

## Lotfi A. Zadeh



Professor Lotfi A. Zadeh was born in Baku, Soviet Azerbaijan. His father was from Iran and his mother was from Russia. At the age of ten, his father moved back to Tehran, Iran. He was graduated in 1942 in Electrical Engineering from the University of Tehran. He obtained his Master's degree from MIT in 1946 and Ph. D. from the Columbia University, New York in 1949. He was a faculty member of the Department of Electrical Engineering, Columbia University, during 1950-1959. He moved to the University of California, Berkeley in 1959. He was in the Electrical Engineering department where he became Chair in 1963. He was the Chairman of EECS department from 1963 to 1968. From 1991 onwards, he is a Professor in the Graduate School, and is serving as the Director of Berkeley initiative in Soft Computing (BISC).

Professor Zadeh held several visiting positions in his career. He was a Visiting member, Institute for Advanced Study, Princeton, 1956, Visiting Professor, MIT, 1963 and 1968, Visiting Scientist, IBM Research Laboratory, San Jose, CA, 1968, 1971, 1974, and 1977, Visiting Scientist, SRI International, 1981, and Visiting Scholar, Center for the Study of Language and Information, Stanford University, 1987.

In his Ph.D. thesis he introduced the concept of a time-varying transfer function, which has found significant applications in the analysis of linear time-varying systems. With John R. Ragazzini (in 1950) he made an important generalization of Wiener's theory of prediction which is considered a classic in its field, and in 1952 he pioneered in the development of z-transform approach to analysis of sampled data system, which is now widely used as a standard method in the design and analysis of control and digital filter systems.

Professor Zadeh pioneered the concept of fuzzy sets in 1965 as a new way of representing vagueness in everyday life. This theory provides an approximate and yet effective means for describing the characteristics of a system that is too complex or ill-defined to admit precise mathematical analysis. Unlike traditional two valued or even multivalued logic, this deals with fuzzy truths, fuzzy connectives, and fuzzy rules of inference just as in human reasoning. Research on the application of fuzzy set theory to supervised pattern recognition was started in 1966 in the seminal note of Bellman, Kalaba and Zadeh where the two basic operations – abstraction and generalization – were proposed. Consideration of linguistic features and fuzzy relations in representing a class is another path-breaking concept suggested by Zadeh. The use of linguistic features may be viewed as a form of data compression that can be termed granulation. Information granules are collections of entities drawn together by their similarity, functional, spatial or temporal proximity. Possibility theory and the theory of approximate reasoning are some of his other key contributions.

Fuzzy set theory is the oldest and most widely reported component of present-day soft computing, another term coined by Prof. Zadeh, in 1991, which deals with the design of flexible information processing systems. These provide soft decisions by taking into account characteristics like tractability, robustness, low cost, etc., and have close resemblance to human decision-making. The contribution of fuzzy sets to pattern recognition, image processing and machine intelligence has been manifold. Its success has been mainly vindicated by the commercial popularity in Japan of fuzzy logic and control systems, where both pattern recognition and image processing provide direct interaction and support. Applications have been reported in various domains, like speech recognition, remotely sensed images, medical imagery, and atmospheric sciences. There is a growing indisputable role of fuzzy sets in the realm of data mining and knowledge discovery in databases. Other significant recent applications of fuzzy sets, which have shown strong promise, include bioinformatics and web mining. Several fuzzy logic based systems are in use now all over the world. Some of his primary contributions to Science and Engineering include the development of dispositional logic, computing with words and computational theory of perception.

He received several honors and awards from many organizations all over the world. Some of them are given here. He received the Okawa Prize from Okawa Foundation in 1996, IEEE Centennial Medal in 1984, IEEE Richard W. Hamming Medal in 1992, Rufus Oldenburger Medal from American Society of Mechanical Engineers in 1993, IEEE Medal of Honor in 1995, Edward Feigenbaum Medal from the International Society for Intelligent Systems in 1998, IEEE Millennium Medal in 2000, J.P. Wohl Career Achievement Award of the IEEE Systems, Science and Cybernetics Society in 1997, Richard E. Bellman Control Heritage Award from the American Council on Automatic Control in 1998, Scientific Contribution Memorial Award from the Japanese Society of Fuzzy Theory (SOFT) in 1999, IEEE Pioneer Award in Fuzzy Systems in 2000 and ACM 2000 Allen Newell Award in 2001. He is a Fellow of several organizations including IEEE, AAAS, AAI, IFSA and Association for Computing Machinery. He received Honorary Doctorates from several educational organizations from all over the world. These organizations are situated in several countries including USA, France, Germany, Japan, Spain, Iran, Poland and Canada. Recently, he received the Honorary doctorate from the Indian Statistical Institute, India.

In India, the work on fuzzy logic was started by Prof. D. Dutta Majumder (the then Head, Electronics and Communication Sciences Unit, ISI) and Prof. S. K. Pal in 1975. Prof. S. K. Pal, the current Director of ISI, was a research fellow in ISI in 1975. The first doctoral dissertation on Fuzzy sets in India was by Prof. S. K. Pal. Prof. Pal visited Zadeh for a few months too in 1980's. Prof. Zadeh has inspired the researchers working on Fuzzy logic at ISI. Their hard work resulted in the establishment of the nation's first Soft Computing Center, at ISI.

Professor Zadeh delivered the convocation address of the 40<sup>th</sup> convocation of ISI.

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