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Cognitive Modelling of a Financial Software Advisor: COFINA

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Abstract: This study proposes a cognitive modelling of a basis of knowledge on the domain of the financial advice and the development of fitting software regarding the exploitation of this expertise. To attain this objective, we used UML as descriptive model and a declarative language for the representation of knowledge (Ibn Rochd). We conceived and realized the system COFINA that develops and facilitates the writing of the knowledge in the financial domain. We have tested it on several bases of complexity knowledge growing, of a weak complexity destined to test the fiabilité to various systems : for the purchase of a car, for the school and educational orientation, or in the domain of the savings and bank credit. At last, we discuss certain limitations and present some ways of researches.

Key words: Investment, movable values, intelligent advisor, invest, COFINA, knowledge representation, declarative language, cognitive approach

INTRODUCTION

The financial placement interests a large audience poorly informed. Technically, it's a problem full of multi-criteria decisions[1], that supposes the combination many professional ones and/or statutory knowledge, that justifies a software resorting to the artificial intelligence techniques.

A major domain of Artificial Intelligence (AI) is the conception of declarative systems, called Knowledge Based Systems (KBS) or Expert Systems (ES). These systems are characterized by a separation between the necessary knowledge to resolve a problem and the mechanisms exploiting this knowledge[2]. This separation allows the description of the knowledge independently from their later usage. This facilitates on one hand the modification and add of new knowledge to the base; on the other hand, one can furnish justifications and explanations of the system behaviour.

Artificial intelligence is then situated in the intersection of data processing and of the "Cognitive Science", that aim to understand how the knowledge is born, used, raised and transmitted.

If an AI program has for goal to imitate an intelligent behaviour, it is necessary for it as for the individual to have access to knowledge. Now, the effectiveness of the program depends of their computer representation[3]. This why, the representation of the knowledge is a question key of the AI. It consists in to formalize the concepts of the real world in an exploitable form efficiently by "intelligent" programs[4].

One can leave simple idea that the knowledge results from a placement in *correspondence* of the real world with a symbolic system that allows reasoning[5].

The *cognitive approach* consists then to assure this correspondence with the assistance of determined processes.

According to Vogel[6], the knowledge concerns again impregnated information of the vision of his enunciator. In the domain of artificial intelligence, the knowledge relative to an expertise often is often divided up in various categories. Among these, the most ordinary ones present themselves according to various criteria: scientific knowledge and empirical knowledge, deep knowledge and surface knowledge, factual knowledge and procedural knowledge, expert knowledge and knowledge fortuitous.

The definition of a formalism under the form of production rules exploited by a general mechanism-the Inference Engine-uses a representation paradigm and of exploitation of the knowledge[7], true incarnation of the declarative programming. A current rather recent considers even the acquisition of the knowledge as a modelling problem beyond the extraction problem and transcription of the knowledge[8].

The construction of models would have in fact to allow avoiding an acquisition "by implantation" while offering levels progressive and better adapted abstractions. The anthology process of expertise leans on a distinction between axis of the models and axis of paradigms[9]. The problematic one acquisition of the knowledge themselves at the level of the knowledge, knowledge that it is necessary well study for better to formalize and structure it.

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Our principal goal is to show the interest and the contribution of the Knowledge Representation Language (KRL) Ibn Rochd[10-12] to resolve representation problems and model a knowledge base for a Financial Placement and to develop a Cognitive System «To Advise for the Financial Placement» baptized COFINA.

Why the financial placement?: If during a long time, the banks constituted a profitable economical sector, sheltered competitive pressures, they knew since the beginning of the years 1980, a deep mutation that, by the bias of a placement in internal competition to the sector, the has progressively dived in an economical. This new financial landscape organizes itself around heavy tendencies as the climbed risks, the development and the uncertainties linked to the development of the bank in line, etc…

The popularity of the modern placements (SICAV, actions, obligations…) does not stop growing so that they uniformly meet again beside the traditional placements of savings.

- The *financial placement* '' a *future trade* '': the management services of heritage multiply themselves. Confronted to a complex taxation, to financial artificial products and to the calls of the financial international markets, in an environment where visibility is weak, the banks, the assurances, the investment businesses, the notaries, the expert accountants, etc.

This service multiplication explains by different reasons:

- The clientele having access to active and of significant income wishes to benefit from counsels before investing.
- The evolution of the needs of the population, resultant of the very numerous sociological and demographic changes: family structure, life method, professional mobility, elevation of the level of life… etc.[13].

Counsellor system: A system to advice is a computer system that proposes an activate assistance «intelligent»[14] to the users of a special software. Typically, advice is a text that suggests to the user to realize an action, indicates for him that his action is incoherent or clumsy or that criticizes the object that it produced. The advice is information: the counsel system not forces at all the user to follow the advices that it produced. The advices are based on an analysis of the actions and productions of the user. The term « intelligent assistance » done reference to the looking for objective: to propose an advice that takes into account the context of the action and the objectives sue for the user. The financial placement is a very important domain and very varied and dynamic because of importance that it has in the evolution of life.

A placement advisor: A person that work on the market movable values and that gives advisors to the savers on the production and the supply of the financial products.

A market of the movable values: The market of the movable values simply the stock exchange, where meet offeres and sekeers of capitals, by the bias of a central computer. The exchanges concern titles of property (Actions) and/or credit titles (Obligations)[15]. Two principal petitioners exists : the state (Public Treasure) and the private and public corporations. To be able to accomplish his political economical one, the government calls upon the national and international investors while emitting for example treasure titles, for the companies, they return themselves towards the stock exchange to find the necessary financing sources to their development. In regards to the offer of capitals, she is determined by investors of different origins (special, businesses or several financial institutions). These investors exchange their financial resources against emitted titles on the stock exchange.

Invest: Work your money in away that it is productive. When you place your money so that the users of your capitals be able to profit from it and some to do to take advantage of other persons, you done then this that one calls a productive investment. There is productive investment when the saving is transported on the markets of capitals, where negotiate themselves the actions and the obligations. This is this special type of investment that stimulates the economy and creates employments.

A placement: values that one possesses or that one buys regarding to do them to be productive, to draw from it an income or a more-worth one or do the two.

A wallet: Together stock and bounds or placements held by a special one or by an institution. A wallet can contain various obligations of governments or of corporations, privileged actions and ordinary actions of different corporations as well as of typical others of values and of elements of active one.

Uml conception: Naturally, several formalisations are possible to represent a same view in a system of knowledge during a problem resolution. It is possible to use a second formalism allowing declaring and to describe a development judged pertinent phase and vital for the previous tasks. UML (Unified Modelling Language) illustrates well a formalism expressing its through different concepts graphic diagrams that correspond to special views of the system: The logical view, the usage cases view, the components view, the deployment view. We limit ourselves here, to the illustration some diagrams.

Diagrams of the usage cases: Preliminary list of the usage cases.

- The system administrator watches on the management and the maintenance of the system;
- The expert (broker, banker, holder…) tests the basis be as an expert or an ordinary user;
- The user is the beneficiary one of the product final in case of asks financial advisor.

Modelling with a declarative language: COFINA is software that we developed to help to advice regarding financial placement field. To realize this project, we collected the knowledge from documents Internet and meetings of interviews with certain bankers of the city that enriched us with their experience in the financial domain. COFINA uses the formalism of the rules of productions for the representation of the knowledge. The rules and the classes and objects are written according to the representation language of knowledge IbnRochd[10].

Power of COFINA:

- Assistance tool, that allows replying to some questions that can be put by the user;
- Capacity to obtain again knowledge through an expert-An expert can introduce again rules, classes or objects;
- COFINA allows a switching during the conversation towards solutions more satisfactory (more optimum);
- COFINA asks questions and according to the responses of the user it proposes a case (or more) of placement more promising.

COFINA include: Mothers class: Customer, Service; - under classes: Individual, Company, Profits _ Compute, Investor_ Profile;

- 525 production rules and 1216 Objects.

COFINA tasks
COFINA is able:

- To advise for an investment;
- To treat a credit for the savings lodging;
- To Calculate the profits;
- To Choose between the financial products;
- To Prepare the retirement.

COFINA Implementation: Our research principally consists to realize a system covering the life cycle of the basis of knowledge « Financial Councillor ». The illustration done by COFINA shows the usefulness of the approach object with its different advantages and multiples specificities: the modularity, the encapsulation, the redefinition, simplicity and the clarity. Software is developed in an environment Windows XP, by the usage of a Personal Computer P3 of 256 MO of RAM and 80 GO on Hard Disc under the development environment « Visual C + + 6.0 ».

COFINA Users: COFINA is dedicated to two categories of users: The administrator of the basis of knowledge and an ordinary User or a banker. It offers to the specialized users in the domain of the finances (Experts) fitting services to the deontology of their function (modification, updated and maintenance). For the no-expert users: to consult and to have one or several solutions it or the most optimum one to resolve problems of financial placements. For the quoted reasons in top, an editor of intelligent knowledge is developed by the integration of the bases of relational data through the motor of the bases of data «Micro Soft Access 2.0». It allows editing: classes, rules and objects. A second modulates essential to the two categories of user is the inference Motor with or without execution track and Integration of a form customer.

Interface user: This is an important unit, for it assures the communication of the system with the exterior one and his integration in a system of general knowledge.

VALIDATION AND PERSPECTIVES

The current test is formed basis of knowledge « To Advise in financial placement », a base that needs enrichment and of updating (maintenance) for the objects that she contains are living. This test is representative and presents a big interest in pure cognitive terms; but, totally controllable in terms of classical algorithm, she allows verifying that the basis deserves cognitive validations more delicate.

The goal of this study was to show the provisions of cognitive modelling of a basis of knowledge in the matter of finance. Realized software was applied to this last expertise. This experimentation confirmed the interest of the techniques of artificial intelligence and we bring to apply that the treatment of this basis of knowledge understands:

- A comprehension phase factual, inductive and that drives to representation rules of knowledge from the point out;
- A phase of cognitive, deductive decisions and that allows envisioning consequent conduits according to a logic guided by a Check the validity of the obtained conclusions.

We have thus been able: to model the basis of knowledge, validate COFINA and combine progressively genius software and needs of the cognitive methodologies, regarding a cognitive genius.

The acquisition of knowledge did not allow, to her alone, to extract efficiently certain knowledge experts in financial counsel. Also the joint usage of the acquisition of knowledge and automatic apprenticeship does she appear as a promising solution?

To the view of the carried out tests thanks to COFINA, certain problems appeared: preferences of the customers, poorly informed customers, financial possibilities, the requirements of the profits, etc…

To Treat these problems, this is not only to improve the basis of knowledge, this is also to reduce progressively the methodology to deploy in upstream of coding and the objections as one can do to the system. Thus consolidated, COFINA could touch large panoply of financial problems: the behaviour of the new system should show itself rather supple to allow a user to express, represent and at last to exploit easily its knowledge, without for as much to have to undergo cognitive rigidity and useless data processing.

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