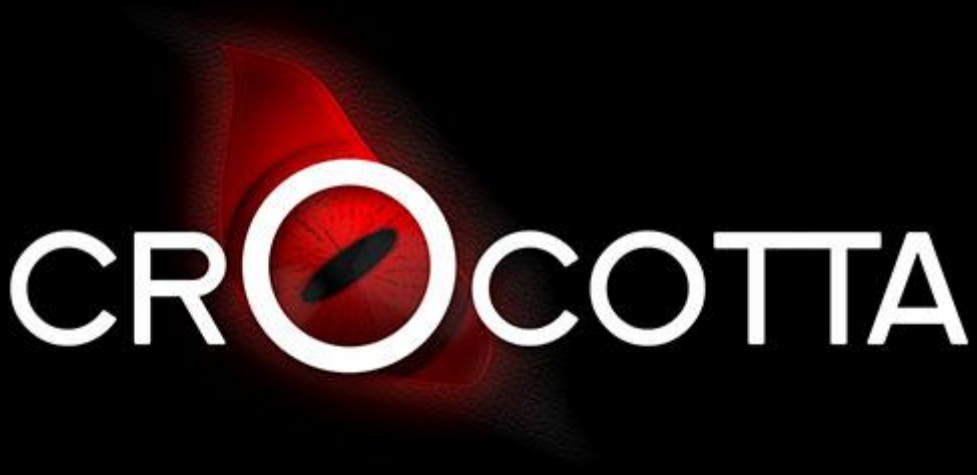

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ARTIFICIAL INTELLIGENCE
AI & ROBOTICS ARE MAJOR RESEARCH AREAS OF THE 21ST CENTURY

By Crocotta R&D

Robert Sugar[1]

FOREWORD

This study addresses the task of creating the next level of AIs applicable across the industries such as robotics, automation, diagnostics, consumer interactions, entertainment, etc. Our interest is focused on five major areas: perception-recognition, problem identification, problem solving, feedback, and learning-adaptation.

To achieve higher level recognition, learning, and problem solving capabilities (to mimic the human intelligence from the low end in other words) is a huge challenge, therefore we have also been studying novel approaches beside the commonly used neural network representations and simple cellular automatons.

So far we have encountered two different forms of intelligence, namely non-conscious and conscious. These forms of intelligence occur in two types, either as biological life forms or electrical devices made by humans. Currently we are aware of no other forms of intelligence, nor did we find evidence of the existence of intelligence (as we know it) beyond the borders of our planet.

WHAT DOES IT MEAN INTELLIGENT?

Somebody or something being intelligent means to have the ability to think. Any form of thinking results in some kind of intelligent action. An intelligent action aims to solve a problem for a goal or to fulfil a desire. The operational meaning of intelligence doesn't necessary require consciousness though.

MIMICKING INTELLIGENCE

Method #1: the cellular automaton

Cellular automata are discrete, as they are composed of a finite or denumerable set of homogeneous, simple units, the atoms or cells. At each time unit, the cells instantiate one of a finite set of states. They evolve in parallel at discrete time steps, following state update functions or dynamical transition rules: the update of a cell state obtains by taking into account the states of cells in its local neighbourhood.

Cellular automata are abstract, as they can be specified in purely mathematical terms and implemented in physical structures.

Cellular automata are computational systems, as they can compute functions and solve algorithmic problems. Despite functioning in a different way from traditional, Turing machine like devices. Cellular automata with suitable rules can emulate a universal Turing machine, and therefore compute, given Turing's Thesis, anything computable.

Method #2: artificial neural network

The inspiration for neural networks came from examination of central nervous systems. In an artificial neural network, simple artificial nodes, called

"neurons", are connected together to form a network which mimics a biological neural network.

There is no single formal definition of what an artificial neural network is. Generally, it involves a network of simple processing elements that exhibit complex global behaviour determined by the connections between the processing elements and element parameters. Artificial neural networks are used with algorithms designed to alter the strength of the connections in the network to produce a desired signal flow.

Neural networks are also similar to biological neural networks in that functions are performed collectively and in parallel by the units, rather than there being a clear delineation of subtasks to which various units are assigned. The term "neural network" usually refers to models employed in statistics, cognitive psychology and artificial intelligence. Neural network models which emulate the central nervous system are part of theoretical neuroscience and computational neuroscience.

Method #3: collective intelligence (our research)

Collaboration between individual lifeforms, which collaboration gives enhanced intelligent capabilities to the collaborating group – the collective – that often outperforms the individual, appears throughout nature. One of the great and most known examples is ant farms.

According to the thesis of Collective Intelligence, shared intelligence can emerge from the collaboration and/or competition of a group of individuals and appear as a sole intelligent decision making system.

We base our research on the thesis of collective intelligence. We propose that the same rules apply on every level in nature, regardless of the complexity of the individual members of a collective, beginning from cell sized lifeforms and ending with human society.

Our approach is to study human society from the point of view of it being a collaborating group. We are looking for behavioural patterns, structure, we are analysing how hierarchies emerge and operate, how the information flow, how the tasks are being distributed, and how the results are being collected.

Our medium term ambition is to setup a few simple models that can successfully emulate basic

- perception-recognition,
- problem identification,
- problem solving,
- feedback
- learning-adaptation

through a collective of semi-complex algorithms (Units) working in a hierarchy that is capable to adapt/restructure itself during back propagation.

Despite our initial findings and concepts, that encouraged us to write this paper, there are still fundamental questions that need to be further addressed, such as:

- How the units specialise – scoring through back propagation then ranking at next task distribution, maybe – to avoid having just general purpose units? In nature individuals do specialise with success therefore it is advised to mimic accordingly.
- To what extent basic definitions and rules need to be hardcoded and the rest to be input through training?

Our models will be based on our observations and processes we copy from social collaboration – mimicking nature.

LAST WORDS

Unlike in the case of cell based collaboration, which developed through our biological evolution and we leave that topic to the neuro scientists, we hope to

get a better understanding of the processes through the social collective, where rather sociocultural evolution plays the bigger role. From our point of view behavioural data and processes (internet/social media, digital archives, public and private organisations) can be better collected and analysed.

We humans have been creating, transforming and structuring our collective in a fully conscious manner since the dawn of mankind, it would be a shame not to understand what and how we did.

REFERENCES

Robert Sugar[1] is a scientist, researcher and IT entrepreneur the same time. He has been starting companies since 1996, ranging from software companies, media companies, computer game developer companies and internet companies.

He was born in 1978, and grew up in Hungary. He graduated in physics at the Lorand Eotvos University (Budapest). First software engineering was just his hobby and later it has become his full time profession. His first development project was about artificial intelligence and graphical visualization for computer games back in 1996. He founded his own game developing studio in 2001 - called Mithis Entertainment - in the heart of Budapest for the purposes of "AAA" game development. From a small group of enthusiastic people, Mithis Entertainment has become the biggest developer studio in Hungary by 2005 and completed four big game titles which were distributed world-wide by well-known multi-national publishers.

Since his departure from the gaming industry in 2006 he has been focusing on the researching of cutting edge technologies.

By Crocotta R&D, October 2015