# Different learning schemes for intelligent system education essay

Education

# CHAPTER 3:

Learning [Kodratoff and Michalski, 1990, Michalski et al, 1983, 1985, 1986, 1993a, 1993b, Stackhouse and Zeiglar, 1989, Winston, 1986] itself is a general term which takes place differently in different natural environment for same or different learners. If we categorize learners in two categories as living beings and non-living beings learning classification works differently for both. If we consider the three initial classes of learning [ Vere, 1978] i. e. Reinforced , supervised and unsupervised learning, these all works for human beings lifelong consecutively and sometimes sequentially. These learning schemes also exist for animals but not all the learning classifications work for all the animal kingdom and vice-versa is also true. Learning has been characterized as a goal-guided process for the improvement of the system's behaviour due to experience and prior knowledge. Behaviour change is change in response to any given experience, implementation of the changes, evaluation of the changes and to employ the prior knowledge. The system knowledge includes both conceptual knowledge (declarative) and control knowledge (procedural). Learning doesn't mean only the change in organization of knowledge, it also consider the improvement (change) in the confidence in the prior knowledge. All of the learning techniques face the same issues [Sammul and Banerji, 1983]: Task: Virtually any task that can be carried out by a computer can be learned. The most commonly studied learning task is supervised classification: Given a set of pre-classified examples, try to classify a new instance in to its appropriate class. Other problems that have been considered include: unsupervised learning i. e. learning classifications when the examples are not already classified,

reinforcement learning i. e. learning what to do based on rewards and punishments, analytic learning i. e. learning to reason faster and inductive logic programming i. e. learning richer representation such as logic programs. Feedback: Learning tasks can be characterized by the feedback given to the learner. Supervised learning of actions occurs when the agent is given immediate feedback about the value of each action. Unsupervised learning occurs when no classifications are given and the learner has to discover categories and regularities in the data. Feedback is often between these extremes, such as in re-enforcement learning; feedback occurs after a sequence of actions and leads to the credit-assignment problem. Representation: Much of machine learning is studied in the context of particular representations (decision trees, neural networks, or case bases). Measuring Success: The measure is usually not how well the agent performs on the training experiences, but how well the agent performs for new experiences. A standard way to measure success is to divide the examples into a training set and a test set. A representation is built using the training set, and then the predictive accuracy is measured on the test set. Bias: The tendency to prefer one hypothesis over another is called a Bias. Learning as search: Given a representation and a Bias, the problem of learning can be reduced to one of search. The definition of the learning algorithm then becomes one of defining the search space, defining the heuristic function and the search method. Noise: One of the important properties of a learning algorithm is the ability to handle noisy data in all of its forms. Some of the methods, in particular, the version space learning and the PAC learning do not work with noise. Bayesian view of learning chooses a posterior

distribution over the hypotheses. The hypotheses can be noisy in that they predict a probability distribution over classifications. Machine Learning: Human beings are working now days in a different field i. e. non-living beings learning; how to make a machine learn. This field explores the wisdom of human being [ Wizenbaum and ELIZA, 1966] to be an expert in making a machine which mimics human being. In this functionality the major contribution is of common sense learning i. e. to make machine or a system capable enough to behave as having common sense [ McCarthy, 1959b]. To overcome the knowledge acquisition bottleneck, machine learning is an integral part of learning methodology. The study of learning processes and computer modeling of learning processes in their multifestations constitutes the subject matter of machine learning. Concepts of neural networks, genetic algorithm, cluster analysis, rough set modeling, symbolic methods and evolutionary approaches represent different methodologies and classifications of machine learning techniques. Although progress in one objective leads to progress in another. The main objectives of machine learning are using engineering approach to solve predetermined set of tasks, working with cognitive modeling approach to understand and to simulate human learning processes and theoretical exploration of the space of possible learning methods and algorithms independent of application domain. Airplanes a successful result of engineering approach is a cognitive simulation of biological counterparts say birds. How do human acquire this specific knowledge or skill? Answer to such question and analysis of those answers create new avenues of learnings. The innate ability to acquire facts, skills and more abstract concepts, genetically-endowed abilities and

environmentally acquired skills are the areas of AI researchers liking to reproduce aspects of that learning behavior in a computer system. And this is the objective of machine learning field to explore possible learning mechanisms, including the discovery of different induction algorithms, the scope and theoretical limitations of certain methods, the information that must be available to learner, the issue of coping with imperfect training data, and the creation of general techniques applicable in many task domains [ Hewitt, 1972]. There is no reason to believe that human learning methods are the only possible means of acquiring knowledge and skills. Common sense suggests that human learning represents just one point in an uncharted space of possible learning methods- a point that through the evolutionary process is particularly well suited to cope with the general physical environment in which we exist. Present day computers presumed to be intelligent are not to be dependent entirely on the teacher to learn how to solve a particular task. Rather they are ready to explore all the ways of learning using machine learning approaches. This is machine learning research which opens different possibilities of instructing computers in new ways with the promise to ease the burden of hand-programming growing volumes of increasingly complex information into the computers of tomorrow. This attractive and required feature comes automatically with exponential growth of applications and availability of computers. Out of all a few objectives of machine learning are: discovery of different induction algorithms, theoretical limitations of methods used in machine learning, handling of imperfect training data set, information set introduced to learner and selection of strategy based on domain. No doubt human approach to

learn is the upmost criteria to adapt the learning behavior but it is not the limiting condition to adaptability. Reading a book to draw some automobile design and redrawing them with perfection is one learning and another is drawing some new design, drawing some new design with some mix and match of existing design and finally doing this all with very natural manner. Knowledge acquisition and skill refinement are the two forms of learning. Giving lesions to the students for the solution of some mathematical problems and let students understand it is the knowledge acquisition. And affluence to solve such problems and use of this knowledge gain in some other problem domain is skill refinement. The essence of knowledge acquisition is a conscious and continuous process resulting in new knowledge whereas skill refinement is the result of repeated practice without concerted conscious effort. We need both in Artificial Intelligent systems[ McCarthy and Hayes, 1969, Newell et al, 1972, McCarthy, 1987]. Based on machine learning approach following are the three meaningful classifications of AIS. 1. Basis is underlying learning strategies; information is provided and strategies are ordered by the amount of inference the learning system do. Learning strategies define the amount of inference a system is capable. A facilitator's role is all the time different to make the learner intelligent. Sometimes he instructs, teaches, monitor and facilitate. The burden of facilitator decreases depending upon inference capability improvement. Good to see the learner learning himself or with minimum assistance but before that learner has to be taught the basics of the concept, answers of all the W's related to the concept of concern. Rote learning and direct implementation of new knowledge, learning from Instruction, learning by analogy, learning from

observations and discovery, and learning from available examples (negative, positive or both) are the strategies fall under the line. 2. Basis is representation of knowledge acquired by the learner; acquisition of decision trees, formal grammars or production rules etc. Knowing rules of different processing, knowing system behaviour, classification taxonomies over a space, behaviour adaptation, context learning, language recognition, grammar understanding, production rules for concept capture [Davis and King, 1977, Vere, 1977, 1978], generalized condition set of concept captured, specialized condition set or the restricted condition for the concept, taxonomies, networks, multiple representations of the concept[Sammul and Banerji, 1983] are the different knowledge representations [ Shank and Abelson, 1977] which can be worked out in the learning processes. More should be shown here for our system3. Basis is Application domain; speech recognition, natural language processing [Hayes, 1977a], image recognition, music, medical [Shortliffe, 1976], robotics, physical object characterization, gaming , expert system, decision support system and analysers are some of the important areas of machine learning. In the making of a knowledge-rich system a wide spectrum of learning methods can be explored. These trends include Knowledge- Intensive approaches with the idea of collecting task-oriented knowledge with the control constraints in the learning process, exploration of alternative methods of learning and incorporating abilities to generate and select learning tasks. Intelligent system learning may be classified according to their underlying learning strategies. These strategies are ordered according to the amount of inference or the degree of knowledge transformation

required by the learning system. This order also reflects the increasing amount of effort required by the learning system and the decreasing effort required by the teacher. These strategies are separated into the following categories: 1. Rote Learning - This strategy does not require the learning system to transform or infer knowledge. It includes learning by imitation, simple memorization and learning by being programmed. In this context, a system may simply memorize previous solutions and recall them when confronted with the same problem. 2. Learning from Instruction - This strategy, also called learning by being told, requires the learning system to select and transform knowledge into a usable form and then integrate it into the existing knowledge of the system. It includes learning from teachers and learning by using books, publications and other types of instruction. 3. Learning by Deduction - Using this strategy, the learning system derives new facts from existing information or knowledge by employing deductive inference. These truth-preserving inferences include transforming knowledge into more effective forms and determining important new facts or consequences. Explanation-based Learning is an example of deductive learning. 4. Learning by Analogy - This form requires the learning system to transform and supplement its existing knowledge from one domain or problem area into new domain or problem areas. This strategy requires more inferencing by the learning system than previous strategies. Relevant knowledge must be found in the system's existing knowledge by using induction strategies. This knowledge must then be transformed or mapped to the new problem using deductive inference strategies. 5. Observing Instances or learning by examples - This strategy, also called concept

acquisition, requires the learning system to induce general class or concept descriptions from examples and counter-examples of a concept. Since the learning system does not have prior or analogous knowledge of the concept area, the amount of inferencing is greater than both learning by deduction and analogy. The goal of the learner in conventional learning methods is to capture the inherent meaning of concepts meaning by observing concept examples, which can be given at once (batch learning) and incrementally. This paradigm works well for knowledge based system applications which do not change with time. But many of the real life applications are characterized by change of time. Even concepts are not static; they grow over time. Applications such as dynamic knowledge bases, intelligent agents and active vision systems violate many of the traditional assumptions of concept learning. All training examples are not available at any given time; training examples are distributed over time. Consequently, the system must not only learn over time, but it may also learn a changing concept. 6. Learning from Observation and Discovery - Using this strategy, the learning system must either induce class descriptions from observing the environment or manipulate the environment to acquire class descriptions or concepts. This unsupervised form of learning requires the greatest amount of inferencing among all of the different forms of learning. 7. Concept Capture -Learning is defined to be the computation done by a learner when there is a transfer of information to him from a felicitator/mentor. The felicitator/mentor draws a spectrum from all the existing encryption for the subject/concept. In the world of knowledge all learners are visionaries, first they create some hypothesis of the subject/concept via all the existing encryptions then make

some understanding and finally with the help of available examples evaluate this available structure. For each and every concept encryption lists textual encryption by giving some name to the concept, sound encryption by pronunciation of the text, image encryption developed through available images of the concept and video encryption if exist. These all work for the creation of illusion/image of the concept. In the case of a concept " Penguin" without its existence in the proximity of our senses, we are able to visualize the concept and able to create understanding of the concept using all the available encryptions. 8. Cumulative learning- Humans accumulate knowledge and abilities that serve as building blocks for subsequent development. Such layered or sequential learning appears to be an essential mechanism, both in acquiring useful abstractions that serve intelligent behavior, and in producing essential new foundations for further development. Cumulative learning (also called layered or hierarchical learning), involves using the results of prior learning to facilitate further learning (e. g., building new knowledge structures from experience by combining previously learned structures). The ' If A then D' part of a Censored Production Rule expresses important information while the unless C part acts only as a switch changes the polarity of D to ~D. Bharadwaj and Kandwal[2005, 2006, 2007] discovered CPRs from the discovered flat PRs using Dempster-Shafer Theory interpretation of a CPR to incrementally incorporates new knowledge. Cumulative learning based on Dynamic Clustering of Hierarchical Production Rules(HPRs)[Bharadwaj et al, 2005] proposed algorithmic approach for dynamic structuring of clusters i. e. incorporates new knowledge into the set of clusters from the previous

episodes and also maintains summary of clusters as Synopsis to be used in the future episodes. Censor Updation during Dynamic clustering of Hierarchical Censored Production Rules(HCPRs)[Kandwal and Bharadwaj, 2007] proposed modification of censored conditions at different level of hierarchy to maintain consistency in the Knowledge base which is used again for the next learning phase. Cumulative learning techniques in production rules with fuzzy hierarchy system (PRFH) [Kandwal and Bharadwaj, 2008] proposed a cumulative learning scheme showing cumulative growth in PRFH clusters. The artificial neural networks, which represent the electrical analogue of the biological nervous systems, are gaining importance for their increasing applications in supervised (parametric) learning problems. Besides this type, the other common learning methods, which we do unknowingly, are inductive and analogy-based learning[ Becker, 1985, Bundy et al, 1985]. In inductive learning, the learner makes generalizations from examples. For instance, noting that " cuckoo flies", " parrot flies" and " sparrow flies", the learner generalizes that " birds fly". On the other hand, in analogy-based learning, the learner, for example, learns the motion of electrons in an atom analogously from his knowledge of planetary motion in solar systems. 9. Multiple Agent - Distributed artificial intelligence (DAI) systems[Michael et al, 2007] solve problems using multiple, cooperative agents as control and information are distributed among the agents. This reduces the complexity of each agent and allows agents to work in parallel and increases problem solving speed. In addition, a DAI system can continue to operate even if some of its agents cease to operate. This behavior allows the system to degrade gracefully in the event of failure of any of its parts. In

general, multiple agents learning involves improving the performance of the group of agents as a whole or increasing the domain knowledge of the group. It also includes increasing communication knowledge. An increase in communication knowledge can lead to an increase in performance by allowing the agents to communicate in a more efficient manner. In the context of improving the performance of a group of agents, allowing individual agents to improve their performance may not be enough to improve the performance of the group. To apply learning to the overall group performance, the agents need to adapt and learn to work with the each other. The agents may only need to learn to work together and not necessarily improve their individual performance. Control Learning, Organization, Communication, Group observation, and Discovery learning are the learning categories for DIS. 10. Learning by HypothesizingWinston [Michalski et al, 1986] proposed concept of transfer frames in hypothesizing the knowledge world. Learning is defined as a computation done by the learner which is a computer whenever information is transferred by the teacher a programmer. This learning or the computation completes in two phases- Hypothesis and Evaluation. A concept of Transfer Frame is used to complete the process of learning. Hypothesis phase produces potential transfer frames which are working to analyse the information in the source and its immediate relatives. This phase, important enough, is showing dependency on transfer frames. It is the beauty of the transfer frame to collect all the related slots, meaningful knowledge acquisition from the source to make the hypothesis simple but large in the sense of abstraction. In the evaluation step, the better of hypothesized frames are selected

through a study of the destination frame, its relatives, and the general context. In simple words giving lot of imaginations first and then compare these to the given scenario to create understanding of it. This is an adaptation of the approach used by Marr in his fundamental work on vision. The approach is: It is necessary to observe or define some learning competence to be understood. A representation should be selected or invented that is capable of capturing the knowledge to be learned. The first and second items should be translated into a precisely defined computation problem to be solved. Algorithms should be devised that perform the desired computation. The result so far should be validated either by successful computer implementation and experimentation or by appropriate psychological inquiries.

## 3. 2 Different learning schemes for Artificial Intelligent Systems

An intelligent system is said to be so only if it possess reasoning capabilities that match the real – life queries, and most importantly, it should offer enriched learning techniques for the maintenance of its knowledge base and the acquisition of new knowledge [[Fu and Bucanan, 1985]. An increase in performance is not necessarily due to an increase in knowledge. It may be brought about simply by rearranging the existing knowledge or utilizing it in a different manner. In addition, new knowledge may not be employed immediately but may be accumulated for future use. The process of learning, which is an inherent feature of intelligence, may be defined as a direct change in the knowledge structure that improves the future working of the system. The process of learning is said to be operative when a system self

modifies to improve upon its own behaviour. In other word, with each step of learning, system performance improves with the adaptation of new knowledge whether the knowledge is procedural or declarative. Change in knowledge structure includes the restructuring or modification of existing knowledge and creation of new knowledge depending upon externally supplied information and already acquired knowledge. Learning is an essential part of intelligence. Learning is the ability to improve one's behaviour based on experience. This could mean the following: The range of behaviours is expanded: the agent can do more. The accuracy on tasks is improved: the agent can do things better. The speed is improved: the agent can do things faster.

## 3. 2. 1 Learning in declarative knowledge

Basically knowledge has three aspects to be considered: its content, its organization, and its certainty. Content is conveyed by a declarative knowledge representation. The knowledge organization is reflected by the structure of the knowledge representation and determines the way in which the knowledge segment is used. The certainty of a segment is the degree to which the system believes that this particular segment is true.

## 3. 2. 2 Learning in procedural knowledge

Learning cannot take place without the ability to reason and the ability to store and retrieve information from memory. Leaning capability of the system makes it able to perform inference and to memories knowledge. Inference includes any possible type of inference, knowledge transformation or manipulation, and a search for a specified knowledge entity. The change

in the knowledge organization can improves the performance of the system for a particular task like reasoning [ McCarthy, 1980, McDermott Drew, 1982], inference, etc. without changing the truth status of the knowledge is also a part of learning. The total change of a system's knowledge is determined by the changes in all these three aspects. LEARNING = INFERENCE + MEMORISING

## 3. 2. 3 Localization of knowledge

In addition to performance and capabilities, online working of any system is a major contributing factor to make it internationally acceptable especially in the case of an intelligent system. It is universally recognized that globalization of any system is a major contributing factor to make it internationally acceptable. Globalization is defined as " Globalization (G11N) = Internationalization (I18N) + Localization (L10N)" where Internationalization is making the application locale independent and localization is adapting an application to a specific locale. Internet has brought the information revolution and people come closer across the globe irrespective of their region, language, custom, background, or even status. Now, they can share information mainly in English. Initiation with English language as it was the predominant language gave constrained access to other language speaking people and hence it limited the access of knowledge and sharing of thoughts and so put curtain on revolution in knowledge world[ Fahlman, 1979] as were in thought. This consideration forces people to think of any language or domain free knowledge flow. New people, language, culture or domain always create new learning environment for human being so with intelligent system as they intend to

mimic the behavior of human being. Characteristics to adjust with new environment which is the inbuilt character of human has to be exhibited somewhat (may be artificially) in the intelligent system. These systems are required to learn to differentiate the changes, adapt the changes, accept the changes and behave with respect to the changes. While targeting this learning one has to conceptualize the best practices possible in the system.

## LOCALIZATION

An intelligent system working for India gets enriched with the knowledge about Indian festivals, Indian customs, Indian currency, traffic rules in India, and seasons in India and so on. This complete package makes it appropriate in this locale and the system is performing well linguistically and culturally. Localization refers to the actual adaptation of the product for a specific environment. It includes translation, adaptation of graphics, adoption of local currencies, use of proper forms for dates, addresses, and phone numbers, and many other details, including physical structures of products in some cases.

## INTERNATIONALIZATION

An international system is designed and developed in a way to remove barriers to localization or international deployment and satisfies user's international preferences as well as can be localized quickly.

An internationalized system is equipped for use in a range of " locales" (or by users of multiple languages), by allowing the co-existence of several languages and character sets for input, display, and User Interface. In particular, a system may not be considered internationalized in the fullest

sense unless the User Interface language is selectable by the user at runtime. Full internationalization may extend beyond support for multiple languages and orthography to compliance with jurisdiction-specific legislation (in respect of copyright, for instance) and other non-linguistic conventions. When an internationalized system comes across new frontiers or set of users through Internet or technically we can say that system is online getting the deep as well vast sea of knowledge, no redesigning or restructuring is needed. In brief we can say that Internationalization encompasses the planning and preparation stages for a system in which it is built by design to support global environment. This process means that all cultural assumptions are removed and any country or language specific content is stored externally to the product so that it can be easily adapted.

## GLOBALIZATION

Globalization of an intelligent system initiates an impressive outflow of information. The globalization of a thing is simply about spreading the thing to several different countries, and making it applicable and useable in those countries. An Intelligent system needs intelligence to perceive, classify, understand, analyze and exploit the knowledge. With this aim objective of a globalized intelligent system is to provide an environment to every user with the cultural knowledge, regional knowledge to portray active and full participation of the system in that society. The system enriched with cultural knowledge and skills will automatically get empowered to share knowledge for individuals, ethnic, social, cultural and religious groups and nations. In particular, globalization is not a process that starts after a product has been designed. If global concerns and plans for aftermarket support are not made

even before product development begins, costs will go up and quality problems will emerge. The goal of this paper is to present Globalized EHCPRs System working as an intelligent agent with the capability of multilingual user interface and multilingual knowledge base working efficiently for a number of locales as well as internationally.

## 3. 2. 4 Integration of knowledge

Artificial intelligence treated as applied epistemology has brought to light entirely new research which resulted in a number of useful practical tools that configure computer systems, diagnose faults in engine, software agents that scour the internet for information on demand etc. An intelligent system learns during its existence. In other words, it senses its environment and learns, for each situation, which action permits it to reach its objectives. An intelligent autonomous system[ Holland, 1986] should have the capability to rapidly learn and optimize the learnt rule base. Learning in the context of computing machinery, is the modification by a system of its behaviour such that its performance is improved. Learning doesn't mean only the change in organization of knowledge, it also consider the improvement (change) in the confidence in the prior knowledge. In short, to achieve learning a system must be able to 1) evaluate effectively the performance of its components that are open to modification and 2) find appropriate modifications. Learning cannot take place without the ability to reason and the ability to store and retrieve information from memory. Learning capability of the system makes it able to perform inference and to memories knowledge. An intelligent autonomous system should have the capability to rapidly learn and optimize the learnt rule base. While targeting this learning one has to conceptualize

the best practices possible in the system. A general learning is to increase the " total" knowledge of the system. Improved performance with time because of the accretion of frequent knowledge is directly proportional to the knowledge management. Knowledge management is defined as the process of capturing [Reinke and Michalski, 1986], distributing, and effectively using knowledge. Instant response of the system is created by supervised learning. Increase in tactical knowledge and strategies in terms of procedural knowledge are part of supervised learning. Knowledge collection and processing methods get changed with the developments of information and communication technologies. Automatic knowledge feed i. e. without human intervention requires a system for knowledge management and different learning on the part of intelligent system. To apply learning to the overall performance of the EHCPRs system, system needs to learn to work together with other existing knowledge bases. In addition to existing learning control learning, organization, communication and discovery learning are other learning categories for the system. A major goal that remains unchallenged yet is to have the system understand enough concepts while connecting it with internet and enable it to learn by reading from different sources in different languages as well as in different context from the internet and thus be able to add to its own knowledge treasure in multilingual manner naturally for its future effective and enrich functioning. Introducing all the required knowledge into a new system is a very complex, time consuming, and error-prone process, requiring special expertise. This task can be simplified by using machine learning techniques. Such techniques would enable a system to develop knowledge in required pattern through the

supervised/unsupervised methods of knowledge extraction. Any new knowledge generated by machines should be subjected to close human scrutiny before it is used. In addition to efficient and correct storage of knowledge imparted to the system, fast/timely access to the relevant knowledge is also a desirable practice. The capability to acquire fresh knowledge and capability to " view" this fresh knowledge in the context of its knowledge base is also desirable feature.

## 3. 3 Summary and conclusion

Artificial Intelligence Technologies have significantly strengthened the role that intelligent systems play in supporting the human life. Be it Business support systems or any emerging field which need knowledge, use of learning and adaptability to the environment. AI is being applied to many applications in business operations and managerial decision making, as well as in many other fields. Artificial Intelligence Research in expert Systems, fuzzy logic systems, and neural networks eventually led to important practical applications in business. As an introduction to the domain and to place our system in perspective, related projects in artificial intelligence are CYC, WordNet, OWL, Eliza and lot more. This study of different learning approaches creates environment and helps to work with these approaches for EHCPRs System.