The Cognitive Machine as Mental Language Automata

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ABSTRACT

This article describes how learning is a native ability of the brain. However, very little is known of the process as it happens. The engineering model presented in this work provides a base to explore the innards of cognition. The computational implementation of the model is usable to assess cognitive profiles by means of machine learning and harmonic filtering. The model relies on an evolutionary dimensional space consisting of phylogenetic, ontogenetic and microgenetic timelines. The microgenetic space reveals the state machine nature of cognition, standing as an internal translator to a brain specific language. The study of this machine and its language is the key to understanding cognition.

KEYWORDS

Automata, Cognition, Engineering, Game, Language, Model

INTRODUCTION

Cognition is the drive of intellectual activity in the mind. It is the pathway where data becomes information, understanding and concept. Moreover, it is the main factor of evolution producing the Homo sapiens sapiens, the very wise man. Although, anatomic evolution leaves its traces, mind evolution cannot be tracked directly. This leaves the study of cognition in the field of behaviorism, where the response to a stimulus is accounted as sign of mind activity. On the other hand, tracking the cognitive process is paramount to understand and optimize the thinking mind development. The best target to cognitive tracking is a model where some feedback from the actual brain process can assert the modelled internal behavior.

The actual complexity of cognitive process lays beyond any attempt to model it in fully fleshed dimensions. A feasible model must focus on a very constrained purpose in order to have tractable dimensions. This work focuses on the study of the learning process, an essential aspect of cognition concerning the development of the individual and the species. An engineering model Hollnagel (2005) is such a proposal where cognition can be reduced to a simple machine. Within the semiotics perspective of cognition, the cognitive process is an unfolding of signs against their meaning. Yielding from this concept, automata turn out to be a suitable machine to construct a model matching the requirements of simplicity and purpose.

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Computational neuopedagogy applies neuroscience to the problem of learning. In the intent to achieve this it produces instruments to assess and intervene in human learning. Intelligent games are examples of such instruments, being computer games developed through a scientific process to achieve introspection into cognitive aspects of learning. They can tap into the unconscious process of learning and interchange information between computer and human cognition.

THE TANGIBILITY OF HUMAN COGNITION

Cognition is an internal process mostly inaccessible from the conscious mind. As Penrose (2014) remarks, consciousness is a process occurring as deep as quantum events in microtubules inside brain cells. The cognition process lies down beneath brain functionality, even more deeper away from consciousness, it belongs essentially to subconscious thought. The hermetic aspect of the particular processes poses as an overwhelming obstacle impeding direct observation with accessible technology for years to come. At psychogenesis level, examination can determine intellectual improvement, once it is a process that occurs in a couple of years. Microgenesis, evolving in the short span of minutes, leaves scarce traces of its whereabouts.

The microgenetic dimension encompasses countless microprocesses that bind in a logical sequence to complete the links of understanding that pertain to human reasoning. If any of these steps are broken, access to information is interrupted due to lack of meaning. When one speaks of microgenetics, there is a range of theories that approach the subject. Inhelder (1992) is co-author of the most accepted theory, largely drawn from the extensive works of her colleague Jean Piaget. Lemos (2014) increases the scope of Inhelder with modern works on this subject.

Microgenetics defines a set of states and a procedure to walk through these states using an internal encoding and processing befit to brain innards. In accordance with the microgenetic theory, the existence of these states and process arise independent of the lack of access to the current states or the mental operations. Regarding the nature and initial installation of the learning machine, it can be said that the distribution is the same for all brains. In contrast, each brain is characterized by an individual formation process, in addition to the cultural interactions that are responsible for reformulating some areas to prevail and others to recede. Inevitably, the theories of microgenesis presuppose the existence of a machine common to all brains capable of stepping through all these states until the cognitive process is completed.

On the empirical side, waywardly to theory expectations, instead of a consistently staging of learning performances, what comes about is a large diversity of cognition abilities scattered among human population. Such diversity sources from the psychogenic formation and matching predisposition of brain abilities from phenotypical DNA expression.

PROPOSAL OF AN ENGINEERING MODEL

An engineering model in psychology refers to an assessment of human behaviour which presupposes that the mind-brain system is a machine. This work states the mind brain system as a language processing machine. In the neural theory of language, Feldman (2009) support this approach.

NTL also suggests that the nature of human language and thought is heavily influenced by the neural circuitry that implements it.

Since language is the very product of its brain circuitry, then a language processing machine is a good fit to represent the mental machine. In computing science, language processing machines are mostly implemented as automata. States in this machine stand for representation levels for a given chunk of language. Since the machine in study is the cognition process, these automata go beyond language parsing level up to the outreaches of understanding. Ensues that linguistics must be the science to provide the basis to define each state for these automata. Simply stated, the proposed
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