A Theory of Case-Based Decisions

By Itzhak Gilboa and David Schmeidler

Gilboa and Schmeidler's book provides a tremendously enjoyable, clear, and user friendly introduction to a new paradigm for analyzing decision making under uncertainty. Case Based Decision Theory (henceforth CBDT) suggests that people make decisions by analogies to past cases, choosing acts that performed well in the past in similar situations, and avoiding acts that performed poorly.

The book is spiced with light hearted examples that pave the road for the casual reader to understand the conceptual point of each section without going carefully into the mathematical constructions. Nonetheless, the book contains enough formal content to serve as a complementary textbook in an advanced graduate theory class, and is sprinkled with hints for open questions and directions for future research.

Going beyond impressionistic commentary, the book is comprised of three parts: 1. a description of the general (static) model with its axiomatic foundations; 2. a discussion of the conceptual foundations for considering CBDT; and 3. an analysis of CBDT in a dynamic setting that concerns issues of planning, repeated choice, and learning.

There are two main components to the basic model – similarity and memory. An agent remembers a collection of cases, triplets that are made up of a choice problem, an action, and a corresponding outcome. When confronted with a new problem, the agent creates an index for each of her feasible actions, and chooses the action with the highest index value. This index is a weighted sum of outcomes that have resulted whenever the relevant action was chosen, the weight being determined by a similarity function that captures the resemblance between the problem at hand and past cases. The authors consider different possible similarity functions: between problems, between problem-action pairs, etc. The general theme of all the suggested functional forms is that consideration of past cases is additive across the agent's memory. A significant chapter in the book is dedicated to providing an axiomatic foundation for the proposed choice rule.

The first mentioned application of CBDT is planning. A plan is defined as a sequence of cases and the essence of planning is *dissection* into cases, *selection* of similar past cases to each segment of the plan, and *recombination* of the selected cases into a stream

of events of which the outcome is known. Despite the fact that the discussion concentrates on a sequence of events leading to one outcome, a value is attached to each segment in the process of decision making. While this seems plausible in some cases, it does raise issues of intertemporal substitutability that are not tackled, and are presumably left for future research.

In the chapters dealing with learning the authors present two different approaches. The first deals with learning in a repeated choice scenario, which is a manifestation of aspiration-level adjustment. The second deals with learning in an extended choice problem, which is interpreted as learning of the similarity function itself.

The authors chose to place the discussion of the conceptual foundations in between the static and dynamic analyses. This has the advantage of providing the reader an immediate philosophical account of the merits of CBDT that is naturally juxtaposed with the axiomatic foundations. Nevertheless, I am not convinced that placing this fragment of the book in the end would not have made more sense in that it would have allowed a full comparison between the current framework and existing ones. For example, the authors do mention in passing their conceptual aversion to mixed strategies as a behavioral model, but the naïve reader can get confused by the end of the book, not understanding that this is, in fact, a crucial point in differentiating the current learning processes from the similarly motivated reinforcement learning models.

Related to that is the hidden discussion on bounded rationality. The authors present a provocative, and non-paternalistic, definition of rationality. Namely, that an action is rational if, when the decision maker is confronted with an analysis of the decisions involved, but with no additional information, she does not regret her choices. With this definition, the authors do not presume to illustrate, or question, whether agents are rational or not. Postponing the philosophical account to the end of the book might have enabled, in addition to taking this point out of its hiding, a discussion of rationality as contrasted with sophistication. In the context of dynamic settings, one wonders to what extent the agent understands what she is doing, and to what extent she utilizes this knowledge. For instance, in the repeated setting, would she tend to manipulate her memory is any way? Would the available memories depend on the problem at hand (as the availability heuristic suggests)?

Summarizing, these are all minor comments and a testament to the book's inevitable effect of making the reader think about the snags and virtues of a new framework for thinking about choice under uncertainty.

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