Specifying Adequate Models of Cognizers

Edward Pogossian [a)]

Institute for Informatics and Automation Problems of NAS RA, Armenia, Yerevan, Paruyr Sevak 1

[a)] epogossi@aua.am

Abstract. Assuming that computer-depended solvers of combinatorial games can be developed to approach the adequate models of human cognizing, what follows is an attempt to argue similar statements, in general, for negentropics, exempted from cellular and computer dependencies. For a type of negentropics, octaves, capable to enhancing the power of cognizing, but so far limited in that, we argue that they can adequately model cognitive development of newborns by Piaget. We also argue that these generalized cognizers are sufficient to reveal the earliest negentropics – energizers, then, octaves, which, in turn, are assumingly constellations of basic 1/2 place classifiers. And since physicists and biochemistries assume that information can originate in Nature, thus, inseparable from it classification, while the chains linking octaves to the highest cognizers have already been tracked, it might be possible that the chains between the originated classifiers and octaves also are not excluded in Nature.

INTRODUCTION

1.1. We, humans, by genomes and cultures of communities are mainly predetermined in our utilities, including our periodical and diversified reproduction, in doings/ doers to promote utilities and support the promotion by their mental ones, including the means to communicate our doings/doers with communities to collaborate with them for utilities [1].

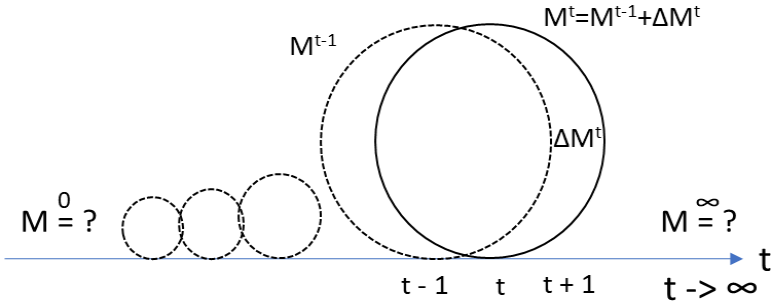

FIGURE 1. A view on inheritance and development of mental systems M of communities in time t.

Thus, by gaining membership of communities C we, personally and collaboratively, become capable of promoting the utilities of C, mentally supporting this promotion, as well as developing these abilities to continue to be successful in the Universe.

And while cause-effect chains of cultural development of communities are trustfully reducible to the roots, the question whether cellular ability to the periodical, diversified, highly deterministic, and extremely compound reproduction was directly originated in Nature or was granted from other types of cognizers of Nature, originated there in certain and unique ways, stays open.

1.1.1. We develop mental doers by cognizing, i.e., learning and organizing them into systems, mental systems (mss), while we learn mss by acquisition and revelation from or with communities in lifetime.

1.1.2. We reveal new mss by processing ad hoc ones, particularly, in inductive, deductive, imaginary and intuitive inferences, in searching and prognosticating strategies and in enhancement of effectiveness of mss.

1.1.3.1. Enhancement of effectiveness of mss -- a mighty pillar of science includes the regularization of mss.

Namely, mss m are regularized if in-realities r of input domains of classifiers induced by m using some algorithms or methods are reproducible regularly.

And mss m are constructively regularized if in-realities r are reproducible by assembling from elementary non-cellular units or systems of such units.

Airplanes, computers, cars, etc., are regularized constructively, while, for example, grown-up crops and domestic animals, inductively learned classifiers and skills passing from hand to hand are regularized but not constructively.

1.1.3.2. And in the miscellany of mss to be regularized, the island of the most overall and fundamental mss can be identified, particularly, by the questions: "What is the Consciousness/ Cognizing/ the Universe?" [2-17], "The origin of cognizing, cellulars, humans?" and "The meaning of it all?" by R. Feynman [2].

Earlier [1] we argued that computer-depended solvers of combinatorial games can be developed to approach the adequate constructive models of human cognizing.

This work is an attempt to argue similar statements generally, for negentropics, exempted from cellular and computer dependencies.

1.2. In what follows, we refine the regularized and modeled classifiers to recall the RGT class of combinatorial games and state sufficiency of RGT Solvers in adequate modeling of cognizers.

We classify negentropics, starting from inevitable energizers, then octaves of cognizing and cognizers themselves, arguing that octaves can adequately model cognitive development of newborns by Piaget.

Finally, we outline some consequent synergies of our models with some noticeable researches that we believe can be productive, and conclude with bringing together the basics of the paper.

REGULARIZED AND MODELED CLASSIFIERS

2.1. Classifiers Cl of members of communities C, x@C, are *regularized* if Cl can be accompanied by some means, methods, algorithms and others, to allow C by these means to output some samples sps of input domains of Cl or provide some adequate models of sps.

2.2. Regularly provided positives r of classifiers Cl and Cl themselves are interpreted as *models* of classifiers Cl' if r are classified as positives of Cl`, while Cl are interpreted as *adequate models* of Cl' if positives r meet certain additional requirements focused on positives of Cl'.

For example, classifiers Cl of algorithms are adequate models of classifiers Cl' of deterministic methods if, interpreting Church, to any method classified by Cl' equal algorithms classified by Cl can be corresponded.

2. 3. Classifiers Cl are *constructively regularized* if Cl are regularized and samples sps or their models are assembled from cellular independent units of matter.

Constructively regularized Cl are *automated* if samples sps or their models can be outputted by algorithms autonomously, estranged from any cellular assistance.

Correspondingly, classifiers Cl` *constructively (automated) model* Cl if Cl is constructively (automated) regularized.

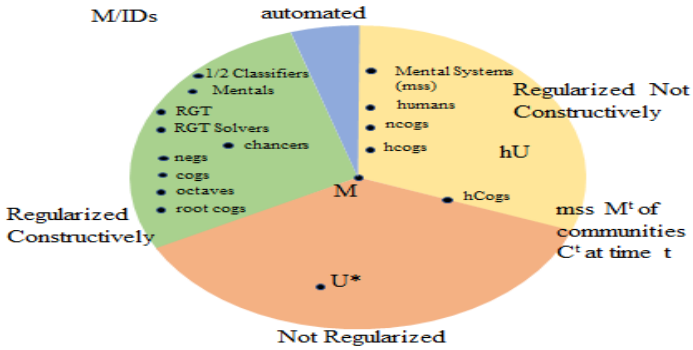

FIGURE 2. Attributing target classifiers as regularized or modeled

2.4. Roughly speaking, both the production and product samples of regularized classifiers can be in some ways cellular dependent, samples produced by constructively regularized classifiers are cellular exempted, while the automated ones, in addition, produce samples also cellular exempted.

2.5. For example, constructively regularized are Plains, Computers, Production of Plants, etc., that become automated if freed from any human or cellular intervention.

2.5.1. At the same time, Cattle, Fruits, Vegetables, as well as Skills, Habits, the Basics Learned by Newborns are regularized but non constructively and are passed from hand to hand in communities.

2.5.2.Non constructively are regularized humans since are regularly reproduced due the genomes and cultures of communities. For the same reasons, regularized are the constituents of humans, including human cognizers (hcogs), as well as the Universes of communities C [1].

COGNIZING POWER OF GAME SOLVERS

3.1. We overcome the barrier of studying the incredibly complex Humans-Universe (HU) problem by approximating it with game models [1,11,29]. We assume that combinatorial games with known hierarchies of utilities and solutions in spaces of possible strategies in game trees can represent HU problem with proper adequacy [1]. Then, we narrow HU to the Solvers of Reproducible Game Trees (RGT) problems with only a few following requirements to belong to:

- there are (a) interacting actors (players, competitors, etc.) performing (b) identified types of actions at (c) specified moments of time and (d) specified types of situations,
- there are identified benefits for each of the actors,
- situations, in which the actors act and in which are transformed after the actions, can be specified by certain rules, regularities.

3.2. Recalling the reasoning on classifiers of RGT problems (RGT) and Solvers (rgtsolvers) [1], it can be confirmed that both of them are constructively regularized, are models of Humans-Universe (HU) and human cognizers (hcogs), correspondingly, moreover, computer models of HU and, moreover, computer models of rgtsolvers, correspondingly, can be developed to become adequate models human cognizers (hcogs).

3.2.1. Defining computer models of negs or *cmodels of negs* as models, where doers/doings on gaining and processing of energy are completely reassigned to the energy suppliers of computers, let us argue the following statement.

St.1.3. *RGT games and cmodels of rgtsolvers of RGT can be developed to become adequate models of Humans-Universe problem and human cognizers.*

Arguing St.1.3. we reason as follows.

Recall that HU is a contemplation of problems, where the unsolved ones appear to be identified as combinatorial ones.

Then, RGT, first of all, embrace combinatorial problems, have no visible limits on their enrichment up to ones of HU, moreover, weakening the strongest requirement on being combinatorial adding, say, some proximity or a measure of likelihood of appearance for situations, the scope of RGT will enrich more and more.

In turn, cognizers hcogs are positioned as universal means of solving new problems appearing, as a rule, in combinatorial modes.

Simultaneously, rgtsolvers demonstrate an ability to successfully involve models of any means of cognizing of hcogs to resolve RGT.

Thus, we can resume that successful enrichment of RGT towards problems of HU and their rgtsolvers to hcogs assure their convergence to adequate models of HU and hcogs.

3.2.2. Assuming that rgtsolvers are incrementally enhancing their adequacy to hcogs, the following corollaries of St.3.1. can be stated.

Clr.1.3.1. *Cognitive power of cmodels of rgtsolvers can attain the highest hCogs level of hcogs.*

3.3. **St1.3**. and its consequences were inferred for HU problem and hcogs, where models of rgtsolvers were embedded in computers and, at least, energetically depended on them.

Asking whether study of cmodels of rgtsolvers can be sufficient for revealing root cognizers rcogs, it has to be acknowledged possible limits of such studying caused by the base of models of rgtsolvers, the computers, supplying rgtsolvers with energy and provide certain specific infrastructure that can restrict the revelation of all generalized constituents of rcogs.

What follows is an attempt to argue similar to **St.1.3.** statements for negentropics, in general, exempted from such cellular and computer dependencies.

Preliminarily, let us define cognizers rooted in negentropicity.

CLASSIFYING NEGENTROPICS

4.1. Negentropicity and its types.

So far, we are dealing with classifiers of humans, and, in general, with cellular realities, or *cellulars*.

In what follows, analogous classifiers exempted from any reference to cellulars are introduced to formulate a generalized problem of Cognizing of the Universe (CU), aimed to approach the adequate constructive models of CU and its solutions.

4.2. Following Schrödinger [3], we assume that *negentropicity* is an attribute, an ability, of realities to gain energy from any sources (assuming there exists, at least, one such source) for preserving certain utilities, while negentropics, or negs, let us name realities capable to negentropicity.

By definition, the ability to gain energy is an inevitable part of root utilities of negs, which in their being can be enriched by lifetime utilities.

4.2.1. Realities are *chancers* if negentropicity and means/doings for preserving the utilities were attained as a consequence of events caused by a chance and, mainly, externally.

For example, a type of negs, *energizers*, can be assumed to be chancers. Indeed, defining *energizers* as negs necessary including classifiers of energy, energy gainers, classifiers of realities favoring and damaging energizers, controllers governing energizers and their constituents , as well as effectors implementing the controls and stores for all constituents, we assume, such energizers can originate in Nature as primordial chancers.

4.2.1.1. To consist the complexity of energizers with their origination by a chance it can be assumed that by a chance, at first, originate the constituents of energizers, then by a chance originate the means of preserving the constituents, followed by their compositions by a chance into energizers and means of preserving energizers on the next steps.

4.2.1.2. Asking how elementary classifiers can originate in Nature, then be self-organized into energizers it is worth to address the ideas of self-organization in biochemistry [31,35,36] and recall that constructed energizers already are constituents of cosmic space stations and satellites.

4.3. To transit from the HU problem of Humans in the Universe to the generalized problem CU of Cognizers in the Universe, let us recall the basics of HU from [1], then define CU analogously.

4.3.1. What we are includes the roots or inherited utilities that we enrich with new utilities in lifetime.

Our roots, first of all, cover doings on continuing to be non-entropic or negentropic by Schrödinger, comprising our energizers, then doings specific for cellulars, especially the ones with diversified reproducibility.

The roots, sensors of all over, effectors to figure out our doings, overall controllers and some others embrace octaves of our cognizing.

4.3.2. Sensors along with other classifiers inherited and identified by controllers in conjunction with those studied and identified in a lifetime, i.e., revealed, discovered but mostly acquired from cultures of communities, comprise attributes of members x of communities C.

The outputs of attributes entail imprints in each x@C that x classify to represent the causers of imprints, particularly those caused by impacts of causers on the utilities of x.

4.3.3. The imprints, their causers and classifiers are *realities of x@C*, while the totalities of realities of x comprise *the Universe of x*, xU.

4.3.3.1. Along with highly genomic identity, we, humans essentially differ from each other due to cultures of our communities and the capacity of thesauri of mss that each of us is able to acquire from our culture, and, generally, learn.

Subsequently, realities of each of us are essentially personal and, correspondingly, our universes, comprised from totalities of our realities, are also personal.

4.3.3.2. While everything over which humans can communicate, including this ongoing presentation, is going in frames of their personal thesauri, and in this sense *humans are egocentric*, humans are attributed also by integrative powers of their communities.

Namely, uniting xU by members of communities C', we get the Universe of C', C'U (that, assumingly, could be also managed by some genius z@C, i.e., zU=C'U), for all humans - HU, and for already targeted communities - U.

And communities C at time t inherit to their generations at t+1 the vast majority of their attributes, thus, the totality of imprints they are able to output and, therefore, the totality of causers of imprints interacting with C, etc.(Fig.1).

4.3.3.2. Note that beyond the revealed universes U communities assume an existence of a coverage U* of U that, apparently, cannot be regularized.

4.3.4. *Human cognizers*, or hcogs, were defined as negentropics over the energizers that in collaboration with communities of analogous hcogs learn and organize mental systems for preserving their personal and community utilities.

4.4. Emphasizing the egocentricity of utilities, imprints, mss, realities, universes, etc., of humans and the importance of their integrated values, let us generalize them addressing to constructions not depended on humans.

4.4.1. For that let us recall constructive mss, *mentals*, the systems of classifiers identifying realities favorable to or damaging given utilities to support their promotion.

And define *generalized cognizers (cogs)* as negentropics that include energizers and in lifetime regularly and unlimitedly learn and organize classifiers and their systems, mentals, to identify realities favorable to or damaging the utilities of cogs to support their promotion, while learn mentals by their acquisition and revelation from or with communities of cogs.

4.4.2. Thus, in ***the generalized problem CU of cognizing the Universe****, given utilities and space of realities of certain negentropics, i.e., corresponding universes, it is required to construct means, cognizers, effectively supporting the promotion of utilities of those negs in their universes.*

4.5. Cognizers can differ in *power of cognizing*, including the dimensions of the intensity of revelation and acquisition of mentals, the intensity of communicative collaboration necessary for the learning, the capacity of stores for mentals and other their constituents, as well as the capacity of thesauri, its accomplishment or not by regularized, adequately modeled and other types of classifiers at the start and other stages of cognizing, the times that learning was processed and the limits on it.

By the power some types of cognizers can differ as follows.

4.5.1. Cognizers are:

- *octaves* if the means of learning and organizing of mentals are *sufficient* for unlimited development of the power of cognizing in any of its dimensions, however, so far, they are limited in the time of this development,
- *cripples* if they are either deprived or limited in some of dimensions of cognizing,
- *roots of cognizers*, or rcogs, if the means of learning and organizing of mentals are *necessary and sufficient* for unlimited development of the power of cognizing in any of its dimensions.

4.6. Note that assumptions on the ability of cognizers to unlimited development are abstractions convenient for its primary study, while more adequate assumptions have to address to unlimited development in any of its dimensions of the integrated power of cognizing of all-inclusive cognizers of target communities.

4.6.1. Arguing that mentals are adequate constructive models of mss [1], it is correct to classify

-human cognizers hcogs as a type of cogs attributed, at least, by their cellular nature,

- the highest hcogs, Cogs, as the integrated ad hoc power of cognizing of communities of humans, and
- the cognizers of newborns, ncogs, as a type octaves.

4.6.2. Many cellulars such as animals, deprived or limited in some dimensions of cognizing, can be classified as the types of cripples.

4.6.3. Root cognizers, rcogs, as a type of octaves with minimized means of development so far are only declared, why the existence of rcogs needs to be proven, particularly by provision of their adequate constructive models.

4.7. The types of cellulars radically differ in the amount of creatures in the diversely reproduced offspring.

When this amount is huge as, say, for insects, these cellulars adapt to environments by survival selections, in fact, allowing them to cognize those environments.

Such negs similar with chancers gain means/doings for preserving their utilities as the effects of fortuitous events, while these events, in contrast with chancers, are mainly caused not externally, but internally and regularly by the negs themselves, so these negs can be classified as *cognizig chancers*.

ATTRIBUTING GENERALIZED COGNIZERS

5.1. Generalized cognizers, cogs, by definition, are cellular freed, include energizers of some nature and are able to cognizing, i.e., to learning and organizing mentals (assumingly the adequate models of mss) to support the promotion of certain utilities.

They are producible constructions, thus, are constructively regularized and can be attributed by the following statements.

5.2. Apparently,

St.1.5. *Cogs are constructive models of hcog,*

while

St.2.5. *Cmodels of rgtsolvers are modeling cogs*.

5.2.1. Then, recalling **Clr.1.3.1.** stating that cmodels of rgtsolvers can be developed up to the adequate models of the highest human cognizers hCogs, we can assume that

St.3.5. *Cognitive power of generalized cognizers cogs can enhance to attain the power, at least, equal to one of the highest human cognizers hCogs.*

5.3. Fundamental hypotheses by Piaget [19] states that cognitive doings are learned stage by stage from certain root doings of newborns to the highest ones by means of only a few rules.

Grounding this hypothesis, we had argued in [1] that mentals are approaching the adequate modeling of mental systems of humans, the rules of cognitive development of mentals are reducible to the rules of development of certain roots, including 1- and 2- place classifiers, and also to some extent had tracked the chains of development of these classifiers to various units of cognizers.

Then, we argue experimentally the ability of cmodels of mrgtsolvers to successful acquisition of mentals [1,29].

We were also questioned, whether is it possible, given octaves of cognizers and certain basic classifiers, to construct models of stage-by-stage development of human cognizing based on the inductors of revelation of 1/2 place classifiers of increasing abstractness and on the procedures of acquisition of mental systems (or their models, mentals), followed by their processing to attain several cognitive doings.

Positive expectations on adequate modeling of cognitive development of newborns by Piaget can be induced from **St.3.5.** (if accepted) as follows:

Clr.1.3.5. *The enhancement of cognitive power of octaves can adequately model cognitive development of cognizers of newborns up to the power equal to hCogs.*

5.3.2. Let us note that properly interpreting octaves for game models, an equal statement can be expected for rgtsolvers as follows:

Clr.2.3.5. *The enhancement of cognitive power of cmodels of octaves properly interpreted for rgtsolvers can adequately model cognitive development of cognizers of newborns up to the power equal to hCogs.*

5.3.3. We assume also that **St.3.5.** induces the following corollary:

Clr.3.3.5. *Studying the generalized cognizers cogs can be sufficient for revealing the root cognizers, rcogs.*

Cmodels of rgtsolvers can be used for studying hCogs in a variety aspects, except the ones of root cognizers, rcogs.

At the same time, studying cogs are fully acceptable for revealing rcogs because, at first, in contrast with cmodels, they are exempted from preliminary requirements to be in the frame of computers and their energizers, and, at second, because properly interpreted octaves in agree with **Clr.2.3.5.** can adequately model cognitive development of newborns up to the power equal to hCogs.

5.4. Addressing to the origin of root cognizers in Nature questioned in [1], let us recall the conclusions of [1] that root cognizers should assumingly have access to the matrices of imprint, include inductors that can form 1- / 2- place classifiers at any level of abstractions, as well as assemblers of 1- / 2- place classifiers into mentals representing, particularly, the algorithms themselves and the communicators of mentals.

Thus, it is natural to ask, whether we can construct models of the origin of basic classifiers and octaves, and then unite them with the aforementioned models of development of cognizers, thus, starting from octaves to construct models of the origin of the highest cognizers in Nature.

In other words, whether following the laws of physics, the chancers can originate 1-/2-place classifiers that, then, by chancers and exhaustive search procedures could chaining ongoing situations with acknowledged utilities reveal regularly algorithms, say inductors, represented, for example, as conjunctions of 1/2 classifiers.

5.5. Recall also from [1], that neurons of either natural or artificial nets are capable to unite the steps of transition from matrices of imprints to rule-based classifiers. And instead of forming, at first, durable infers as attributes to form then case- based matrices followed by a transition to rule-based classifiers, neurons, in fact, are capable to make them in parallel.

CONSEQUENT SYNERGIES

6.1. Cognizing is the nucleus of human being, therefore its models pierce any human activity and research. In addition, the generalized models of cognizing let us overcome Babylonian handicaps of its mutual misunderstanding and may become some Esperanto for the researchers.

Let us outline some consequent synergies of our models with nearly noticeable researches and formulate some open yet questions induced by the models, we believe, can be productive in further researches.

6.2. ***The hypothesis*** induced by our modeling we state as follows:

non-cellular energizers can originate in Nature, then develop to octaves, followed by the development, at least, up to equal to the highest human cognizers to reproduce themselves in a variety of modes, particularly, in the cellular modes,

The hypothesis is based on the following key assumptions and research findings [1].

St.1.6. *Cognitive systems and means of their construction are various compositions of basic 1-/2- place classifiers. Only a few means are sufficient to realize these constructions and compositions.*

We argue St.1.6. by providing decompositions of ongoing constructive cognitive models to the basic classifiers and interpreting in our models the essentials formulated by Jean Piaget asserting that only a few rules are responsible for the development of our cognizing.

St.2.6. *At present, the highest cognitive power of humans brings them close to the constructive modeling of their own self-reproduction, both biologically and cognitively.*

St.2.6. is based on references to current advances in chemical modeling of biological cells and AI advances in cognitive modeling.

St.3.6. *Information and classification are inseparable from each other.*

St.4.6. *Elementary 1-/2- place classifiers can originate in Nature.*

We induce St.3.6. learning from the research by J. Parrondo and his colleagues [8] aimed at revealing the ways in which information can originate in Nature.

In parallel, admitting that, in general, "…the difficulty of searching for a successful search increases exponentially with respect to the minimum allowable active information being sought" argued by W. Dembski and R. Mark II in [30], we believe that successful models of the origin of elementary 1-/2- place classifiers in Nature (or the min information) could consist the above positions.

Thus, St.1/2/3/4-6 can imply the following corollaries:

Clr.1.6. from St.3.6: *The problem of origination of min information can be reduced to the origination of elementary classifiers.*

And, since the origination of classifiers seems to be more tangible, the studies of origination of information [8,9, 30], and, therefore, negentropicity, get an additional research dimension.

Clr.3.6. from St.1.6 and Clr1: *Non-cellular, constructive cognizers, comparable to the highest human ones, can originate in Nature.*

Clr.4.6. from St.2.6 and Clr3: *In Nature, non-cellular, constructive cognizers can produce, in a variety of ways, descendant cognizers with comparable effectiveness.*

It is not excluded that the existing cellulars, in fact, represent one of these constructed, evolved cognizers. Cellulars are much more complex than, say, computers or satellites, so their appearance by chance has almost zero probability (see also [30]). At the same time, if the origin of primordial elementary classifiers in Nature is possible there are premises of their development to the highest cognizers that, as it was stated in the assumption of St.2.6, are capable to constructive modeling of their own self-reproduction both biologically and cognitively. Particularly, they would be capable of producing cellular cognizers developing themselves to the present-day highest human level.

Clr.5.6. *If corollary Clr3.6. takes place, and if conditions similar to those around us (e.g., in our galaxy) are manifold in the Universe, it can be assumed that powerful cognizers can originate in various regions of the Universe and self-develop to the highest levels allowing them to reproduce themselves in a variety of modes.*

6.3. Our models meet some of the requirements by Andrey Linde [17], namely, the models are explicitly based on the imprints of their causers, realities, while all constructions eventually are, in fact, the compositions of nominated imprints, which, in turn, are the attributes of classifiers both as genomic, as well as like sensors, or gained in lifetimes.

6.3.1. Recall that realities in our models of cognizing include imprints, the causers of imprints and classifiers/attributes, why "our realities "are "…not substituting the reality of our feelings by a successfully working theory of an independently existing material world", so, we think that they could be the basis for trying to answer

"…What if our perceptions are as real (or maybe, in a certain sense, are even more real) than material objects? ", questioned in [17].

6.3.2. For modeling the interrelationship of observers/cognizers with the Universe within the framework of our combinatorial game models of Human in the Universe, it will be necessary, at first, to specify the aspects of the Universe induced by the questionnaires in [17] to represent and examine them in our models.

6.3.3. While many hypotheses and findings, particularly [6], assume the existence of our Creators, the question of how these Creators appeared remains open.

Our work, assuming that the kernel of the power of Creators is in their immense cognizing capabilities of the Universe, argues, in fact, that Creators can origin in Nature following the laws of physics.

6.3.4. The above also provides certain premises to try to model a highly questionable consciousness, to examine the adequacy of the models as well as to try to answer to the questions in [17] on "Will it not turn out, with the further development of science, that the study of the Universe and the study of consciousness will be inseparably linked, and that the ultimate progress in the one will be impossible without the progress in the other?" Unfortunately, consciousness has no a proper denotative description. For example, Jaquez Pitrat [16] provides 6 ongoing versions of consciousness. If some of its versions have convincingly been argued, we would be glad to try to model them and then examine the adequacy of the models.

6.4. We develop models to be consistent and complimentary to those in AI [1,11,15,18], have successfully applied them in computer networks intrusion protection, optimal management and marketing strategy elaboration in competitive environments, defense of military units from a variety types of attacks, personalized teaching, whereas adapting them to expert knowledge based analysis of software and computational materials discovery [1,29,32,33,34].

Our models correlate also with Virtual Knowledge Graphs for OBDA [19] and can learn from details and implementation, enriching them with the aspects of learnability of cognizing by J. Piaget, applications to combinatorial problems, say, Intrusion Protection and Marketing, and the origination of cognizing.

6.5. Our models, we hope, provide certain constructive and often experimentally supported basics for research in linguistics, psychology, biology [21-28].

For example, our assumption that the basic units of languages, i.e., 1/2place classifiers, can originate in Nature, not only support the famous Chomsky's [21] hypothesis on the innate nature of our primary languages, but, in fact, argues that languages along with other cognizing structures (not necessarily cellular) can originate in Nature, then develop up to the levels allowing them to reproduce themselves.

Undouble, further thorough studies of the ideas and findings in [21-28] will correct and enrich our models of cognizing, which, in turn, will be useful in their unification with those in physics and AI.

6.6. Let now recall some formulated in [1] questions induced by our models and to so far open.

6.6.1. Can we provide relationships universal for certain classes of languages or prove that is impossible?

6.6.2. Can relationships be represented not numerically, particularly, by neuron nets?

6.6.3. What patterns of mental personality of humans including their emotions, motivations and social relationships can, in principle, be represented by adequate algorithmic models?

6.6.4. Are the patterns of personality of humans, including the entire ranges of human emotions, motivations and social relationships inevitable in cognitive modeling and if, so, can they be equally represented by mentals?

6.6.5. Can we advance in Human-Computer Communications to the extent acceptable, at least, for chess players recalling that chess languages represent the natural ones like drops of water in oceans?

6.6.6. Can we organize neurons in nets having mental doings equal to those of mentals?

6.6.7. Given classifiers f presented by Boolean tables, we can transit both to their DNF and ANN representations. DNF line is transparent, while the NN one remains vague.

To prove the idea that deep learning of f by NN can be interpreted as the construction of reduced DNF.

6.6.8. Construct RGT Solvers based on the processing of mentals

6.6.9. Extend chess scales of effectiveness of strategies to the entire RGT problems

6.6.10. Consist the scales of effectiveness of mental doings of humans with ones of doings of RGT Solvers

6.6.11. Compare the adequacy of On the Job Performances [1] and attributive estimates of the effectiveness of attaining certain solutions.

6.6.12. How to organize ANN capable of performing all mental doings available to the mentals and equal to them?

6.6.13. Can thesauri Th be adequately modeled by computers, particularly, represented by the memory of computers in the way that any mental doings processed in Th could be equally reproduced in computers?

6.6.14. How to minimize the sets of attributes for the max compression of mpgi matrices of imprints without destroying the original classifications?

6.6.15. Given octaves of mss and certain basic classifiers to construct models of stage by stage development of human cognizing based on the inductors of revelation of 1/2 place classifiers for processing for several cognitive doings?

6.6.16. Can we construct models of the origin of octaves of mss and basic classifiers, then unite them with the aforementioned models of development of cognizers, starting from the octaves of mss, to construct models of the origin the highest cognizers in Nature.

6.6.17. Answering the question of how stored classifiers can be self-organized into algorithms it is worth addressing the ideas of self-organization of units of other types, specially from the point of view of biochemistry [31].

Other words, let us ask the following similar question: whether following the laws of physics in the spaces of originated 1-/2-place rels, exhaustive search procedures can be originated that seeking chains from the ongoing root-situations to the acknowledged utilities could regularly reveal algorithms, represented for example, as conjunctions of rels.

6.6.18. Discoveries in physics, biochemistry and biology let Bernd-Olaf Kupper [35,36] to assert that "... language is a general principle of Nature, rooted exclusively in physical and chemical laws. Such a radical idea inevitably leads us to view the essence, origin and evolution of life in a completely new light. At the same time, it shifts the coordinates of our scientific world-view. We have to abandon our traditional anthropocentric view of language in favor of an overarching concept of language that is able to bridge the gap between matter and meaning. Thus the language of Nature may also be the key to a better understanding of the relationship between mind and matter."
Let us believe that this discoveries amalgamated with ones in cognitive sciences will let us to enlighten the origin of cognizers and, possibly, ourselves.

6.7. Finally, let us outline an application of our models in projecting ***Expert Systems for Prognostication Infection /starting from viral/ Defense Strategies,*** in fact, interpreting an approach succeed in defensing networks from intrusion attacks [1,32].

Compared with applications, where network-vulnerability analysis was based on finding critical paths in the priory known graphs of attack, in our RGT game tree based model the search of counteraction strategies was comprised from elementary and universal units – elementary procedures, an alphabet, that intruder or administrator use to combine either attacks or defense procedures, correspondingly. Some of those procedures can coincide, particularly, with elementary attacks. But the kernel of that approach was in finding procedures enough elementary to cover diversity of intruders and defenders' behaviors but nevertheless being meaningful for human understanding and operations. Alphabetic approach to representation of attacks and defense operations causes game tree size explosion was successfully overcome using successful experience of expert knowledge based RGT Solvers.

6.7.1. While *problems* of infections *defense* treatment focused on the *viral* ones (PVD), say COVID19, for each particular one have to be specified by the Experts in the Defense from Infections (IDE), let us interpreted for PVD an approach succeed in the defense of networks from intrusion attacks [1,29,32].

6.7.2. We reduce PVD to the following RGT problem.

6.7.2.1. States of a patient, or *spats*, SP are the totality of situations determined by sets of professional classifiers, attributes Atr while integrated quantitative states of patients, or *qspats*, are values either quantitative or qualitative, attributive corresponded by experts to the spats.

Thus, patients at any time t are represented by triples s/qs/t.

Let assume that treated, or healthy patients meet the classifiers +pts and numerically are corresponded to 1, heavily ill ones meet –pts and 0, the uncertain ones are =pts and ½ while other states meet classifiers of some expert scales quantified, in turn, between 0 and 1.

Viral/infection actions, or *vrs*, from the set Vr applied to input spats, *inspats*, output corresponding *vrspats*

Defense actions, or dfs, from the set Df applied to inspats output *dfspats*

6.7.2.2. *Assumptions.*

Ass1. Actions are represented by time types 2rels, i.e., if 1rels' then 1rels" that is happened in some time period delta Δ1 or can be prognosticated.

Ass2. 1rels', 1rels" are functions over outputs of the attributes

Ass3. While in the first approximation actions are deterministic, i.e., applied to spats change them deterministically, further models of actions can include probabilistic constituents

Ass4. Viral and defense actions are applied to patients one after the other, consequently and in discrete times Δ2

Ass5. PVD trees VDT are complete, i.e., include all ad hoc known viral and defense actions, spats contain all valuable attributes used in ad hoc viral treatments while any defense strategy have adequate representation at the PVD of experts

Ass6. While IDs of any node of VDT are triples s/qs/t the terminal nodes of VDT are sets of spats +P and -P classified by +sps and -sps.

The nodes of VDT can be identified by pairs s/qs if all of them are focused at time t.

Ass7. If expected successful defense time period experts estimate as nΔ2 any strategy S in the VDT of the depth nΔ2 are evaluated by functions w over values of terminal of nodes of S and the best defense strategies attain max of w.

For example, V can evaluate proportion of terminal +sps nodes of successfully treated, defended expectations wrt all possible terminal cases.

Ass8. While min max strategy search is valid for VDT to transit to knowledge based search by IGAF or PPIT [1,29,32] there is need that experts have identified intermediate goals in defense what, in turn, will induce defense plans.

6.7.3. Expectations from PVD Solvers

Ideally, expectations from the PVD Solvers are the following:

if for given patients p were constructed adequate models of Infections-Defense Knowledge- Base, i.e., thesauri, T of experts, then in that model it would be possible to arrange search of the must effective defense, or treatment, strategies for p.

Apparently, at least, the following sub problems have to be positively resolved: construction of thesauri of ID mss adequately modeling the ones of experts, identification of trees of possible ID actions in the thesauri, determination of strategy search algorithms in the trees, including min max, IGAF, PPIT.

6.7.4. Experimental prove of the adequacy of model ID strategies to ones of experts. Premises to start to look for solutions of the above sub problems can be positive solutions for similar but more transparent RGT problems, say chess.

Namely, solutions of problems: Thesauri for chess mss. / Game trees in frame of the thesauri/Search strategy algorithms in frame of thesauri/ Prove of the adequacy of strategy search chess based model

While chess game trees even based on the lists of possible actions of chess players can be adequate models of possible strategies of experts, models of search spaces of infections defense strategies of experts have to be able to represent the entire diversity of actions of experts, which, in fact, means that the expressiveness of the models have to be comparable with ones of medical languages.

CONCLUSIONS

1. We refined the regularized and modeled classifiers and in these dimensions frame the classifiers of introduced types of negentropics and cognizers, as well as Human-Universe and combinatorial RGT games.

2. We argued that:

-constructively regularized RGT problems and computer models of RGT Solvers are sufficient to be developed to become adequate models of human cognizers and the Humans-Universe problem,

-generalized cognizers can be constructive models of human cognizers, while

-computer models of RGT Solvers can model generalized cognizers.

3. Defining octaves as a type of cognizers capable of enhancing the power of cognizing, but so far limited in the time of this development, we believe that the enhancement of cognitive power of octaves can adequately model the cognitive development of Piaget's newborn cognizers up to the power equal to the highest human cognizers.

We also believe that the study of generalized cognizers can be sufficient for revealing the root cognizers, which, in turn, could be an important step for resolving the fundamental all ever questions on origination of the basic 1/2 place classifiers in Nature, their transition to energizers and octaves developing to the highest cognizers.

Finally, we outline some consequent synergies of our models with some noticeable researches, so far open questions and an application of our models *to* ***Expert Systems for Prognostication Infections*** */starting from* ***Viral/ Defense Strategies/*** that are vital and, we believe, can be fruitful.

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