AI: Uselfulness, Disasters and AI vs Humans

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1 Usefulness and Disasters of AI

AI is certainly useful in many cases, first and foremost, in my opinion, as component of Decision Support Systems, for example, in the medical field.

But there are also problematic cases.

I will start with a personal example.

There are some social sites for research, like Academia an Research Gate, but I do not recommend that you look for me over there.

Unfortunately, my name is a rather common one in Italy. I have a lot of homonyms. In this world of inception of A.I. dominance, the robots embedded in those sites pester me asking dumb questions.

Consider a Mathematical book written in French and suppose that you want to translate it to Italian (I make this example because Brezis' Functional Analysis book came to my mind). What you do is to give the job to a translator that knows both French and Italian.

Right?

Completely wrong!

The reason is that it is impossible to translate the book unless the translating person knows French, Italian **and Mathematics**. This is because *you must understand the mathematical content thoroughly* (in the case of the example Functional Analysis) *to be able to make a decent translation.*

Similar remark apply event to a novel, where *understanding the story* is crucial to be able to make a non preposterous translation.

Robots instead make translation locally applying a set of rules, but without understanding a bit of what is going on!

This has hilarious or tragic consequences according to the cases.

Coming back to the homonyms, I tried to explain to the robot in the first place that for a person' name *capitalization does matter.*

I am

Paolo d'Alessandro

So I am not:

Paolo D'alessandro

There is no way to explain to the robot this fact (I tried with no avail). He dumbly executes his algorithm, in which, evidently, an incompetent designer has decided that there is only one way to capitalize a name (first letter capital and all subsequent letters lower case) or, else, that capitalization should be ignored.

But things are much worse than that. I guess even a layman understands that mathematics and poetry are two different things and it is unlikely that the same person writes about, say Functional Analysis and Petrarca (an Italian Poet 1304-1374).

Now look at this example of message I received, among a zillion similar ones, from Academia:

Paolo, is this publication yours? Help us keep your profile up to date.
Petrarca, fam. 16. 6. 3
Paolo D'alessandro
1994
Add to Profile / This Is Not Me
Adding this paper will upload it to Academia.edu.

I am pestered by similar messages almost daily.

R. Penrose is among the scientists who work on this issue is skeptical about certain pretended capacities of A.I.. An A.I. product does not understand what is going on at large, he only applies a dumb algorithm locally. It does not understand a story, let alone Mathematics.

I will get back to this issue in more formal terms, but for now I will look informally to the general and real world picture.

So how does instead a mathematician works? How can he select open question that are relevant and invent theory that allows to solve a mathematical mystery? I am absolutely convinced that there is huge weight of non-formal work in the activity of a mathematician.

This non-formal work is based on the exploitation of mental capabilities like *understanding, like* the capacity of *abstraction*, of *intuition*, of *conjecturing based on intuition*, *phantasy* (yes *phantasy*!), *creativity*, which allows to *conceive new theories*. These capacities are instrumental to investigate and possibly solve an open question, and *achieving insight*, along this whole process.

And after conjecturing a mathematician devises a tentative proof of a conjecture. Then verifies if the proof is correct or not, and, if not, the insight so achieved can lead to a new proof or a more logical conjecture or even a more advanced version of the theory or a downright brand new tentative theory. After much efforts (which can take years) he/she possibly solves the mystery giving the right proofs of some conjectures involved in the theory has conceived.

Now I contend that none of this mental activities is algorithmic. How could one possibly create and algorithm that reproduces understanding, the abstraction process, intuition, the capacity of conjecturing, of fantasizing, that of understanding when a proof goes wrong what line of thought is necessary to fix

the proof and/or the whole theory, that of achieving insight that drives further research, and that of inventing new significant and useful theories?

The results of the fact that A.I. of not able to understand can range from hilarious to tragic. It is amusing to look at the description of products at say Amazon, typically translated from Chinese. I am collecting them for fun. So, to give a taste of it, a mast foot becomes a windsurf sock!

So let's foresee a scenario where robots take over and become the unique interface between any organization (that it be a company or a public office or a government institution) and us.

We can already envisage the result when we call a provider e.g. of our cell phone services and, after a lot of time of waiting and messing with menus, finally, to start with, you talk with a bot. Which initially makes a lot of pleonastic questions about data the he already knows, just so that you waste more time, and then ask how he can help you. You tell him how and the bot says: "could you repeat?". You repeat and the bot says: "could you tell me this in different words?". At this point you try: "go to the hell" and the bot answers:

" I am not qualified to answer this question. I will pass your call to a human operator".

You finally speak with a human being, which understands and solves your problem in a second.

Bottom line: you wasted a lot of time, and time is the most precious resource we humans have. Dante Alighieri comes to my mind:

Che perder tempo a chi piu' sa piu' spiace

Moreover, you are unnerved and discouraged to call again (which is what they want).

Now suppose you get rid systematically of the human override, and you have a clear picture of the *next middle age of doom and gloom awaiting mankind.*

No one can solve any bureaucratic issue anymore, like those about homonyms, that it be with a company an institution or the government. Total chaos takes over and each one of us will be persecuted because of ambiguity and unsolved issues. We will become an humanity of all mister K, the *hero of Kafka's novel "The Process"*, which eventually will be executed on behalf of bureaucrats (in this case of robots).

But there is much more. Think of autonomous drive cars that clash to each other or jump on pedestrians, or dark A.I., or the dangerous consequences of an information dominated by A.I. (even at the level of international relations) and the so many other problems stressed in the media.

Not understanding, as explained above, is by no means the only fundamental concern about A.I.. My impression, although after I participating to a Congress long time ago I have not being active on this field anymore, is that the revival of A.I. is more due to availability of powerful hardware than progress on the foundations.

In 1989, in the paper [3], we argued that a decision support systems should be designed endowing by a sort of emulated self-awareness and discussed how

this goal can be achieved. Such sort of emulated self-awareness could provide the picture of an issue at stake in a larger perspective, if not surrogate a real understanding.

But can machines have selfawareness and really understand? I don't think so.

The cited paper initiated citing the following pense' by Blaise Pascal about selfawareness and thought:

"L'homme n'est qu'un roseau, le plus faible de la nature, mais c'est un roseau pensant. Il ne faut pas que l'univers entier s'arme pour l'écraser; une vapeur, une goutte d'eau suffit pour le tuer. Mais quand l'univers l'écraserait, l'homme serait encore plus noble que ce qui le tue, puisqu'il sait qu'il meurt et l'avantage que l'univers a sur lui, L'univers n'en sait rien.

Toute notre dignité consiste donc en la pensée. C'est de là qu'il nous faut relever et non de l'espace et de la durée, que nous ne saurions remplir. Travaillons donc à bien penser voilà le principe de la morale."

2 Humans vs Robots

The industry working on AI has made a distinction between Strong AI (also called AGI, which stands for Artificial General Intelligence) and Weak AI. Strong AI has the ambition of creating artificial humans, while Weak AI aims at machines that appear similar to humans.

Nevertheless, even the company Open AI, which aims at Strong AI, defines its missions that of creating a: "*highly autonomous system that outperforms humans at most economically valuable work*". A mission which seems to be far away from the idea of Strong AI.

At this point, we have to settle some premises. We anticipate that the debate about the comparison between human and robots struggles to find a formal framework, because it is based on certain idealizations and because of some fundamental lack of knowledge about the issue (in the first place about human mind) .

To begin with, however, we should avoid some obvious misconceptions.

If an human plays chess against a computer running a specific software, we are not comparing a human and a machine, this is just a conventional way to depict the situation. In reality, there is an unaided human player which plays against another human, the person (or team in which case we may think of a idealized human and keep speaking of a human) who has developed the software. Whatever the machine does the human software engineer has done. Thus no machine can surpass humans. We are, so to speak an upper bound for the capabilities of any machine. And if the machine does it wrong (like the autonomous drive cars which invest some pedestrians) the software engineer did, so we should not forget about artificial stupidity as well.

It may be useful for argument sake to talk of machines as they were aliens visiting our planet, provided we do not forget that is just a convention.

Moreover we should explicit a concept, which to some extent has already surfaced.

By human being we don't mean a single man (for example a mathematician) we mean an idealized man which expresses all the collective knowledge and wisdom of mankind, as it has accumulated through the history of human thought, and assume, additionally, that this idealized man has unlimited time and resources. Similarly, by a machine we mean a not just a computer, but an idealized computer, namely a Turing machine, which is an idealized computer (a computer with infinite memory and which can run forever).

In this initial remarks we have also to observe that the span of human intellectual activity is huge and immensely articulated, this has to kept in mind, with reference to the proposed strong A.I..

As another field, which offers further a compelling example of the challenges facing Strong AI, is Art. We have an aesthetic sense, which, for the educated art lover, leads to nearly objective assessments of artistic value, with reasonably universal consensus among experts.

An art lover has also an emotional response when the artistic values reach this extremes. These can result in the Stendhal syndrome or else a sort of hypnoses, whereby the viewer can stop staring at the work of art.

Even if we confine ourselves to this other narrow field of human activity we should ask obvious practical questions.

Can a Robot have this true and not fake artistic sense and emotions? I contend that it can't.

And let us instead confine ourselves to mathematics, which is reductive, but it is the single field which is more promising for the purpose of getting as close as possible to a formalization of the debate. If the proponent of Strong AI want to be true to their goals, they should propose us a machine that enrolls at some university, attend lectures, takes its exams, achieve its degrees in Mathematics up to a Ph.D., writing and discussing successfully a good thesis. And then it has to undertake an academic career, writing and submitting interesting, correct and original papers which pass the peer review process and are published in prominent Journals.

This activity requires all the capacities, which I have listed above, harmonically coordinated, so to be able to create a meaningful, consistent, specifically focused and significant piece of new knowledge.

And then also they have to teach courses with all that it implies designing a course, writing notes, ideating and proposing exercises for home work and tests in class and discussing them with students, and so on. It must as well participate to Congresses, here too with all what is needed for a successful contribution, and then giving a good talk and answer questions.

Can they develop such a robot? I contend that they can't.

In the next Section we will give an overview of the ongoing debate about Humans vs Robots, which unfortunately lacks a true formalization, and is to some extend unresolved, although I have my own firm opinion.

Having given these words of caution I will explain at the same time why, in my view, not only we are an upper bound for any machine, but I am absolutely skeptical about the possibility that his upper bound can be achieved.

I am not a specialist of logic, but I have always attributed great importance the foundation of the field I have been working on, and so, since the beginning, I have devoted some attention and study to this topic.

3 My Views on an Almost Formal Debate

The issue of comparison of A.I. and human mind issue is intimately connected to the work of the famous mathematician and logician Kurt Godel. So without delving in depth into this topic, which would require huge space (and effort) let's try to explain the meaning of two results he discovered, which are involved in the debate on A.I..

3.1 Godel Incompleteness Theorems.

At the beginning of the century there was an intense research activity about the problem of laying a non contradictory formal system, capable to encompass the whole mathematics, or at least almost the whole mathematics, since as we shall see the first case is impossible.

A formal system is made up of a set of symbols, syntactic rules, that allows to write well formed formulas, a set of inference rules and a set of axioms.

A first attempt was made by the mathematician and logician G. Frege. But as soon as the first volume was published (and before the publication of the second), B. Russel objected that there was a contradiction, that is since then called the Russel antinomy or paradox (however, E. Zermelo was aware of that a few years before Russel communicated it to Frege). The formal system proposed by Frege allowed to define the set:

$$y = \{x : x \notin x\}$$

Now it is obvious that $y \in y$ implies $y \notin y$ and $y \notin y$ implies $y \in y$.

It is natural to say that a system is consistent if it is not possible to prove, for any statement formulated within the system, that both the statement and its negation are true (or both false, which can be seen to be equivalent). Now the Russel paradox shows that both $y \in y$ and its negation $y \notin y$ are contradictory and hence false. Therefore Frege's system was not consistent.

Indeed this was not a such a big failure as it might seems. The setback was promptly overcome with the proposal of a number of new formal systems, that were free of any obvious antinomy. The first was proposed by B. Russel and A.N. Whitehead (Principia Mathematica), which has limited follow up nowadays.

Then came the Zermelo Fraenkel (ZF or else ZFC for short, see [4]). We will explain below the difference between ZF and ZFC momentarily. And also the Godel Bernays also called Von Neumann Godel Bernays system (GN or NBG for short, see e.g. [6]) and the Morse Kelley system (MK system for

short, see [5]). The first two are essentially equivalent, while MK is a stronger theory which in fact can prove that NBG is consistent (in this respect read on to make sense of this claim).

Each of these systems can be thought as an axiomatic set theory system and can be essentially seen to be able to encompass almost all mathematics, and in particular all arithmetic.

The kind of reasoning behind the Russel paradox, is similar to that underlying the liar paradox. If I say "I am a liar" in the sense that I systematically lie, I incur in a contradiction. Because if my statement is true, I am not a liar, but also I am a liar. If it is false I am a liar but also I always tell that truth.

Kurt Godel had in mind this sort of reasoning, but he used a modification of it to derive his famous first incompleteness theorem. Note that all this kind reasoning are connected to self-referential statements.

We now state the two incompleteness theorems.

These theorems pose the rather minimal requirement that a formal system at issue contains a certain amount of arithmetic. This is not that important in our arguments. We could say as well: given an axiomatic system that contain enough arithmetic. It suffices to say that the formal system that, in practice, defines the natural numbers (0 and the positive integers) is called the Robinson arithmetic system and is denoted by Q. The Peano system PA adds to Q the possibility of making recursions on the integers, and, finally, PRA stands between Q and PA,because only allows finite recursions.

The first incompleteness theorem runs as follows.

If F is a formal system, which is consistent and contains the Robinson arithmetic system Q, then it can be constructed in F a statement G_F, which is true, but, within F, it is impossible to prove neither G_F nor its negation. In other words, G_F is undecidable within F.

The second Incompleteness Theorem is a consequence of the first and run as follows

Assume that F is a consistent formal system, which contains enough arithmetic (namely the PRA system). *Then the consistency of F is not provable within F.*

Note that, from this result, it follows that, we cannot say that there is a system which we are sure that it is consistent and contains all mathematics (because consistency of the system cannot be proved within the system). However, we might say there is a system, of whose consistence we are reasonable sure and contains most of all mathematics.

In the debate at issue we are more interested in the first incompleteness theorem. Naturally they have both a huge importance, and the second in particular, shattered any hope that a goal proposed by the famous mathematician D. Hilbert proposed within a lecture in 1900. In this lecture he proposed 23 unsolved problems and the second one was to prove the consistency of arithmetic axioms. This is nowadays intended that such a proof must be given within the PA arithmetic, and Godel showed that this is impossible.

3.2 The Debate About Mechanism and AntiMechanism

There is a school of thought, called Mechanism, that maintains that all theorems that an idealized human mind can produce are the output of an idealized computer called Turing machine.

In this respect, we recall that there is a theorem called the isomorphism theorem which states that each axiomatic system F is equivalent to a Turing machine which outputs all theorems valid in F and viceversa each Turing machine is equivalent to an axiomatic system F.

Note that in practice a Turing machine blindly produces theorems without any criterion or general mathematical vision and so it is possible, and even likely, that it does not produce any interesting, non trivial and significant theorem, while mankind is in existence.

Turing machines, albeit they can be more or less suggestive, do not add to the theory of formal systems, and are mentioned here because of the way Mechanism is defined. However, we can and will consider, equivalently, the Mechanistic thesis as the assimilation of the idealized human mind to a formal axiomatic system.

There is as well an Anti-Mechanistic school that refuses the Mechanistic thesis, and some argument against it are based on Godel Incompleteness Theorems. The most prominent advocates of the Anti Mechanism are J.R. Lucas ([7], Godel himself (in an original way) and R. Penrose ([2]).

Here reference is made to the first two, while we will look also at the Penrose work in a future release. The argument of Lucas is as follows.

Godel first Incompleteness Theorem proves that Mechanism is false, because, given a machine, which is consistent and capable of doing simple arithmetic (and so it implements an axiomatic system F), there is a statement (e.g. G_F) in F, which is undecidable, while **we** know that it is true, and so we have found a contradiction to the Mechanistic thesis.

The argument of Lucas appears valid to me, but objections have been put forth by the Mechanists.

The main objection is that Godel's theorem assumes that F is consistent, but we don't know that this is true.

I think this objection is in practice not valid. Since we are talking of an ideal mathematician let's assume that such system is ZFC. Now there is a large consensus that ZFC is consistent. (Besides all mathematicians would not be doing their work if they felt otherwise).

Here are some major reasons to justify this.

First there is a pragmatic consideration. The system dates back to 1930 and in almost a century of history nobody has come out with a contradiction.

Second. There are 9 axioms in ZFC. The first eight are very basic and constructive, so that they are impossible to be questioned. The ninth axiom is the Axiom of Choice.

I would say the Axiom of Choice the true axiom of abstraction and I believe that what Mathematics is all about is indeed abstraction. If you refuse abstraction you refuse mathematics.

In fact, the Axiom of Choice (AC for short) say that if you consider a collection of sets, then you can pick an element from each set (technically this means defining a function, namely the choice function, on the collection of sets). Why this is an abstraction? Because in certain cases we can only to say that this is possible (i.e., the choice function exists) but we cannot construct an example.

So AC is the only unconstructive axiom in ZFC.

Now, although AC is an abstraction, it is overwhelmingly compelling and reasonable, as I think all of us (mathematicians or not) can convene.

But there is much more than that.

You don't like the AC? If you delete from ZFC the AC you obtain the plain ZF.

Now Gödel proved not only that AC cannot be proved in ZF (so that it is independent from ZF), but, and most importantly, he proved a relative consistency result. This result states that if ZF is consistent, then it remains consistent after AC is added to it (so that ZFC is also consistent), and, conversely, if the system ZFC is contradictory, it stand contradictory as well after removing AC, (so that ZF is contradictory).

For me this is more than enough to be strongly convinced that ZFC is consistent.

Incidentally, recall that in MK it is possible to prove that ZFC is consistent, and I have searched in vain for a paper stating that MK is not consistent.

In conclusion, in my opinion, the main objection to the AntiMechanicist statement of Lucas is irrelevant.

It is surprising for me that, given the outstanding contribution of Godel to mathematics, a contribution whose importance goes well beyond mathematics itself, little consideration was given to the fact that Godel expressed in his own way an AntiMechanist stance.

In a lecture in 1951 at the American Mathematical Society, Godel made his famous disjunction statement. It runs as follows (I adapt a little but inessentially to the present context to avoid a technicality about Diophantine equations which is irrelevant for us):

Either the human mind is infinitely superior to any machine, or there exists mathematical problems which are absolutely unsolvable.

Note that it is called disjunction, but the two possibility are not mutually exclusive. However, if one refuses the second possibility, obviously only the first remains. And it is exactly what Godel did. The first alternative comes from the assumption that human mind is not assimilable to any formal system, and the second comes from the fact that if we are, so to say, trapped in a single formal system, there are lots of mathematical problems (like the problem consistency of such system, in view of the second incompleteness theorem), that we absolutely cannot solve.

Now Godel refused the idea that there are mathematical problems, which are absolutely and intrinsically unsolvable, as a consequence of the fact that mathematics is our own invention, and therefore is unreasonable to accept the second possibility. Therefore, he embraced the first and possibility, which defines an AntiMechanist stance.

This is another convincing argument for me to refuse the Mechanist thesis.

Regarding R. Penrose contribution (see[2]) for the moment I only note that we know little about our mind, and Penrose contends that the mechanisms underlying human thought and hence the way our brain functions are to a large extent quantistic (personally I was always convinced of this, ever since I learned about the Na K pumps present in all our cell, which are also responsible of the propagation of signals in our nervous system) and so we have a long way to go in order to clarify them.

I observe that even more mysterious is my interpretation of thought proposed in my article " The meaning of being alive".

Moreover, not only the nervous system, but the whole human physiology is largely quantistic. In fact, as I said, these pumps are in each and every cell. Other examples: our eyes can catch a single photon, hormones have concentrations in the picogram-nanogram/ml range and so on.

But I will cover Penrose work in a forthcoming section, which will also be a review of the cited book.

Anyway I can already draw my own conclusions. In my opinion, the Mechanist thesis is wrong, and so we can rest assured that A.I. will never be capable of building a robot which can substitute a mathematician which is just and only doing mathematics. For that matter I believe that there are many other jobs that it is better to leave to us humans as well.

Lets robots do what it useful for us, provided they do not make any damage.

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References

[1] Roger Penrose, *The Emperor New Mind*, Oxford University Press, 1989.

[2] Roger Penrose, *Shadows of the Mind*, Oxford University Press, 1994.

[3] P. d'Alessandro, M. Dalla Mora and E. De Santis - *Issues in design and architecture of advanced dynamic model management for decision support systems*, Decision Support Systems, 5, 1989, pp. 365-377

[4] G Takeuti and W.M.Zaring, *Axiomatic Set Theory*, Springer, New York, 1982.

[5] J.L. Kelley, *General Topology*, Springer, New York, 1955.

[6] T Banakh, *Classical Set Theory:Theory of Sets and Classes*, arXiv, April 13, 2023.

[7] J.R. Lucas, *Mind Machines and Godel*, 1961, available on line