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Representing and Managing Experiential Knowledge with Decisional DNA and its Drimos® Extension

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Abstract— **The Semantic Web concept is proposing a future concept of the WorldWideWeb (WWW) where both humans and man-made systems are able to interconnect and exchange knowledge. One of the challenges of Semantic Web is smart and trusted accommodation of knowledge in artificial systems so it can be unified, enhanced, reused, shared, communicated and distributed with added aptitude. Our research represents an important component of addressing the above challenge and exciting, cutting-edge exploration trend in the general area of developing tool for intelligence augmentation.**

I. Introduction

MOST experts agree that intelligent non-natural system is yet to be established. The main issue that remains a challenge is securing trust and explainability in such systems. This is where the notion of augmented intelligence comes into play. It is an alternate insight of artificial intelligence (AI) that focuses on AI's enhansing role [1]. Enhancing role of intelligence amplification inspired our initial research idea and vision to develop, expand, and extend an artificial intelligence augmentation system, an architecture that would support smart discovering, capture, adding, storing, improving and sharing information and knowledge among agents, machines, and organizations through experience. Bio-inspiration comes in this case from the fact that in nature experiences that all living organisms (including humans) go through during their operating lives support sustainable development, evolution, and add smartness to all associated functionalities and practices. The significance of experience in biological development cannot be overemphasized. We propose an original experience-based Knowledge Representation (KR) approach in which experiential knowledge is represented by Set of Experience (SOE) and is conveyed into the upcoming by Decisional DNA (DDNA) [2,3].

For the sake of completeness, SOE and DDNA are very briefly introduced here. Set of Experience Knowledge Structure (SOEKS) is a knowledge portrayal structure created to acquire and store formal decision events in a organized and unambiguous way. It is composed by 4 fundamental elements: variables, functions, constraints, and rules. Variables are commonly used to represent knowledge in an attribute-value form, following the conventional approach for knowledge representation. Functions, Constraints, and Rules of SOEKS are techniques of associating variables. Functions define relationships between a set of input variables and a dependent variable; thus, SOEKS uses functions as a way to create links among variables and to build multi-objective purposes. Constraints are functions that act as a way to limit options, limit the set of possible results, and manage the performance of the system in relation to its aims. Lastly, rules are relationships that operate in the world of variables and express the condition-consequence connection as "if-then-else" and are used to represent inferences and partner actions with the conditions under which they should be executed [3]. Rules are also methods of recording specialist-defined knowledge into the system. The Decisional DNA is a edifice capable of capturing decisional characteristics of an individual or organization and has the SOEKS as its foundation. Several Sets of Experience can be assembled, classified, organized and sorted into decisional chromosomes, which mount up decisional policies for a specific region of decision-making occurrences. The set of chromosomes embrace, lastly, what is called the Decisional DNA (DDNA) [4].

II. DDNA knowledge management in practice

DDNA technology has been verified, tested, and applied through numerous real life case studies and implementations. Table I below lists some of the most successful DDNA based real life applications with their references for possible further reading. All of them use our advanced portable and domain independent software representation for SOE and Decisional DNA embedded in DDNA Manager [4].

TABLE I.
SOE-DDNA IMPLEMENTATIONS IN VARIOUS DOMAINS

Application domain	Reference
Implementation of Decisional Trust and Reliability	[4]
Virtual Engineering	[5]
Geothermal Energy, Renewable Energy and Net Income	[6]
Workflow-Centered Experience Management	[7]
Embedded Systems/Robotics	[8]
Knowledge Quantification	[9]
E-Decisional Community	[10]
Business Experience Management	[11]
Continuous Improvement in Experience Feedback	[12]
Interactive/Smart TV	[13]
Decision Support Medical Diagnosis Systems	[14]
Cyber Physical Systems for Industry 4.0	[15]
Engineering Innovation Amplification	[16]
Cognitive Vision for Industrial Hazard Control	[17]

The Decisional DNA Manager is a software platform for experience administration. This tool supports collecting, storing, improving, and reusing experience from formal decision events. It can be used as a tool to analyze, query, consolidate and administer semantic experience captured by the means of SOE and Decisional DNA [4]. With DDNA Manager in hand we will be able to develop in the next future step its hardware representation entering into the fully evolved age of Semantic Web where machines and other man-made systems would have their "own DNA" allowing for the future Artificial Evolution (AE).

III. DDNA-BASED EXTENSIONS

A. Human Activity Recognition (HAR)

Human Activity Recognition (HAR) is one of the most active research areas in computer vision for various social contexts like security, wellbeing, smart healthcare, and intelligent human computer interaction. We propose a novel approach that utilizes the convolutional neural networks (CNNs) using experience and the attention mechanism for HAR [18]. In the presented method, the activity recognition accuracy is improved by incorporating attention into multi-head convolutional neural networks for enhanced feature mining and assortment.

B. Cognitive Vision Platform

This research is part of an attempt to advance of a Cognitive Vision Platform for Hazard Control (CVP-HC) for purposes in manufacturing workplaces, adjustable to a wide range of surroundings. We challenge the difficulty of cognitive vision classification with knowledge-based vision system using experience and Decisional DNA (see Fig 1)

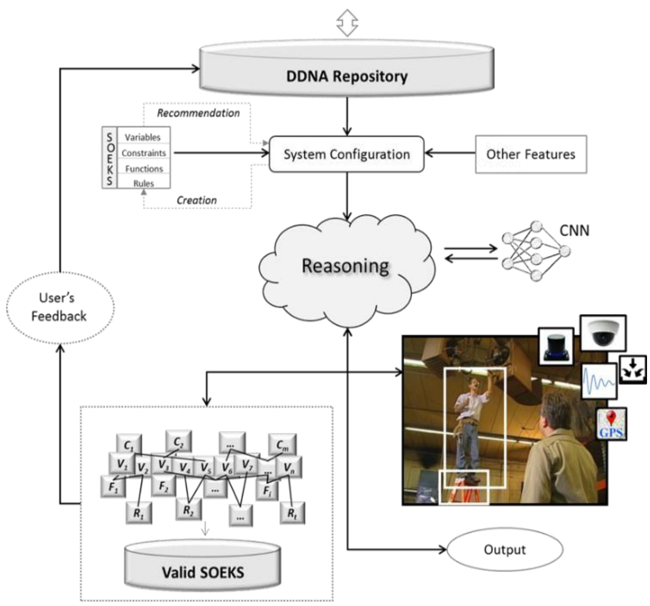

Fig. 1 DDNA-based Cognitive Vision Platform [19]

C. KREM Model

This DDNA extension is evolving collective intelligence structures to support and improve human actions in cognitive society. KREM design (Knowledge, Rules, Experience, Meta-Knowledge) is presented in [20]. The uniqueness of the representation comes from the inclusion of the treatment of experience in the buildup of the system's meta-knowledge.

D. Idream.Technology: From Individual to Collective Experiential Knowledge Management

The new and the furthermost large-scale DDNA extension is the drimos® platform from Idream Technology Pty Ltd (www.drimos.ai) (Fig. 2). We have developed social digital platform using collective experience. This DDNA-based application, which commences in mid-2022 after comprehensive one year long design, testing, and validation, projects personalized road-maps to achieve purposes, goals, and aims taking into account individuals' personalities and circumstances. Specific areas of human activities covered within the platform include travel, education, acquisition, and well-being.

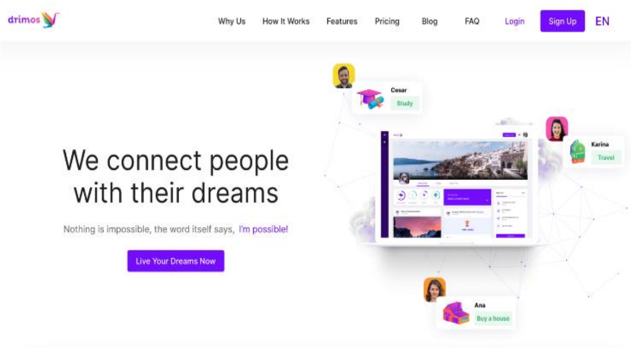

Fig. 2 The AI coaching platform to achieve your goals and dreams – drimos.ai homepage screenshot (from Idream Technology)

The popular existing social platforms personalize members' profiles classifying them by purchasing patterns or consumption of web content. drimos® platform from Idream Technology goes further because it mixes human intelligence with artificial intelligence, identifying how people make decisions. It captures, integrates, stores and reuses thousands of experiences occurring during the process of achieving personal, individual dreams or goals. In other words, it uses collective decision-making experience and applies it to amplify the individual one. As the result, dreamer's profile is presented with a systematic procedure to follow in order to achieve their personal dream or objective.

In terms of augmenting the human intelligence, drimos® considers two important elements to achieve its purpose: (i) a goal setting technique developed by an international expert in this area Karina Sterling (https://www.ted.com/talks/karina_sterling_cumple_tu_sueno_y_cambia_el_mundo) which strengthens the emotional attachment to goals, and (ii) the capture of day-to-day anonymous experience from dreams/goals achievers which is explicitly formalized into Sets of Experience and added to the drimos® DDNA.

The main technique behind the process of managing experiential knowledge stored in the DDNA, is the similarity concept based on mathematical distance between Sets of Experience [2,4]. This concept has been successfully used in all applications presented in Table I. In drimos® platform from Idream Technology the similarity notion is applied to the distance among users profiles of the drimos® community. The most similar profiles are chosen by the system to assist in the creation of successful path to reach the goals set up by others. Fig. 3 shows the similarity engine in action, and Fig. 4 presents the screenshot of gamification and set of tasks suggested to the user by the platform based on profiles' similarity.

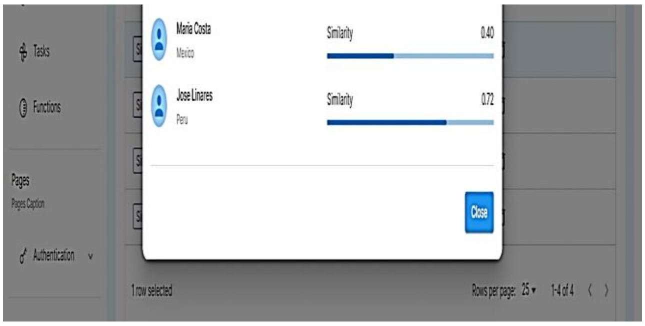

Fig. 3 Similarity selection

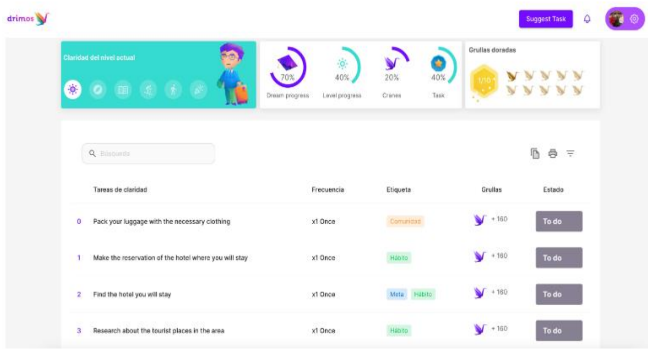

Fig. 4 Screenshot of goal steps with indicators and gamification model

Idream.Technology is a start-up hi-tech company to offer its smart enhancement of dedicated coaching services through drimos® application. It provides DDNA technology based tools to enhance peoples' sustainable development. It addresses global societies by covering English and Spanish speaking regions of the world.

IV. Future Outlook

Set of Experience (SOE) and Decisional DNA (DDNA) concepts are at the beginning of their advance but are already making a difference to knowledge management theory and practice. Future integration of various DDNA extensions would provide an intelligent and sustainable Internet application environment that would enable cybernetic positions (instruments that expediate interoperation among users, applications, and resources) to effectively capture, publish, share and manage explicit knowledge means and sources. It would also provide support for on-demand services creating vast commercial potential for this technology. Through our approach to knowledge representation and formalization embedded in the concept of Decisional DNA, the future DDNA-based knowledge grid would incorporate epistemology and ontology to reflect human cognition characteristics and adopt the techniques and standards developed during work toward the next-generation, beyond-semantic web.

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