Experiences in Teaching Decision Analysis Courses

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Abstract: In this paper I will summarize my experiences in teaching series of two courses on Decision Analysis: Soft Decision Analysis course at Turku Center for Computer Science, Turku, Finland and Decision Analysis course at Eötvös Loránd University, Budapest, Hungary.

Keywords: Decision Analysis; Probability theory; Soft Decision Analysis; Fuzzy sets

1 Soft Decision Analysis Courses at Turku Center for Computer Science, Finland

Turku Centre for Computer Science (TUCS) is a joint research institute of University of Turku and Åbo Akademi University. TUCS conducts basic and applied research in computer science and engineering. The core expertise in TUCS is in the following areas:

- Fundamentals of computing and discrete mathematics
- Formal methods
- Computational biology and bioinformatics
- Software engineering
- Embedded systems
- Information systems

The research activity in TUCS is carried out in 23 research units. TUCS boasts a long history of high-level achievements of its affiliated researchers, in terms of articles in high-level journals and conferences, high number of citations, invitations to speak in the most important conferences in the field, and memberships in editorial boards of many high-level international journals.

I used the theory of fuzzy sets in Soft Decision Analysis courses and the main goals of the courses were to explain: (i) how to make decisions under strict uncertainty; (ii) how to make decisions with risk; (iii) how to choose appropriate aggregation operators; to decision process where trade-offs are allowed; (iv) how to solve linear programming problems with soft objective function and constraints; (v) how to model the decision maker's preferences by fuzzy sets; (vi) how to "solve" multiple objective programs using fuzzy logic;
The process of aggregation of imprecise and uncertain information appears in many applications related to the development of intelligent systems. One sees aggregation in neural networks, fuzzy logic controllers, vision systems, expert systems and multi-criteria decision aids. Fuzzy logic resembles human reasoning in its use of imprecise information to generate decisions. Some of the essential characteristics of fuzzy logic relate to the following: (i) In fuzzy logic, exact reasoning is viewed as a limiting case of approximate reasoning. In fuzzy logic, everything is a matter of degree; (ii) In fuzzy logic, knowledge is interpreted a collection of elastic or, equivalently, fuzzy constraint on a collection of variables; (iii) Inference is viewed as a process of propagation of elastic constraints; (iv) Any logical system can be fuzzified.

Fuzzy set theory provides a host of attractive aggregation connectives for integrating membership values representing uncertain information. These connectives can be categorized into the following three classes union, intersection and compensation connectives. Union produces a high output whenever any one of the input values representing degrees of satisfaction of different features or criteria is high. Intersection connectives produce a high output only when all of the inputs have high values. Compensative connectives have the property that a higher degree of satisfaction of one of the criteria can compensate for a lower degree of satisfaction of another criteria to a certain extent. The Home Page of the course can be found under the URL: http://users.abo.fi/rfuller/lsda.html.

2 Decision Analysis Courses at Eötvös Loránd University, Hungary

I delivered Decision Analysis courses for students of applied mathematics at Eötvös Loránd University, Budapest, and used the book by Simon French [1] as a reading material. I taught around 41 courses between 1992 and 2009. I used the theory of probability in Decision Analysis courses and the main goals of the courses were to explain: (i) how to make decisions under strict uncertainty; (ii) how to make decisions with risk; (iii) how to model the decision maker's preferences using the Neumann-Morgenstern utility theory; (iv) how to use the Analytic Hierarchy Process to make decisions from pairwise comparisons.

Conclusions

My experiences show that students interested in practical problems prefer the soft (or fuzzy) methods and students of calculus prefer the normative (or probabilistic) approaches.

References

[1] Simon French: *Decision Theory: an Introduction to the Mathematics of Rationality*, Ellis Horwood, Chichester, 1986.