**Machine Learning**

Learning is one of the most important activities of human beings and living beings in general, which help us in adapting to the environment. Humans learn from nature as well as from special learning environments through different techniques that vary in complexity. The learning requires transformations of ideas and information structures in the human mind.

A common view holds that learning involves making changes in the learning system that will improve it in some way. These changes are *adaptive*, because it is found that the system does some task or tasks more effectively the next time when they are drawn from the same population of tasks.

Most of the knowledge of the world we have around us, and about the explicit

set of tasks, is not formalized, and even not available in text form. The latter is a

necessary requirement for it to be understood by any computer program. This is the reason it is not easy to write a program for a computer to do many tasks that we humans do so easily, such as understanding spoken sentences, images, languages, or driving a car. Any attempt to achieve this, i.e., organizing sets of facts in elaborate data structures to enable computers to understand it, has achieved very little success.

The concept of *learning* is based on the principles of training the computing

machines, and enabling them to teach themselves. Tenet of these machines/programs is related to what we consider as good decision. For humans and animals, evolutionary principles dictate that any decision made by them should lead to such behaviors that optimize the chances of *survival* and *reproduction*. In the societies of human beings, a good decision is one that might include social interactions that bring *status*, or a sense of *well-being*. For a machine such as a self-driving car, such criteria cannot exist! So the quality of decision-making for a self-driving car is measured based on the criteria as to how close the autonomous vehicle imitates the behavior of trained human drivers.

It is important to note that the knowledge required to make a good decision in a

particular situation is not necessarily clear to the extent to code it into a computer program. Consider, for example, that a mouse has knowledge about its surroundings, and has an innate sense of where to sniff and how to find food or mates, and at the same time save itself from predators. It is not easy for any programmer to specify step-by-step procedures or a set of instructions to produce such behaviors for some artificial mouse. However, this all remains encoded in the brain of a mouse in the form of knowledge.

Before we think about creating computers (programs) that can train themselves,

it is important to answer the fundamental question as to how we humans acquire

knowledge. Partly, the knowledge in humans may be innate, but most of it is

acquired through experience and observation. What we know intuitively has been

often learned from examples and practice—the process which cannot be turned into a clear sequence of steps as a computer program. Since 1950 people have looked for ways and means and tried to refine general principles that allow animals or humans, to acquire knowledge through experience.

Machine learning aims to create theories and procedures—*learning algorithms*—

that allow machines to learn. One such is learning from examples presented

to them, called learning by examples.

**Types of Machine Learning**

Rote Learning

Learning by Instruction

Learning by Deduction

Learning by Analogy

Learning by Induction (or Similarity)

Reinforcement Learning

Discovery-based Learning

These strategies are in increasing order of complexity of transformation required in the initial information, which is stored as knowledge base.