The new Theory of Objects and the Automatic Generation of Intelligent Agents

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ABSTRACT

The new mathematical *Theory of Objects* [1] is based on the Matrix Model of Computation, which, in its imperative form (iMMC), can perfectly represent any finite physical system. Transformations exist that convert any iMMC representation into a *canonical* form (cMMC) [1], where the system is represented by a single sparse *canonical matrix of services* C. A cMMC representation can also be directly constructed as a *knowledge base*, either from percepts or from *natural instructions* provided by a teacher [1, p.161]. A learning cMMC develops *intelligence* by automatically forming *objects* from what it already knows and using them to improve its ability to learn, a process known as *scaffolding*.

The theory applies to any system, and establishes that the *profile* of C corresponds to the *internal energy* of the system and the *stable attractors* to the objects in the natural ontology of the system. The *dynamics* of the system is random and dissipative, and is provided by the *Scope Constriction Algorithm* (SCA). SCA minimizes the profile by refactoring the matrix and dissipating the energy, while preserving the canonicity of C and the behavior of the system. Under this dynamics, similar services coalesce into highly cohesive but well differentiated modules, the *attractors*, which represent the objects existing in the system, while the refactored matrix becomes the complete digital *equivalent circuit* of the system. The objects themselves are found in the attractors by the Object Recognition Algorithm (ORA). Objects are characterized by their *stability* and *configuration independence*. If an interaction between objects perturbs them into a disordered state, they will soon recover, perhaps in a different configuration. ORA uses precisely these features to recognize them.

This presentation emphasizes the ability of cMMC to learn, reason, and develop intelligence. The services in the cMMC are logical conjunctions of variables [1, p.159]. If the variables represent sentences in propositional logic [1, p.162], and with the addition of an inference algorithm that converts the sentences into *conjunctive normal form*, *resolution* can be applied for reasoning. Resolution is always sound and complete. Since the cMMC automatically forms objects that can learn, reason, and systematically improve their ability to learn and reason, then the cMMC is a *thinking machine* and the objects are *intelligent agents*. The type of agent depends on what has been learned. Domain-specific learning results in *logic-based* and *circuit-based* agents, method-specific learning results in *bootstrap learning components* specialized for that method of learning. An example is presented where several logic-based intelligent agents are automatically generated.

[1] "A New Universal Model of Computation and its Contribution to Learning, Intelligence, Parallelism, Ontologies, Refactoring, and the Sharing of Resources." Sergio Pissanetzky. Int. J. of Computational Intelligence, Vol. 5, No. 2, pp. 143-173 (August 2009).

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