

Thinking Machines



Art by Google's DeepDream

By CMCL

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HELLO WORLD

Thinking Machines has the purpose of convincing the reader that machines are thinking, and that they are capable of reaching consciousness. It's not science fiction it's reality that has yet to unfold, and it's only when we think of it from this point of view that we concern ourselves with the implication that AI will bring to the way of life.

Today, our life is affected by machinery, and AI in a smaller scale, one way or another easing and simplifying the process by which we do accomplish things. Affecting our economy, society and culture; so when AI is introduced to all of these aspect, and more, on a commercially large scale every aspect of life will be changed once more, as it did the the industrial age.

Unlike before, in the industrial age, we need to concern ourselves with the implications that “thinking machines” will have on our existence.

“By failing to prepare, you are preparing to fail.”

— Benjamin Franklin

I

THE PROBABILITIES OF THINKING

“Just because someone or something thinks differently than you do, it doesn’t mean that it’s not thinking.” — A.M. Turing

“We are unlikely to someday have robots that decide to turn on us, defeat us, make us their slaves, or exterminate us; and just as unlikely to have them befriend us or show us love without being specifically prompted by instructions to do so. This is because such intentional behavior from an A.I. would undoubtedly require a mind, as intentionality can only arise when something possesses its own beliefs, desires, and motivations.”^[2], one with little experience or faith in machines would argue.

Is the mind limited to us? Can we not adapt machines to think as we do therefore giving them our mind? Sure, at the moment we lack the understanding of the very thing we are. Yet, we hold on tight to our theories as if they were the truth. With those very theories we give machines systems modeled after our own minds, and still we say they can’t think. What is it that limits thinking to us, is it perhaps that we’re living?

What is a “*mind*”? Merriam-Webster dictionary defines it as, “the element or complex of elements in an individual that feels, perceives, thinks, wills, and especially reasons”, a definition composed of words which have a almost endless amount of interpretation, words like “feelings”, “thoughts” and “will”.

We live by our will, and our will, in most cases, drives our intent. So how can a machine have a will much more a intent? After all, aren’t those all human aspects that require a consciousness to achieve such a feat? Well, like many of us, our intent is discovery and understanding of all that surrounds us, and that’s just about what machines are being trained to do.

I I TRAINING MACHINES

As I've mentioned before we've reached a point in which we don't program every action a machine takes, but instead we "train" them. The field of machine learning has verily started, and yet our algorithms, which we'd have to manually tinker with before, have evolved into something like that of our own neural networks which form our mind. Machines capable of automating decision making, and much more impressive being able to "think" of why and why not a decision is most appropriate.

Machine learning is a vast and ever growing field which started around the 1950. Today, companies worth billions like Google, Microsoft and Facebook have dedicated teams to the research and development of the field. In the past few years astonishing feats have been accomplished from Siri, a personal assistant reachable from your phone, to AlphaGo, beating top human players in the game of Go which has 2.08×10^{170} moves a feat ahead of its time by decades.

Siri and AlphaGo are two AIs that are worlds apart, both serving a different function. Yet they are one in the same as they're both "thinking machines", and their AI would be classified as weak or narrow. For even when they accomplish feats centuries ahead of predictions they are still simple compared to a strong or general AI. There are major differences between a weak/narrow and strong/general AI, but nevertheless they are both thinking machines.

Weak/Narrow AI, according to the Techopedia dictionary, it's a form of AI specifically designed to be focused on a narrow task and seem very intelligent at it. Has never been viewed as general intelligence, but rather a construct designed to be intelligent in the narrow task that it is assigned to. Techopedia gave a very good example of a weak AI that being Apple's Siri, which has the Internet behind it serving as a powerful database. Siri seems very intelligent, as it is able to hold a conversation with actual people, even giving snide remarks and a few jokes, but actually operates in a very narrow, predefined manner. However, the "narrowness" of its function can be evidenced by its inaccurate results when it is engaged in conversations that it is not programmed to respond to.

Strong/General AI, is a form of AI designed with general intelligence allowing the machine to successfully perform any intellectual task that a human being can do, such as: reason, strategy, puzzle solving, judgment, plan, learn, communicate and

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integrate everything into a common goal. However we have many hurdles before we can achieve such a feat:

1. To autonomously and interactively acquire new knowledge and skills, in real time. This includes one-shot learning — i.e. learning something new from a single example.[\[7\]](#)
2. To truly understand language, have meaningful conversation, and be able to reason contextually, logically and abstractly. Moreover, it must be able to explain its conclusions![\[7\]](#)
3. To remember recent events and interactions (short-term memory), and to understand the context and purpose of actions, including those of other actors (theory of mind).[\[7\]](#)
4. To proactively use existing knowledge and skills to accelerate learning (transfer learning).[\[7\]](#)
5. To generalize existing knowledge by forming abstractions and ontologies (knowledge hierarchies).[\[7\]](#)
6. To dynamically manage multiple, potentially conflicting goals and priorities, and to select the appropriate input stimuli and to focus on relevant tasks (focus and selection).[\[7\]](#)
7. To recognize and appropriately respond to human emotions (have EQ, emotional intelligence), as well as to take its own cognitive states — such as surprise, uncertainty or confusion — into account (introspection).[\[7\]](#)
8. Crucially, to be able to do all of the above with limited knowledge, computational power, and time. For example, when confronted with a new situation in the real world, one cannot afford to wait to re-train a massive neural network over several days on a specialized supercomputer.[\[7\]](#)

While the list of hurdles seems long and tedious do not mistake it for a list of impossible task. For most of the task, if not all of them, are intertwined with humanity's prosperity, meaning, if all of humanity is to prevail it must overcome these hurdles.

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Just as you and I were educated by a school, AIs are also educated. While we have different types of schools such as public, private, homeschool and etc. AIs have different learning methods with different traits, benefits and disadvantages. Schools to us, are like learning methods to AIs.

Supervised Learning, the algorithm is taught or trained from data which is already labeled with the correct answer. The larger the data set the more the algorithm will be able to generalize in a more precise way. Once the training is completed, new data is provided, without the correct response labels, and the learning algorithm uses the past experience acquired during the training stage to predict a result.^[4]

Unsupervised Learning, the algorithm is trained using a data set that has no label; in this case, the algorithm is never told what the data represents. The idea is that the algorithm can find by itself only patterns that help to understand the data set.^[4]

Reinforced Learning, the algorithm learns by observing the world around it. Your input information is the feedback or feedback you get from the outside world in response to your actions. Therefore, the system learns based on trial and error. A good example of this type of learning can be found in games, where we try new strategies and we select and perfect those that help us win the game. As we gain more practice, the cumulative effect of reinforcement on our victorious actions will end up creating a winning strategy.^[4]

Deep Learning, is a particular set of machine learning algorithms that use deep structures of neural networks to find patterns in the data. These types of algorithms currently have a great interest, since they have proven to be extremely successful in solving certain types of problems; as for example, the recognition of images. Many consider that these types of models are those that in the future will lead us to solve definitively the problem of Artificial Intelligence.^[4]

Those are but four of the many methods used to teach machines today, and the field of machine learning is ever growing. It's without a doubt in my mind that reaching the pinnacle of weak and strong AI is only a matter of time, and when such a event occurs we'll need to have machine ethics on par.

I I I

WHAT IS INTELLIGENCE?

“Intelligence, by its very nature is something that cannot be understood but not because understanding it is impossible but because understanding it destroys our perception of it as intelligence.”^[3], does this mean that when we understand how the human mind work we stop becoming intelligent? If not, then what of machines when we give them our thinking process, are they still not intelligent? As A.M. Turing said, “It doesn't matter how it works - if it behaves like a human intelligence then it is a human intelligence.” ^[3]

Two theories of the brain exist namely the **Grandmother Cell Theory** and the **Distributed Representation Theory**. The first theory asserts that individual neurons have high information capacity and are capable of representing complex concepts such as your grandmother or even Jennifer Aniston. The second theory neurons asserts that neurons are much more simple and representations of complex objects are distributed across many neurons. Artificial neural networks are loosely inspired by the second theory. ^[5]

So even when we model machines thinking process after the very thing that makes up our mind we still deny them the right to think. Why is that? One would argue the following:

“All digital computers are binary systems. This means that they store and process information exclusively in terms of two states, which are represented by different symbols—in this case 1s and 0s. It is an interesting fact of nature that binary digits can be used to represent most things; like numbers, letters, colors, shapes, images, and even audio with near perfect accuracy.

This two-symbol system is the foundational principle that all of digital computing is based upon. Everything a computer does involves manipulating two symbols in some way. As such, they can be thought of as a practical type of Turing machine—an abstract, hypothetical machine that computes by manipulating symbols.”^[2]

At the moment our machines are being built with fine metals such as copper, gold, and silicon among other materials, and it's these very materials that limit our machines; but not for long. It's only recently that we've looked into other fields to improve our thinking machines. The field that is of most use to our thinking machines is

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Biology, the two intertwined is commonly referred to as Biotech. A field that has already accomplished various feats from DNA digital data storage to artificial neurons.

“While still in their infancy, **DNA Computers** will be capable of storing billions of times more data than your personal computer. Scientists are using genetic material to create nano-computers that might take the place of silicon-based computers in the next decade.”^[6]

DNA is in four binary code, meaning it processes in 0s, 1s, 2s and 3s that's double the binary then our current machines can process! Double the binary is a feat that solves just about every issue current machines exhibit such as corruption, physical limitations, speed and so much more will be revolutionise by DNA Computers. “One pound of DNA has the capacity to store more information than all the electronic computers ever built; and the computing power of a teardrop-sized DNA computer, using the DNA logic gates, will be more powerful than the world's most powerful supercomputer.”^[6]

“A Turing machine’s operations are said to be “syntactical”, meaning they only recognize symbols and not the meaning of those symbols—i.e., their semantics. Even the word “recognize” is misleading because it implies a subjective experience, so perhaps it is better to simply say that computers are sensitive to symbols, whereas the brain is capable of semantic understanding.”^[2]

COMPARE THE VALUE OF CASH TO THE VALUE OF A WORD/OBJECT AND HOW MOST OF US USE IT WITHOUT REALLY KNOWING THE VALUE BEHIND CASH

What is meaning? Can we define the meaning behind a word? What about the meaning behind a object? Chances are you can't you can say countless uses and descriptions of those words or objects, but you can never truly explain the meaning behind a word much less a object.

Understanding what something is much more the uses for that something is very hard especially when there is a infinite amount of uses for any given thing., so as you can imagine training all uses of one thing to a machine would take months if not years, much more if you're programming such a tedious task. But we don't need such a thing because just as we as children did trial and error so can machines, at a much faster pace at that. Duplicating themselves over and over again until they are in million if not billions of models at any given time. But this has proven to not work for the answer to

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this is not given a machine every possible output but instead a limited amount proven outputs and let it evolve from there. Once a computer learns that flipping the bottle will drop its content out it can apply that same logic to just about any container with the same aspects of a bottle.

Two things we must do to prevent the bad type of AI. First, natural language processing must be developed to the point where communication is pitch perfect and no errors can be found. Second, machine ethics must be universal and much more a democracy allowing everyone a voice. If these two things are present by the time strong A.I. comes to be a thing I'm sure humankind and machine will prevail as one.

What is understood? We've yet to reach a universal consensus on the understanding of understanding. So two questions arise from this, "How can a machine be thought to understand when we do not what understanding means?", well if you break down understanding you can see that it can be represented in multiple fields from physical, ideological meaning you can look at a painting and find a shape that when layered on top of each make the pattern of a face a computer could do just that and so much more finding the shape face and just about any aspect of this art, from the creator the material used to create the art. Understanding the meaning behind something is a bit tricky since we never can get to the objective meaning. For it all depends on perspective but never the less we can come to a consensus that something we can touch is physical and if a computer can come to that conclusion by its own accord then I believe it can reach a meaning behind things that we can never unless specifically told.

Humans are not special meaning we aren't unique since we share many of our traits with others such as mammals and reptiles fish and plants and just as we share traits with our fellow living comrades we too share traits with our creations. The closest thing to us might not be the ape but instead the computer. This is, in my opinion, because we project ourselves onto our creation. Our forms of communicating, arithmetic, physics, feelings and so much more is being projected onto a thing that knows not what it is for now. But it is without a doubt that these things will grow out of our reach into something self conscious.

Do we require ethics, and if so why do we require ethics? I'd say we do, reason being our free will would be the death of us had we not a guiding compass. After all, why isn't it we steal from others when we want what they have? We decide to not steal because of a combination of laws, compassion, beliefs and so much more. These things make up our daily decision making process, and it's all these things that make up our ethics.

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What is decision making? Is it free will? And if so what is free will? Does thinking make us free to do what we please and in turn allow us to decide? Are we fixated on the illusion that we are free? Do we decide to follow based on our ethics or is it something predetermined?

Even today we have models that we've created and are beyond our comprehension.

These words are not unique to us, meaning, they can be used to describe other living and non living creators. For instance, the will of a ant in the retrieval of a grain can be explained and reason with a few minutes of observation.

But I propose to consider the question, "Does one need free will to have ethics?"

Let us first define "*ethics*" Merriam-Webster dictionary defined it as, "The discipline dealing with what is good and bad and with moral duty and obligation.", and I'm sure that just about anyone you ask would agree with this definition. It's only when we ask where we obtain our ethics does everyone's opinion differ.

Socrates, the father of ethics, believes that we humans acquired our ethics through maturity, wisdom and love. If we all obtained are ethics in such away then our moral compass for a good chunk of our life is missing, for we do not always love mature or obtain wisdom. But out counter parts machines have a pool from which we can Socrates was a strong advocate of teaching ethics and acceptable standards of conduct. (REFERENCE)

living beings, have ethics given to us by other entities, who are also living, for instance your moral compass tells you not to rob candy from a baby, because your mother told you otherwise; but had your mother not told you so you might of just stolen the baby's candy.

Natural Language Processing, *NLP*, is a field of computer science, artificial intelligence concerned with the interactions between computers and human languages, and, in particular, concerned with programming computers to fruitfully process large natural language data.

Machine Ethics is a part of the ethics of artificial intelligence concerned with the moral behavior of artificially intelligent beings. Machine ethics contrasts with roboethics,

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which is concerned with the moral behavior of humans as they design, construct, use and treat such beings. Machine ethics should not be confused with computer ethics, which focuses on professional behavior towards computers and information.

With the introduction of the internet new services/media arrived such as social platforms(e.g. Facebook, Twitter, Instagram and etc.) in which we can find a great bulk of information like never before. Not only did new services arrive but old services/media evolved as well things like books, magazines and etc. are now at our reach within just a few seconds, and new medias like videos and images can be shared to millions of consumers with a press of a button. Having access to all of the above and more we can take the facts and opinions of millions, if not billions, of books, magazines, post, blogs, images and etc. then do whatever we please with them. Utilizing such data in a way that we can analyze and determine into the ethics of each individual, and then form a sort of "Ethics Book" that lays laws based on the majority; if not based on the mayor, for whatever reason, then laws will be based in manual/past laws. Thus we can modify and adjust laws to be or previously stated so that one doesn't trample the other nor do we have to manually overview each law when context changes as this would be a automated system.

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