DESCRIPTION FOR THE GENERAL PUBLIC

Project:
Algorithmic models of prediction: formal properties and philosophical implications

Predicting future, or fortune telling, may seem a kind of magical activity, done mostly by fairies and conjurers. As a matter of fact, prediction is crucial in a plethora of human endeavors, be it daily chores or more formal settings such as doing science. The ancient Egiptian priests already predicted the movements of celestial bodies. The ability to correctly assess the future outcomes would give them power. Nowadays, prediction is done at stock exchange and even a bus schedule is a form of prediction.

Prediction is done not only for practical purposes but also to satisfy our intellectual drive for knowledge and understanding. Scientific theories may be seen as some procedures for prediction of future phenomena built on past observations. Mathematical models are fitted to data with a hope that they will permit us to foresee the future. The notion of prediction serves as a basis for explication of various philosophical concepts such as determinism, causality or scientific method.

The act of prediction may be described and studied using mathematical methods. Usually, such research is done from the viewpoint of probability theory. We can contemplate, e.g., the probabilities of making a wrong or right prediction. On the other hand, we can treat prediction as a purely deterministic process which is focused on foreseeing a particular determined phenomenon.

In both cases, we may ask for a set of minimal conditions that should be satisfied by a good theory of prediction. In our research proposal, we assume that such minimal constraints are given by effectiveness, which is identified with computability in the sense of theoretical computer science. Simply speaking, we define the act of prediction as carrying out a certain algorithm. Thus, our focus is the scientific prediction rather than the mystical or prophetic one.

Our main goal is to study the minimal theory of prediction as understood in the previous paragraph. Since we are thinking of prediction as a form of computations, our research will be based on computability theory, which is the mathematical theory of computation. That being said, our problem is a bit different from standard problems in computability theory. Roughly speaking, computability theory studies how hard some problems are to solve. The complexity of prediction is formally different. Therefore, we want to compare these two different notions of hardness or complexity. Moreover, we also want to adapt some probabilistic results to this computational framework. For these reasons, our project will rely on developing new mathematical proof constructions and reasoning strategies.

That being said, in our project, mathematics is rather a tool than a goal itself. What we will be really trying to achieve is a coherent theory of prediction, which could serve as a basis for philosophical investigation on the nature of prediction and its limitations. By providing a comprehensive insight into prediction from the computability-theoretic perspective, we hope to illuminate our general understanding of this fundamental phenomenon and its philosophical significance, including constraints stemming from its effectiveness.