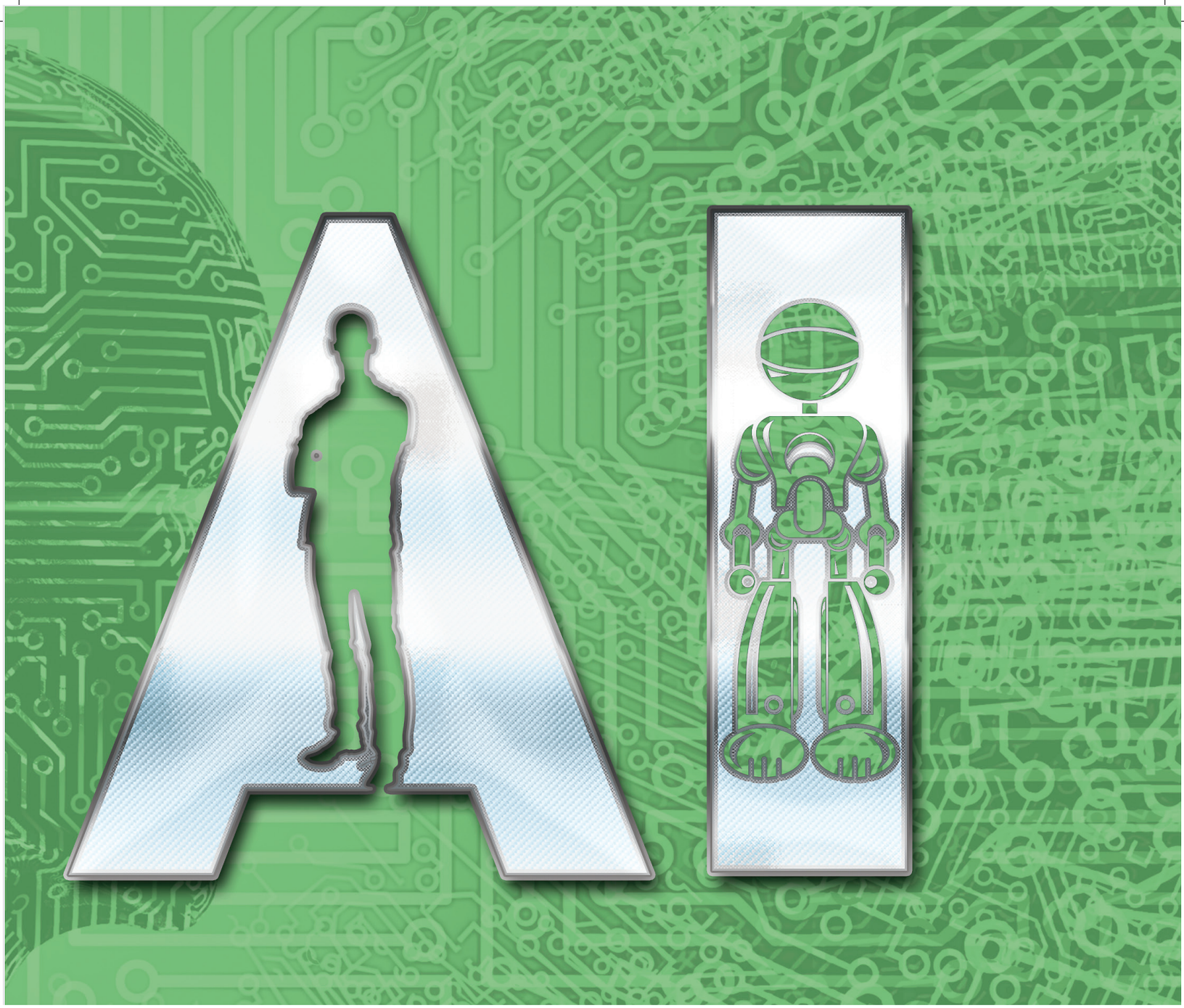


Perils and perks

Will human expertise find relevance in the AI landscape?

✦ RAJENDRA SONAR, IIT BOMBAY

Although academicians, researchers, and select industry players have been working on AI for many decades; but the industry and media picked up AI only recently, and now everyone is talking about it. Maybe such technologies were sitting in the labs but are now poised to become mainstream systems with advancements in technologies and firms like Microsoft, Google, and Amazon making them more accessible. However, many who are exploring AI for business or otherwise have only limited knowledge of it. Experts have extreme views: pessimistic as well as optimistic about the future of AI and its impact on mankind. We have seen that for many, machine learning and chatbots are the end of AI—they limit their knowledge to image recognition, voice recognition, searching relevant things, and NLP.

One has to understand what AI can do well and what it cannot, and what humans can do well and what their limitations are. AI developers must understand the basic ways to make machines intelligent, the different techniques and technologies, the kind of data, information, or knowledge they need, the sources of knowledge, and so on.

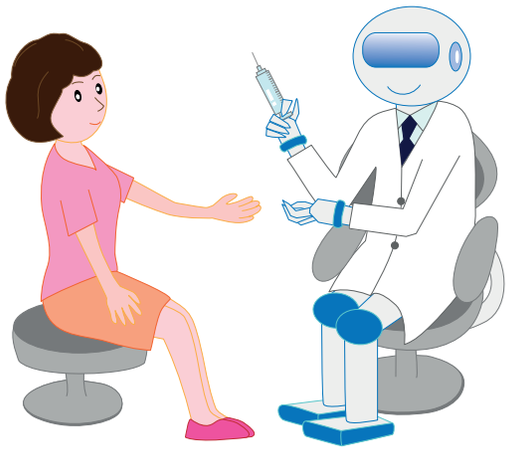
AI has done remarkable progress in many domains like speech recognition, image recognition, beating masters in games, autonomous cars, personalisation and recommendation, general and common knowledge, and understanding transactional instructions. However, understanding deep and contextual domain and functional knowledge remains a challenge.

Where does AI not work? Take the example of character recognition application. Machines understand properly written text or at least text written in a structured way in a line with approximately same sizes to a great extent. However, the moment the positions of letters in the words are changed or their sizes vary, machines fail to understand them (that is why captcha graphical characters are always displayed in random fashion with different shapes and sizes). While human intelligence involves powerful abstraction ability and can recognise even letters in a word shown randomly with variable font types, shapes and sizes. Imagine some more complexity added to the captcha—enter four letters shown in images which are placed at top left and right bottom—and machines will never able to figure it out easily.

Reading sentences in isolation and only matching patterns is not enough, it needs the context behind who wrote or created it.

Human intelligence works with broad focus; it can simultaneously observe images (objects within images), read text, understand audio, and connect them with reference to the context rather than looking at them individually. Even within a picture, we look for various objects and interpret them accordingly. While machines are trained to solve specific problem, such as, software trained to recognise characters will recognise characters of specific language and will not have the ability to understand anything other than that. For example, if there is a picture of a boy brushing his teeth, the machine surely will fail to recognise the baseball-shaped tooth brush as a toothbrush but may recognise it as a baseball bat because it looks at the shape in isolation while human intelligence works in context. The moment we see something near the teeth held horizontally in the hand, we assume it is brushing and at the back of mind we relate 'brushing' with the toothbrush and not baseball. Context itself can have many dimensions such as location, subject, time (temporal), and domain knowledge.

Machines, on the other hand, work great with things that are structured. Machines understand programming languages because they are structured while natural languages are not. English words are interpreted based on context—the same word can have different meanings and this makes NLP and translations fail. The same thing can be said in different ways using a different set of words. For example, the word 'table' in the sentence 'I am looking for help on table style' can refer to furniture table style, HTML table CSS style, or MS-word table formatting. NLP needs to take care of slangs, proverbs, idioms, linguistics, and ambiguity. Fake videos, fake news, fake pictures, and tweets are not easy to identify as machines often fail to understand the difference between fake and real. Reading sentences in isolation and only matching patterns is not enough, it needs the context behind who wrote or created it. Human intelligence always works on context and interprets things in context. Credibility of any news depends on what the news is and the background of the person who wrote it and the source that published it.



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However, there is another side to human intelligence—it varies greatly from person to person, is not consistent or applied consistently, and is sometimes biased and subjective. We tend to forget unless we recall knowledge on a periodic basis. As human beings and natural species, we do have limitations on our physical strengths. We cannot work continuously 24x7 and are prone to fatigue. We have mobility limitations too—we cannot fly, or go to hazardous or tiny places.

Humans can help tackle some of the issues of AI especially in the machine learning context. Human intelligence can be used to guide machines—what to learn and how to learn. Most of us learned through supervised (teacher-assisted) learning (someone taught us 'c' for 'cat'). We should not expect machines to figure out what a 'cat' is by wasting so much of computing power. Rather it makes sense to label cat pictures and training machine learning algorithm to learn what makes a picture to be

Human intelligence—context and abstraction, domain knowledge, broader focus —can be combined with the attributes of machines.

called a cat picture. However, the right expertise should be used to model the knowledge. If somebody teaches you 'c' for 'sing', then you will learn accordingly. Machines need to be trained with rightly labelled and curated data. Understanding things from the natural language text will always be a challenge; humans can help create structured writing and cases (may be handcrafted) to model and learn problems. If machines have the right kind of examples and the right kind of contextual models, then they can learn from cases and analyse a large number of parameters using their computational capabilities.

Experts acquire huge amount of knowledge through experience, which remains mostly in a tacit form, and the same can be used to model operational intelligence by automating it. Almost all domains need human expertise. There are many domains where extensive human expertise is needed such as legal, medical and health, auditing, taxation, and education. Automating knowledge of domain experts and making it available to interns, juniors and to common public who need it. For example, analysing crime cases from various angles, structuring them, and putting them in context, and letting machine learning algorithms to learn. This can help police departments solve similar crime cases quickly. Learning from past experiences, machines can help reduce crime rate, take proactive steps, or make people aware before they become victims. Legal cases/knowledge can be automated to make it available to common people whenever they need it to understand its relevance to their problems. This can help expedite court cases by letting machines retrieve and refer contextually, matching similar cases. Similarly, senior and well-known doctors' tacit knowledge can be elicited and modelled through technologies. Their experience on cases can be documented and digitised and reused to solve problems using technologies like case-based reasoning. This will make lot of practical health and medical knowledge available to junior doctors and people working in the health sector in rural and semi-urban areas. This helps in replication and distribution of precious human expertise at scale and can be used to train juniors thereby accelerating the learning process. However, a major challenge will be in convincing the experts to share their knowledge, then extracting, documenting, and structuring. However, with more and more automation—digitisation, IoT devices, government initiatives like KYC, Aadhar, and medical health record databases—AI will soon be used in these processes down the line.

Human intelligence—context and abstraction, domain knowledge, broader focus—can be combined with the attributes of machines—huge computational capabilities (can learn faster), ability to organise and manage huge amounts data and dimensions, reach, scalability, and ability to learn complex relationships between input-output. This combination can give much better outcomes of AI, and can take care of the present challenges. In short, humans should support machines by providing their tacit and practical knowledge and let them learn and get trained properly with the right set of experiences, and machines should assist humans in taking right, real-time and informed decisions. IM

How human intelligence can supplement AI

Human Intelligence	AI
Creates right, representative, curated, properly labelled and tagged data/cases for supervised learning. Can add conceptual knowledge and heuristics to machine learning.	Can be trained better and results can be reliable and accurate. To a certain extent, can understand context.
Experts can help share their practical domain and functional knowledge.	Knowledge automation and scaling, making it available to masses.
Look at problems from a broader perspective.	Can help in simultaneously look at many aspects and rather than just narrow focus on specific problems.

How machine intelligence can help humans

AI	Human
Automation of various cognitive tasks	Will make them free from mundane and repetitive tasks and focus on more creative and value-added jobs. Bring efficiency, consistency, and transparency in taking informed decisions.
Analyses huge amount of data from GPSs, sensors, and various IoT devices	Help take accurate decisions in real-time. Can help in managing every resource optimally.
Autonomous, mobile, and intelligent devices or vehicles.	Can guide and perform complex tasks which humans cannot do, bring efficiency, safeguard, and augment human beings with disabilities and carry out day-to-day activities intelligently.

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