# Games do not simulate real life

by *Astro Calisi*

The scientific journal *Nature* describes the results achieved by *AlphaGo*, a system based on artificial intelligence, programmed to play Go, a famous game of Chinese origin. The goal of Go is to conquer a larger portion of the board (*goban*) than the one controlled by the opponent, arranging their tokens in such a way that they cannot be captured.

*AlphaGo*, a software developed by *Deepmind*, a computer company controlled by the giant Google, has already achieved many successes playing Go with human opponents. To date, its strength has been to learn the winning strategies by storing data from thousands of matches played by many champions of the game. Now, with great emphasis, comes the news that *AlphaGo* has taken a further step in learning by collecting information from millions of games played against himself. As starting instructions it is given only the basic rules of the game; everything else is learned from *AlphaGo* by playing against himself.

This new learning strategy is presented as an important innovation towards the reproduction of laboratory intelligence, then applicable to real life, since one of the most important aspects when confronted with everyday reality is to know how to act even if you have little data available. According to Demis Hassabis, Deepmind's project manager, the solutions developed by *AlphaGo* can be profitably used in the coming years in the most diverse fields, including scientific and medical ones.

The critical comments following the publication of this article are almost non-existent. I can cite, for the pure love of completeness, the one raised by Pedro Domingos, professor at the University of Washington. According to Domingos, the fact that the program needs to play millions of games in order to acquire the skill of a player is a serious limit. It would be interesting if *AlphaGo* could beat a champion after playing the same number of matches as the champion has played throughout his life.

One may wonder why the need to play more games than a human player should be a limit, especially in the consideration that artificial systems are incredibly faster than us in their operations, so it is to be assumed that *AlphaGo* has taken less time than a champion of the game to develop its skills.

For my part, I think it is essentially misleading that the *AlphaGo* learning, obtained by playing against itself, follows the human learning and that therefore this strategy can have important relapses in the field of artificial intelligence applied to real problems. Go, like chess, is a game characterized by a large number of possible moves, a large number of combinations on the goban (board); so great that not even the most powerful supercomputer today is able to embrace them all. For this reason it is necessary to develop *heuristic strategies*, i. e. a set of guidelines, criteria, partial paths to be used in the face of certain situations on the board, which allow to progressively gain an advantage over the opponent and thus achieve victory.

Let's imagine, however, that we can increase the power of today's computers (in terms of processing speed and memory capacity) by many orders of magnitude - in fact, by a number of orders of magnitude at will. It is unquestionable that sooner or later we should arrive to the point where the computer would be able, for each combination of pieces on the board, to calculate all the possible combinations of moves that lead with certainty to victory. There would be no need to develop any

heuristic strategy, since, at any moment, the computer would have the "vision" of the entire field of possible developments of the game and would be in a position to choose, time by time, the best move. Against such a computer there wouldn't be a game for any human player, however skillful, because it would inevitably be doomed to lose.

What researchers working on the *AlphaGo* project do not seem to understand is that games such as Go or chess represent *artificial*, simplified situations, delimited by some well-defined rules, whose application gives rise to a very large number of possible combinations of pieces on the board. A huge number of game situations, but still *finished*, consisting of possibilities that are all already *given*. This means that an artificial system that operates by processing information based on algorithms is in a position to develop winning strategies, increasing more and more its ability, simply by playing a large number of games against itself.

Real-life situations, on the other hand, do not lend themselves to being circumscribed within rules of conduct or factors that can be defined in an exhaustive way, which make it possible to calculate and predict all possible outcomes. Not only are elements that influence the evolution of real situations not fully determinable (or predictable), but they tend to change over time with the repetition of situations, evolving them as well, increasing or decreasing their influence, transforming themselves into something else or disappearing altogether. This is especially true when human beings are involved, since many of their actions take on a *historical* connotation, changing the way in which certain factors will interact with each other in the future.

In such a perspective, the exponential increase in computer processing capacity beyond a certain limit no longer leads to appreciable benefits. Therefore, it is also scarcely productive to simulate a large number of situations with the intent of obtaining useful indications for subsequent activities. What is lacking, basically, is the possibility for the system to know exactly the outcome of the various attempts made, i. e. to receive *feedback* on the validity of its choices.

In the case of chess and Go, the "closed" logic in which the game takes place makes it possible to calculate precisely where each move leads. There is no possibility of errors or oversights, because the reference framework is fully defined.

In real situations we have to deal with an "open" logic, that is to say with a quantity of information and a number of parameters to be taken into consideration that can never be determined exhaustively. Internally simulation doesn’t produce new knowledge, as the results achieved are marked by a large degree of uncertainty. The only way to know the developments of a given situation is to measure oneself concretely with it, going all the way to see where it leads. But even so, the computer may not be able to properly evaluate the results of its simulation. It could come across new aspects that are beyond its assessment capabilities.

To go further into this limitation, which *AlphaGo* designers seem completely ignore, it may be useful to give concrete examples.

Imagine applying the self-learning methodology developed by *AlphaGo* to translation from one language to another. The system should translate a large number of texts, for example, from Italian to English (or vice versa), on the basis of appropriate algorithms implemented internally, with a view to gradually increasing their skills. However, the system wouldn’t have the ability to assess the quality of the translations carried out in order to make any changes or additions to its reference parameters (if it did, it could only refer to the same algorithms and information data used for translation, thus obtaining full confirmation of the goodness of its work). Only a human being can provide feedback, indicating errors and inaccuracies

The application of *AlphaGo*'s methodology in the medical field, indicated by its designers as a possibility not to be excluded, is subject to the same limitations. Imagine using this methodology as a support to doctors who make diagnoses. Here, too, the system could not increase its competence by simply simulating a large number of diagnoses within itself, evaluating certain symptoms on the

basis of the information and algorithms it has been equipped with. How would the system know if its diagnosis is correct, so as to add new elements to its knowledge, if there is no external factor (a human being) capable of providing appropriate feedback?

With regard to the possibility of using internally simulation in the field of scientific research, which is also ventilated by *AlphaGo*'s designers, it can be said that it is completely unfeasible in the light of the actual way in which scientists operate.

The most qualifying part of scientific research, although delimited by a reference methodological framework, is not carried out by processing data on the basis of pre-existing processes (as is usually the case in computational systems), but by projecting *beyond* what is considered acquired at a given moment. It requires in fact to identify and solve problems (mainly of discordance among facts and theories, or of choice between rival theories), to put forward new hypotheses, to devise new experimental situations in order to test hypotheses, to interpret the results of empirical observations, etc. All this cannot be obtained without a certain amount of *creativity*, a faculty largely irreducible to computation, i. e. the processing of information on the basis of data algorithms.

In such a perspective, one does not understand what contribution can come from a mode of functioning that operates strictly according with the content of its programmes, without ever confronting external reality.

*AlphaGo*'s way of acting could be defined as "autistic", because it is closed in itself and unable to reproduce anything other than the information and procedural rules previously inserted in it. If in games such a mode seems to give results, it is because all the possibilities are already defined at the beginning and the only problem to solve is to overcome the huge number of combinations to be explored in useful times, developing appropriate strategies (shortened assessment courses) that allow to achieve advantages on the opponent.

The real situations do not allow to significantly improve the knowledge possessed by means of simulations carried out internally, since the precise boundaries of the domain in which to make the attempts are missing, with consequent loss of relevance of the results obtained and any feedback obtained from them.

Ultimately, the methodology developed on *AlphaGo* is to be considered a sort of "curiosity", without significant applications in the real world: a possibility that had to be explored anyway, since even from errors, from outgoing paths, science often draws useful cues for its own progress.

[Translation from Italian by the author]