocating for Robot Tax. The intention behind imposing Robot Tax is to use it as a social tool to slow down the process of automation and thereby displacement of human beings. In other words, it is intended to smoothen the transition process by affording adequate time

88. Explan. 4 of Section 9(1)(vi) of the ITA: For the removal of doubts, it is hereby clarified that the transfer of all or any rights in respect of any right, property or information includes and has always included transfer of all or any right for use or right to use a computer software (including granting of a licence) irrespective of the medium through which such right is transferred [Emphasis Supplied].

89. Supra note 2

90. Income Tax Act, 1961, Section 115A

91. Supra note 2

92. Ibid.

93. Article 5 of Tax Treatise generally contain the definition of PE.

94. Please refer to the tax section of our research paper on Internet of Things

95. Xavier Oberson, Taxing Robots? From the Emergence of an Electronic Ability to Pay to a Tax on Robots or the Use of Robots, Vol. 9, World Tax Journal, IBFD (2017).

for the human beings to find alternative ways of earning income. While no precise method of taxing robots has been developed, some thoughts that have emerged globally include taxing programmers / users on the profits that they make out of using AI, disallowing any expenditure which may be incurred for the use of AI, imposing fees on the use of AI to earn profits etc. South Korea is the first country that imposed Robot Tax as recently as August 2017. The model that South Korea has adopted is to disallow any expenditure incurred on automation / use of AI. Whether other countries are going to follow suit or improvise on the methods of imposing Robot Tax or not impose it at all, are questions which are going to be answered only in due course.

D. International Consensus

The advent of AI is a global development. For cross border transactions involving AI, international tax issues such as double taxation, double non-taxation, transfer pricing, aggressive tax planning etc. are likely to be aggravated. In order to harmonise the principles of international tax which may be applicable to AI's across the globe, global organizations such as the United Nations ("UN"), Organisation for Economic Co-operation and Development ("OECD") should start working towards developing model principles for taxation of AI's, which could be incorporated in tax treatise / used as a base by countries to develop their domestic laws on taxation of AI's.

6. Conclusion

The penetration of self-driven cars, robots and fully-automated machines, which are currently being used in various economies around the world, is only expected to increase with the passage of time. As a result, the dependency of entities and individuals on AI systems is also expected to increase proportionately.

This may be evidenced from the fact that AI is expected to bolster economic growth by an average of 1.7% across various industries by 2035.⁹⁶

However, in order to safeguard the development and integration of AI systems with the industrial and social sector, it is important to ensure that the current concerns that exist with regard to AI systems are appropriately addressed. The most prevalent issues being (i) the issue of imputation of liability or in other terms the issue of holding an AI to be responsible for its actions; and (ii) the issue pertaining to the relationship / interplay between ethics, the law and AI and robotics systems.

Whilst addressing the aforementioned, it would be imperative that the regulators undertake a reasonable and balanced approach between the protection of rights of citizens / individuals and the need to encourage technological growth. Failure to do so may either impact the protection of rights or on the other hand may adversely impact creativity and innovation. In addition, the regulations should also undertake steps to provide for guidance / clarity as to the rights and obligations of programmers or creators of AI systems, in order to crystallize the broad ethical standards to which they are required to abide to whilst programming / creating AI and robotics systems.

Due to the lack of legal jurisprudence on this subject, it is hoped that in the near future legal and tax principles are established which will not only foster the development of AI but also ensure that the necessary safeguards are in place.

96. <https://www.forbes.com/sites/louiscolombus/2017/06/22/artificial-intelligence-will-enable-38-profit-gains-by-2035/#2f7f30da1969>, last accessed on September 26, 2017

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