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Zdzisław Pawlak life and work (1926–2006)

In the history of mankind, Professor Zdzisław Pawlak, Member of the Polish Academy of Sciences, will be remembered as a great human being with exceptional humility, wit and kindness as well as an extraordinarily innovative researcher with exceptional stature. His research contributions have had far-reaching implications inasmuch as his works are fundamental in establishing new perspectives for scientific research in a wide spectrum of fields.

Zdzisław Pawlak was born on 10 November 1926 in Łódź, 130 km south-west from Warsaw, Poland.¹ In 1947, Pawlak began his studies in the Faculty of Electrical Engineering at Łódź University of Technology, and in 1949 continued his studies in the Telecommunication Faculty at Warsaw University of Technology. In 1950, he presented in Poland the first project of a computer called GAM 1. He completed his M.Sc. in Telecommunication Engineering in 1951. His publication in 1956 on a new method for random number generation was the first publication abroad in informatics by a researcher from Poland. In 1958, Pawlak completed his doctoral degree from the Institute of Fundamental Technological Research at the Polish Academy of Science with a Thesis on Applications of Graph Theory to Decoder Synthesis. During 1957–1959, Pawlak was also a member of a research team in technical University of Warsaw that constructed one of the first computers in Poland called UMC 1. Pawlak received his habilitation from the Institute of Mathematics at the Polish Academy of Sciences in 1963. In his habilitation entitled *Organization of Address-Less Machines*, he proposed and investigated parenthesis-free languages, a generalization of polish notation introduced by Jan Łukasiewicz.

During succeeding years, Pawlak worked at the Institute of Mathematics at Warsaw University and, in 1965, introduced the foundations for modeling DNA and what has come to be known as molecular computing. During the 1960s, he proposed a new formal model of a computing machine known as the *Pawlak machine* that is different from the Turing machine and from the von Neumann machine. During the 1970s, Pawlak introduced knowledge representation systems. This led to his most widely recognized contribution, namely, his brilliant approach to classifying objects with their attributes (features) and his introduction of approximation spaces, which establish the foundations of granular computing and provide frameworks for perception and knowledge discovery in many areas.

In 1973, he introduced knowledge representation systems as part of his work on the mathematical foundations of information retrieval. During the early 1980s, he was the head of a research group at the Institute of Computer Science at the Polish Academy of Sciences, where he introduced rough sets and the idea of classifying objects by means of their attributes.² Rough set theory has its roots in Zdzisław Pawlak's research on knowledge representation systems during the early 1970s. Rather than attempt exact classification of objects with attributes (features), Pawlak considered an approach to solving the object classification problem in a number of novel ways. First, in 1973, he introduced knowledge representation systems. Then, in 1981, he

¹ Wikipedia summary of the life and work of Pawlak: http://pl.wikipedia.org/wiki/Zdzislaw_Pawlak.

² Z. Pawlak, *Rough Sets*. Research Report PAS 431, Institute of Computer Science, Polish Academy of Sciences (1981); Z. Pawlak, *Classification of Objects by Means of Attributes*. Research Report PAS 429, Institute of Computer Science, Polish Academy of Sciences, ISSN 138-0648, January (1981); Z. Pawlak, *Rough sets*. *Int. J. Comp. Inform. Sci.* 11 (1982) 341–356; Z. Pawlak, *Rough Sets – Theoretical Aspects of Reasoning about Data*, Kluwer Academic Publishers, Dordrecht, 1991.

introduced approximate descriptions of sets of objects and considered knowledge representation systems in the context of upper and lower classification of objects relative to their attribute values. During the succeeding years, Pawlak refined and amplified the foundations of rough sets and their applications and nurtured worldwide research in rough sets that has led to over 4000 publications.³ The consequences of this approach to the classification of objects relative to their feature values have been quite remarkable and far-reaching. The work on knowledge representation systems and the notion of elementary sets have profound implications when one considers the problem of approximate reasoning and concept approximation. Also, during the 1980s, Pawlak invented a new approach to conflict analysis.

Professor Zdzisław Pawlak was with us only for a short time and, yet, when we look back at his accomplishments, we realize how greatly he has influenced us with his generous spirit and creative work in many areas such as discovery of rough sets and development of rough set theory, approximate reasoning, intelligent systems research, computing models, molecular computing, pattern recognition, philosophy, art, and poetry. As many can readily testify, Pawlak gave generously of his time and energy to help others. His spirit and insights have influenced many researchers worldwide. During his life, he manifested an extraordinary talent for inspiring his students and colleagues as well as many others outside his immediate circle.

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³ See, e.g., Rough Set Database System, <http://rsds.wsiz.rzeszow.pl/>.