

## **WCECS 2014 Keynote Speaker I:**

### **What is Fuzzy Logic and What does it have to offer? Lotfi Zadeh \***

There are many misconceptions about fuzzy logic. To begin with, fuzzy logic is not fuzzy. Basically, fuzzy logic is a precise logic of imprecision. In many ways, fuzzy logic is a radical departure from traditional logical systems. Actually, fuzzy logic is much more than a logical system. In large measure, fuzzy logic is aimed at providing a basis for formalization/mechanization of two remarkable human capabilities. First, the capability to communicate, reason and make rational decisions in an environment of imprecision, uncertainty and partiality of truth; and second, the capability to perform a wide variety of tasks, such as driving a car in heavy city traffic, without any measurements and any computations. To this end, fuzzy logic is designed to deal with imperfect information. Imperfect information is information which in one or more respects is imprecise, uncertain, incomplete, unreliable, vague or partially true. In the real world, such information is the norm rather than exception.

To deal with imperfect information what is needed is the fuzzy-logic-based methodology of Computing with Words (CWW). In CWW, the objects of computation are words and propositions drawn from natural language. There are two stages of computation and deduction. In the first stage, the meaning of words and propositions is precisiated through translation into the so-called Generalized Constraint Language (GCL). In the second stage, computation/deduction is carried out through propagation and counter-propagation of generalized constraints.

By providing a system for dealing with imperfect information expressed in a natural language, fuzzy logic provides a basis for achievement of two basic objectives. First, it opens the door to a wide-ranging enlargement of the role of natural languages in scientific theories. And second, it points to a way for progression toward the achievement of long-sought human level machine intelligence.

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## Biographical Note

Professor Lotfi A. Zadeh

LOTFI A. ZADEH is Professor Emeritus in the 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. From 1950 to 1959, Lotfi Zadeh was a member of the Department of Electrical Engineering, Columbia University. He joined the Department of Electrical Engineering at UC Berkeley in 1959 and served as its Chair from 1963 to 1968. During his tenure as Chair, he played a key role in changing the name of the Department from EE to EECS.

Lotfi Zadeh 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.

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 Finnish Academy of Sciences, the Polish Academy of Sciences, Korean Academy of Science & Technology, Bulgarian Academy of Sciences, the International Academy of Systems Studies and the Azerbaijan National 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 Fieriet 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, the Egleston Medal, the Franklin Institute Medal, the Medal of the Foundation by the Trust of the Foundation for the Advancement of Soft Computing, the High State Award 'Friendship Order', from the President of the Republic of Azerbaijan, the Transdisciplinary Award and Medal of the Society for Design and Process Sciences, other awards and twenty-five honorary doctorates. In 2011, Lotfi Zadeh was inducted into the AI Hall of Fame. In 2012, received the PAAIA Lifetime Achievement Award. In 2013, Lotfi Zadeh received the BBVA Foundation Frontiers of Knowledge Award for the invention and development of fuzzy logic.

Lotfi Zadeh is known as the inventor of fuzzy logic. His first paper, Fuzzy Sets, 1965, is the highest cited paper in Computer Science (Web of Science) and the seventh highest cited paper in

Science (Web of Science). He has published extensively (over 240 single-authored papers) 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 seventy journals.

Prior to the publication of his first paper on fuzzy sets in 1965, Lotfi Zadeh's work was concerned in the main with systems analysis, decision analysis and information systems. His current research is focused on fuzzy logic, semantics of natural languages, computational theory of perceptions, computing with words, extended fuzzy logic and Z-numbers.

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