From Fuzzy Logic to Extended Fuzzy Logic – A First Step

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I. Abstract

Fuzzy logic adds to bivalent logic an important capability – a capability to reason precisely with imperfect information. Imperfect information is information which in one or more respects is imprecise, uncertain, incomplete, unreliable, vague or partially true. In fuzzy logic, results of reasoning are expected to be provably valid, or p-valid for short. Extended fuzzy logic adds an equally important capability – a capability to reason imprecisely with imperfect information. This capability comes into play when precise reasoning is infeasible, excessively costly or unneeded. In extended fuzzy logic, p-validity of results is desirable but not required. What is admissible is a mode of reasoning which is fuzzily valid, or f-valid for short. Actually, much of everyday human reasoning is f-valid reasoning.

f-valid reasoning falls within the province of what may be called unprecisiated fuzzy logic, FLu. FLu is the logic which underlies what is referred to as f-geometry. In f-geometry, geometric figures are drawn by hand with a spray pen – a miniaturized spray can. In Euclidean geometry, a crisp concept, C, corresponds to a fuzzy concept, f-C, in f-geometry. f-C is referred to as an f-transform of C, with C serving as the prototype of f-C. f-C may be interpreted as the result of execution of the instructions: Draw C by hand with a spray pen. Thus, in f-geometry we have f-points, f-lines, f-triangles, f-circles, etc. In addition, we have f-transforms of higher level concepts: f-parallel, f-similar, f-axiom, f-definition, f-theorem, etc. In f-geometry, p-valid reasoning does not apply. Basically, f-geometry may be viewed as an f-transform of Euclidean geometry.

What is important to note is that f-valid reasoning based on a realistic model may be more useful than p-valid reasoning based on an unrealistic model.

II. Short Bio.

LOTFI A. ZADEH is a Professor in the Graduate School, Computer Science Division, Department of EECS, University of California, Berkeley. In addition, he is serving as the Director of BISC (Berkeley Initiative in Soft Computing).

Lotfi Zadeh is an alumnus of the University of Tehran, MIT and Columbia University. He held visiting appointments at the Institute for Advanced Study, Princeton, NJ; MIT, Cambridge, MA; IBM Research Laboratory, San Jose, CA; AI Center, SRI International, Menlo Park, CA; and the Center for the Study of Language and Information, Stanford University. His earlier work was concerned in the main with systems analysis, decision analysis and information systems. His current research is focused on fuzzy logic, computing with words and soft computing, which is a coalition of fuzzy logic, neurocomputing, evolutionary computing, probabilistic computing and parts of machine learning.

Lotfi Zadeh is a Fellow of the IEEE, AAAS, ACM, AAAI, and IFSA. He is a member of the National Academy of Engineering and a Foreign Member of the Russian Academy of Natural Sciences, the Finnish Academy of Sciences, the Polish Academy of Sciences, Korean Academy of Science & Technology and the Bulgarian Academy of Sciences. He is a recipient of the IEEE Education Medal, the IEEE Richard W. Hamming Medal, the IEEE Medal of Honor, the ASME Rufus Oldenburger Medal, the B. Bolzano Medal of the Czech Academy of Sciences, the Kampe de Feriet Medal,

the AACC Richard E. Bellman Control Heritage Award, the Grigore Moisil Prize, the Honda Prize, the Okawa Prize, the AIM Information Science Award, the IEEE-SMC J. P. Wohl Career Achievement Award, the SOFT Scientific Contribution Memorial Award of the Japan Society for Fuzzy Theory, the IEEE Millennium Medal, the ACM 2001 Allen Newell Award, the Norbert Wiener Award of the IEEE Systems, Man and Cybernetics Society, Civitate Honoris Causa by Budapest Tech (BT) Polytechnical Institution, Budapest, Hungary, the V. Kaufmann Prize, International Association for Fuzzy-Set Management and Economy (SIGEF), the Nicolaus Copernicus Medal of the Polish Academy of Sciences, the J. Keith Brimacombe IPMM Award, the Silicon Valley Engineering Hall of Fame, the Heinz Nixdorf MuseumsForum Wall of Fame, other awards and twenty-six honorary doctorates. He has published extensively on a wide variety of subjects relating to the conception, design and analysis of information/intelligent systems, and is serving on the editorial boards of over sixty journals.

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