WAYS TO IMPROVE MACHINE LEARNING AND INTELLIGENT BEHAVIOR

by

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This paper deals with presenting various methods to be adopted in the Artificial intelligence field so that machine learning can be improved, starting from the simplest to more complex level. The problem of machine learning is viewed as a similar problem to the human learning approach, trying therefore to adopt as many of them as possible techniques from the cognitive area, always taking into account though, the differences and limitations of machines.

Concerning the human learning procedures, we classify them according to the inferences drawn, into the following categories:

1. Rote Learning
2. Learning by Instruction
3. Learning by Deduction
4. Learning by Analogy
5. Learning by Induction

Trying to transfer these techniques to accommodate "machine learning", we have to deal with tremendous amount of knowledge. Learning then, could be a process of storing and continuous process of knowledge, which leads to categorize it to two main categories:

1.Data/Algorithmic Approach
2.knowledge-Based Approach

The problem is also depended on the amount of present knowledge, as well as the various ways for optimal ways to use it to find any solution(s), if they exist. The classic approaches are then presented as the British Museum Procedure, the Depth first Search (dFS), Breadth First Search (BFS) and a comparison between them. The British Museum Procedure works on the idea of continuous generating all the possible states, within the state space to find the correct one(s). This method is appropriate for small domain problems, since the total of generated states increases exponentially in the number of operators.

The comparison of the methods is done through an example-the travelling sales problem- approached with the Depth First Search firstly, and secondly with the Breadth First Search. Many factors are examined which affect the result of the searches, such as the branching

factor, number of states. The two searches are also viewed under both the theoretical as well as the practical point of view.

To improve these kinds of exhaustive searches, we have then to develop Heuristics or rules-of-thumb, which have to be in the form of algebraic function, so they can be evaluated and a decision can be made based upon their results. Since the problem of machine learning is not only a problem of "searching knowledge" but a problem of representing knowledge in effective ways as a state space, different kind of trees are proposed (data structures), and the possibility of using "intelligent databases" or "object oriented databases", for optimal decision time, depending on the nature and the complexity of the particular problem. An example is presented here, the problem of the travelling salesman, solved using different ways among them two ways using Heuristics, the Best Search First (BSF) and the A* Heuristics. The Automated Mathematican (AM) model is also considered, for a practical application of Heuristics as concepts of interest and representing then in the IF-THEN form, as well as a comparison of Mathematical and Heuristic models, presenting their advantages and disadvantages. Finally the incorporation of Heuristic functions in neural networks is proposed and discussed.