

Human-in-the-loop AI in decision and control systems: the role of linguistic data summaries

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Abstract

We consider the problem of how to develop an Artificial Intelligence based - or AI based, for short - system for solving complex decision making and control problems, in both engineering and socio-economic systems. We consider problems in which, in addition to aspects which are subject to an „objective” evaluation by sensors, there are many relevant aspects which are subject to human judgment, intentions, preferences, etc. which are difficult to quantify, subjective, changeable over time, and subject to many cognitive biases, notably the status quo bias. As the presumably most promising architecture for solving such problems we assume the „human-in-the-loop” paradigm, called also the „human-in-the-loop AI” in which it is postulated and implemented a synergistic cooperation between the human being and the „machine”, that is, approaches and algorithms employed. We use the human-in-the-loop paradigm for decision making and control. We argue that the most promising solution in this context is the use of the human centric systems philosophy, originated at MIT, in which no (additional) interface between the human being and the computer is postulated. Therefore, to attain this we advocate to use in the problem formulation and solution (support) some tools and techniques of natural language which is the only fully natural means of articulation and communication for the humans. Specifically, we use the linguistic data summaries, introduced by Yager and then developed by him and Kacprzyk. They are meant to represent large data sets by short, comprehensible sentences. For instance, if we have a (large) set of data on employees, a static linguistic summary can be „most young employees earn around the mean salary”, and a dynamic summary can be „in most recent years the increase of salaries of experienced employees was slightly growing”. Notice that no matter how big the data set is, such short sentences are fully comprehensible for the human being, and imprecise terms are natural. We present various aspects of such linguistic summaries, such as context dependence, representation of language modalities, etc. We show how they can be used for an effective and efficient human-in-the-loop AI based systems for supporting decision making (mostly static summaries) and control (dynamic summaries). We present an implementation for supporting a day-to-day running of a small computer retailer.