ACQUISITION, MANIPULATION AND USE OF THE KNOWLEDGE WITH EXPERLAB

Index:

This document aims to be a guide for people that need or want to devote themself to the creation of professional systems through EXPERLAB so that they can learn how to use the appropriate tools to transmit the competences from an expert's mind to a computer. This handbook is targeted mostly to those people -called engineers of the knowledge in this document- that for EXPERLAB are simply individuals that devote themselves to the elaboration of specialized systems.

Our intention is not to create a document full of formulas and mathematical methods, that could annoy the reader, but to expose the following elements in a based, elementary intuitive and simple way by using concrete examples to develop expert systems with EXPERTLAB. This will help the reader to formulate a more concrete idea of what this system can do.

In this document, there will be no explicit references, with the exception of urgent needs, to the functionalities and the way that users operate, regarding every screen of the EXPERTLAB product. Therefore the user's guide must be consulted.

DB: Data Base BD

KB: Knowledge Base CB

EK: Engineer of the Knowledge IC:

ES: Expert System IF:

EP: External program PE

IF: Inside Function FI:

WRK: Way to Represent the Knowledge. MRC:

IM: Interference Machine MI

UI: User Interface IU

- **First steps**

  There are different situations in which some people manifest some abilities, when the activity is not excessively complicated and does not require particular knowledge. For example, some farmers can forecast the rain only by observing the surrounding environment and exploring its conditions and they are rarely wrong. They may not be capable of explaining their forecasts as lot of experts do, but they have both the intelligence and the experience to forecast the rain with a minimum margin of error, only by observing the surrounding phenomena. Let us imagine for an instant that if such knowledge were within the reach of everyone, the physical consulting of the person would not be necessary, but it could be consulted in any moment.

  Therefore, the role of expert systems is to transfer to the computer the whole reasoning and gear that allow an expert to reach certain conclusions for any subject he needs solutions . In reality, the expert systems can be transferred to any aspect of the human knowledge. There aren't any human tasks or situations that don't imply any specialization and therefore great and precise skills in the long term.

  From the simple farmer that forecasts the rain to the doctor that is able to come to a diagnosis of the patient with few elements. Anyway, we don't think that the

use of expert systems is useful and appropriate in any field. As matter of facts, much knowledge is formalized, and doesn't necessarily require the use of the system and others derive from people's common sense. An expert system must be developed in an area where the formal knowledge does not succeed in resolving a concrete problem completely. For example, even if a vast bibliography of general medicine exists, not all the doctors are able to use it in a perfect way and so reach important conclusions with limited resources. At this point the important role of a doctor's ability and the feasibility to think about an expert system come to play. In the life of any person, there are moments in which a simple decision brings important consequences. For example, that can seem catastrophic, but it happens: a person decides to go to the cinema; but the weather is going to be bad and the cinema is in a low zone that is easily flooded. The person goes to the cinema because he likes the film, but while he is there the storm rages. The cinema and the district are evacuated, and this person, along with the rest, is carried out to a safe place; however far from their own family and house. The person does not die; but how many ugly moments he has passed (away from his family and friends) for a simple decision.

Perhaps this history is exaggerated; however, it is an example to show the reader that the human experience (acquisition of knowledge) could have been useful. Probably if the person had had the farmer's experience, he would have known that the cinema is in an easily flooded area and he would not have left but he would have postponed the cinema to another day. In conclusion, the film is projected for different days in the same cinema. We insert this comment because our example wants to make people realize what being at a crossroad, as going to the cinema, means starting by some considerations. Let us assume that someone wants to produce an expert system that helps people to take some decisions. It is true that if someone consulted an expert any time, life would be hell and it would be impossible to breathe because there would be the risk of polluted air. This is not our intention. It is simply the introduction of a real situation, for which an expert system can be drawn, that we will consider as an example during the reading of this document.

EXPERLAB is made up of two major subsystems: one is devoted to acquire the knowledge obtained by the experts (which brings the classical name "Acquisition and Use of Knowledge System" (AUNS); the other (which has the name "System to be consulted" (CS) that allows you to consult the knowledge acquired and use it in a concrete situation. That is, the first is similar to the school and the daily

experience where the future doctor is studying and the second is similar to turning to a doctor for a headache when he is already an experienced doctor.

During his studies, and subsequently with the practice, the doctor acquires the knowledge and ability in the diagnosis for the treatment of the illnesses. This learning is the equivalent process of how much could be done with the first subsystem when you insert all the knowledge into a computer. Nevertheless, the second subsystem allows its use through the consultation, as it happens when we consult a doctor for an illness: he uses the stored knowledge for the diagnosis. In the following chapters all the necessary passages to realize an expert system will be faced. Therefore, we will use the example system "DecidExp", which will be developed inside the document. In the end, you will get to create this system and you will be able to consult it, by using the same EXPERLAB tools.

- **Expert System Project**

It is neither convenient nor compulsory that every real problem is resolved by an ES. There are situations in which the use of an ES or several ones, connected one to the other, is necessary to solve a concrete problem as well as the use of the experience of a particular group of skilled people. That is, we only need a good management software that allows us to manipulate the data in a specific and organized way to control a hospital, a hotel, a factory or another system of the reality. However if we desire to undertake a study to arrive to some conclusions from the data stored during a certain time, we need to create an "intelligent" system that allows "to reason" with these data and arrive to certain conclusions that point out the state of the entity among other conclusions. It is exactly here that the ES will play an important role. Another example is the one in relation to the diagnosis, where some specialists' experience is crucial when we need to diagnose what happens in relation to a given problem.

A concrete case is the knowledge of many long-experienced doctors that allows them to determine, in a rapid and sure way, what happens to a person when they become ill. For example, it is essential to transfer it to a computer, as there are some places and times where and when you cannot rely on a specialist. So having "scanned" skills can give access to this knowledge quickly and securely

only with few clicks on a PC that save so many lives. The declaration and definition of a ES project is realized by the first subsystem SAMC and it is saved in a database. The project ES that we want to develop can be created and processed by SAMC. As will be seen it the last chapter, after entering the corresponding knowledge it can be compiled and implemented. AN ES, obtained from EXPERLAB, is a set of FRC that are related one to the other that allows us to solves the concrete problem for which it was created, from the implementation of a consultant system that interacts with those who benefit from it. It consists of the same elements:

- **Knowledge Base (KB**) It is structured by the EXPERLAB's "Knowledge Acquisition and Use System"(KAUS) and it allows to define, for an ES, proposals, rules, contexts, consequences and equivalents, etc. that make it up. In other words, it is the recording of the knowledge for an ES, where the relationships that allow the machine of inferences (deduction) to "reason" and to come to some conclusions are kept. This part will be the equivalent of a part from the human brain that stores the special experiences that allow us to reason and make certain decisions, such as keeping experiences in our mind, to bypass a hole and not to go over it for the fear of falling, if the hole is very large.

- **Interference Machine (IM),** which is nothing else but the software that uses the knowledge saved in KB to process a consultation and offer the user their own conclusions or make decisions about the actions to be completed. It is the equivalent of that part of the human brain that allows to use the knowledge saved inside and to deduct the decisions to take. For example to answer to the question *Does the person have to skip or bypass the hole?*

- **User interface** consists of a software that allows communication between IM and the user of the ES. This is the essence of the second subsystem, which is the consultant system, since it is the one that monitors the consultation, by asking questions to the user, urging IM, passing the responses of the same one. In addition, the user can see the conclusions taken from the ES. by the IM that

- **External programs,** which the ES uses during a consultation when needed. Generally, these are created and implemented specifically for each ES and are

in communication with IM via communication protocols. Not all ESs include EPs.

At the moment, it is good to know that a FRC(according to EXPERLAB) can be a proposal, a rule, a production, a context, a variable, and so on. All these structures are available in EXPERLAB and will be explained later on.

Another factor to be considered is that the person that develops the ES by using the SAMC subsystem will be named “the Knowledge Engineer” (EK), and every person who uses the ES, already generated by EXPERLAB, will be called “user”,. Compared to the real concept of an user, both are users. The first is a SAMC user and the second is a SC one; but here they differ because one is an EK and the other an “user”.

In the light of the above, the realization of an ES seems to be possible only by skilled and prepared people but that isn’t the case. This document will describe the different parts that constitute an ES, how it works at the time of consultation and how it is built.