Learning as an inverse problem

Marco Prato *

Dipartimento di Scienze Fisiche, Informatiche e Matematiche, Università di Modena e Reggio Emilia

June 9, 2022

When we talk about machine learning we are talking about that particular branch of artificial intelligence that develops different mechanisms that allow an intelligent machine to improve its capabilities and performance over time. The machine, therefore, will be able to learn to perform certain tasks by improving, through experience, its skills, responses and functions. One of the main features of machine learning is its close correlation with many different scientific disciplines, such as computer science, statistics, numerical optimization and many other sectors of modern intelligent sciences. In this lecture we will review the statistical formulation of the learning from examples problem, defined following the works of the Russian mathematician Vladimir Vapnik in the 90's. In particular, we will show that the main idea of machine learning can be traced back to the regularization of a ill-posed inverse problem, and the several machine learning algorithms developed during the years derive from this formulation according to the choice of the data fidelity measure and the parametric form of the predicting model.

*marco.prato@unimore.it, https://cdm.unimore.it/home/matematica/prato.marco/