What happened to ‘my’ AI?

Yves Kodratoff

AI in 1975 (mainly in France)

Symbolic learning 2018 (Muggleton et all)

A possible computer-aided creativity?

1. (mostly French) AI in the 1975’

- **AI has not been welcomed in the scientific environment AND computer science itself has still been very unpopular**
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- **Importance of Turing’s Test : (as known in the 1970) : may machines learn enough from humans so as they may be confused with humans?**
- **(people working on AI 1. Interested but never were challenged by it. The few who worked on this topic finally proved that some humans may be confused with computers.)**

1.1 Computer scientists rather focused on the goal of doing better than human-based science

- **A:Computer based discovery of expert system rules from examples:**
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- **Ryszard S. Michalski (U. Illinois / Georges Mason) : († 2007) Inference from examples of rules for a better managing of soya farming.**

- **B: Problem solving :**
- **J-L. Laurière Paris 6 : († 2005) Alice (1976, Paris 6) Solves a problem a specialist (a Paris 6 professor) failed solving and proposed as a challenge to Laurière.**

C: Medicine thyroid cancer surgery :

Ivan Bratko U. Ljubljana: (in this time) uncertain diagnostic brings many useless surgeries (patient’s throat opened with no cancer to see).

Decision trees built rules (a kind wink to Ross Quinlan) are

- slightly less efficient than the best specialists,

- much more efficient than other specialists.

This pushed him at once to ‘ class’medical doctors: exceptional, proper, bad medical doctors.

1.2 Our main problem (especially in France)

finding data bases to work upon. Example of two personal failures: In both cases, the ‘strongest’ rule obtained (in my research group) by a machine learning system have been:

(Judicial data) IF nationality = French AND IF has_a_job = yes THEN sentencing = no.

(Industrial data) IF company = XXX THEN loan limit = undefined (meaning: infinite).

We had to work with ‘toy’ data bases

Hence creation (1989) by Gregory Piatetsky-Shapiro of Data Mining field (KDD 89)

1.3 AI beginning in France

Jacques Pitrat († October 2019)

A generally hostile atmosphere) → the “Science versus pre-Science” argument (together with the comment: “as alchemy has been a pre-science to chemistry”)

….Nevertheless

AI got a welcoming from two influential university professors:

<u>Jean-Claude Simon</u> Paris 6 († 1985 ?) has been able to get from the EU the very first AI research contract (around 1978-9).

<u>Gérard Guiho</u> Paris-South Univ. In July 1981, supported the 1st AI French organized international conference, taking place in Paris-South university, though actually promoted by an English AI seminar (traces on the web?)

Conclusion : Until the 80’ AI has generally been looked upon as a monstrous “white elephant” in France.

All ‘serious’ research domains as linguistic studies, pattern recognition and robotics did not want to be dubbed as belonging to AI.

2. (an example of) Symbolic Machine Learning 2018

- **Muggleton & al. : Machine Learning (2018) 107:1119–1140**
- **Available at : https://doi.org/10.1007/s10994-018-5707-3**
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- **Some recent results in the field of IML (Inductive ML) proved to be a first instance of what a pioneer in ML, Donald Michie, thirty years ago called "Ultra-Strong Learning"**
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- **REF: (Michie, D. (1988). Machine learning in the next five years. In *Proceedings of the third European working session on learning* (pp. 107–122) Pitman)**

Three criteria for Machine Learning classified as *weak*, *strong* and *ultra-strong* criteria.

***Weak* criterion identifies the classical case where the machine learner produces improved predictive performance with increasing amounts of data.**

This criterion is the one actively promoted by what is currently dubbed as "machine learning"

S*trong* criterion additionally requires a learning system providing in a symbolic form its hypotheses.

Ultrastrong **criterion extends the strong criterion by requiring the machine learner to teach some knowledge to a human, whose performance has to be consequently increased to a level beyond that of the human studying the training data alone.**

The computer system has to show three complementary abilities.

The first one is to *generate pieces of programs* that are 'immediately' understandable to a (Prolog trained) human being.

The second one is that the program is able to generate new Prolog clauses (known as "*predicate invention*")

The third is that human beings (normal ones though Prolog knowledgeable) may be able to understand how to handle the invented predicates (they have to be expressed in a human comprehensible way i. e. the computer is able to teach humans how to use them)

The whole process is based on ‘comprehension tests’

An example of comprehension test

(‘target concept’)   p(X,Y) :- p1(X,Z), p1(Z,Y).

p1(X,Y) :- father(X,Y).   (‘program’ to run)

p1(X,Y) :- mother(X,Y).

Father(john,mary).   (‘Data’)

Mother(mary,harry).

BASIC QUESTION: (p(john,harry)?

Compare Turing's test with Michie-Muggleton's:

…

M-M: Are there comprehension tasks in which 'machine comprehension' might increase humans' one (in the context of tasks defined by Prolog programs)?

The point is not that a computer 'does like/better' or not than humans. The point is that humans are able to make use at once of a computer generated information.

Until 2018, there existed no documented attempt has been made to demonstrate Michie's *ultra-strong* criterion.

- **Two groups of students (all Prolog-compatible ones) had to execute 'comprehension tasks' relative to data illustrating 'concepts' that have been generated by a symbolic Machine Learning algorithm.**

An example of comprehension test
Group 1

- **Task 1: Students are tested WITHOUT the machine-generated predicates (and are actually urged to find by themselves which 'sub-concepts' they may need in order to understand the meaning of the target concept). They show then an extremely poor level of comprehension (many wrong answers).**

- **Task 2: the same group of students except that now they are tested while being informed of the machine-generated predicates.**
- **This results in a large increase of correct answers.**
- **(hence they did learn something of the computer generated knowledge)**

Group 2
Third step (control)

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- **Another group of similar students is tested on the same data directly WITH the machine-generated predicates.**

- **Result: about the same amount of correct answers as group tested with Task 2.**

- **Note: 'Obviously, Muggleton had to build definitions of Comprehensibility that where compatible with this kind of experiment.**

3. A possible computer-aided creativity?

- **Ultra-Strong Learning shows that a human person may benefit from the help of a computer system able to generate ('invent') new helpful pieces of knowledge that the same human person failed to generate. This opens a track enabling the thinking that a computer system may suggest new ideas helping a human to be creative (rather: to behave as if he/she was creative).**

What kind of tools need such a system? Is it yet another ‘white elephant’

A few words about Symbiotic Systems

- **Our approach is a try at preparing the fundamentals for *designing automated tools* that help humans performing tasks that require some creative thinking. It may be also be possible that, for some tasks, these tools could be able alone to perform this complex task.**
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- **Symbiotic Systems aim at *formalizing strategic aspects* of human creativeness**

- **Specialists tend to still dispute about what is a ‘system’ and what is symbiosis. Let us use very basic definitions (that could obviously be criticized as to much naïve ones).**
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- **Personal recalls:**
- **My 1963 first programming has been done in the so-called ‘Machine Language’ (where there has been no ‘relative’ numeration).**
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- **This implies being forced into symbiotic programs**

<u>Vocabulary</u>: *Synergy* is a mutually profitable composition of elements (this composition is called a 'system') but their system is not destroyed nor mutilated by separation.

A synergy-based system is usually called a modular system and its 'parts' are called modules.

(What we call…) symbiose-based system is also made of 'parts' (we call 'pieces' instead of 'modules') in which each piece is symbiotic with all other pieces.

“*Symbiosis* **(also called ‘Mutually Beneficial Symbiosis’) is vitally separation-sensitive composition of several parts of a system. By *vitally separation-sensitivity* of a composition, we mean that eliminating one of its parts leads to three possible consequences:**

complete destruction

non-recoverable mutilation

uselessness of the remaining parts

This means that the widely used divide and conquer strategy (that cuts a problem into ‘possibly’ independent parts) does not preserve symbiosis because of its ‘conquer’ side.

Examples:

- Peano's arithmetic for

NAT:NAT = 0 ♦ successor ♦ NAT

If we eliminate one part from this system, for instance 0 or Suc, NAT disappears. (This does not preclude that, outside the problem of the existence of NAT, both 0 and Suc may have a role to play in many cases!)

More examples:

- **Approaches to Physics that tried to put in evidence one general theory of universe, known as 'Theory of everything' (ref. Hawking)**

- **Euclidian geometry**

- **Parents/Children etc.**

an example of (I believe to be) a new problem:

Is human brain somewhat symbiotic? Instead of systematically looking for 'zones' would it not be better to look for a limited symbiosis? Its regeneration properties are known but how much time do they to become effective?

REFERENCES

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