Hirotugu Akaike, former Director-General of the Institute of Statistical Mathematics, passed away on August 4, 2009, at 81 years of age. As a researcher in the field of statistical science, he made major contributions to changes in statistical paradigms and greatly influenced many fields of science and technology.

Hirotugu Akaike was born on November 5, 1927, in Shizuoka, Japan. After graduating from the Department of Mathematics, Tokyo University, he joined the Institute of Statistical Mathematics (ISM) in 1952. He organized and became the director of the Fifth Division, carrying out research on statistical prediction and control and system analysis in 1973. In 1985, the ISM was reorganized as an Inter-University Research Organization and he was appointed as director of the Department of Prediction and Control. From 1986 to 1994, he served as Director-General of the ISM, established cooperative research systems and led the ISM in a new direction of statistical science based on statistical modeling. During this period, he was actively involved in the establishment of Japan’s first graduate university for advanced study, which offered only graduate courses, and where he served as Head of the Department of Statistical Science. This was a very significant step because there was no other statistical department in Japan at that time. Further, as a member of the Science Council of Japan, he contributed to starting the Grant-in-Aid for Scientific Research in statistical science. Until that time, Japanese statisticians had to apply for grants related to other fields of mathematics, engineering, economics, medical science, etc.

In the early stage of his research, he wrote a paper on the behavior of the steepest descent method, which is a well-known optimization method. He struggled with many real-world problems through collaborative research, e.g., control of filature processes in the 1950s, time series analysis of vibrations in ships and motor vehicles, control of cement rotary kilns in the 1960s, control of boilers in thermoelectric power plants, seasonal adjustment of economic time series and analysis of the living body in the 1970s. In the process of solving these problems, he developed various statistical techniques such as estimation methods based on the power spectrum and frequency response function, identification methods for the multivariate AR and ARMA models, and evaluation and selection criteria for statistical modeling such as the final prediction error (FPE), Akaike information criterion (AIC) and Akaike’s Bayesian information criterion (ABIC).
In the course of his research, he has always attempted to develop the software required to implement his models, including computational methods, model evaluation or statistical analysis methods, information extraction, prediction and control methods that allowed users to immediately apply his techniques to their real-world problems. In particular, the TIMSAC package that allowed identification of multivariate time series and their application to the analysis and control of dynamic systems was very popular. This reveals his practice-oriented attitude to research.

Among his many contributions to the world of statistics, the AIC, first proposed in 1973, represented a major leap forward. It is a natural extension of the likelihood and was derived based on a predictive point of view and the Kullback-Leibler information. In the minimum-AIC procedure, the model with the minimum value of the AIC is selected as the best one among many possible models. This provides a versatile and semi-automatic method for statistical modeling that is free from the ambiguities inherent in hypothesis testing procedures. The impact of this criterion can be understood by the fact that after 35 years, the number of papers citing Akaike’s two original publications on AIC exceeds more than 16,000. In fact, the annual number of citations has increased exponentially and these papers are distributed over a wide range of research disciplines, involving not only statistics and mathematics, but also control engineering, system science, informatics, earth science, environmental science, medical science, epidemiology, biology, economics, finance, psychology and social science.

The impact of the AIC is not limited to the realization of a semi-automatic model selection procedure, but it eventually led to a shift of paradigm in statistical science. In conventional statistical inference, theories of estimation and testing are developed under the assumption that a true model exists. However, due to the development of information and communication technologies, we now have access to huge amounts of large-scale heterogeneous data in various fields of science, technology and society. In applications such as statistical modeling for signal extraction and knowledge creation from data, the model is usually not given a priori, and it must be constructed based on the entire information available, including factors such as knowledge, experience, observations and even the objective of the model itself. Akaike's modeling framework has proved itself very useful in such diverse situations.

Actually, immediately after the proposal of the AIC, Akaike realized the limitations of the maximum likelihood method and the importance of Bayesian modeling for such situations, and in 1979 presented a Bayesian modeling framework and a practical method of selecting the prior distribution using the ABIC. This was instrumental in the current rise of Bayesian methodologies in statistical science, informatics, knowledge science and many other areas of inquiry.

Hirotugu Akaike’s pioneering research has had a major influence on developments in statistical science and related fields including control engineering. For these great contributions, he has received several honorary prizes such as the Ishikawa Prize (1972) and Okochi Memorial Technology Prize (1980) for the development of a novel statistical optimal controller for cement rotary kilns and thermoelectric power plants, respectively, and the Asahi Prize (1988), Purple Ribbon Medal (1989), Japan Statistical Society Prize (1996), Second Class Order of the Sacred Treasure (2000) and the Kyoto Prize (2006) for his seminal work on time series analysis, information criteria and Bayesian modeling. Further, he has been named as a fellow of the Royal Statistical Society, the American Statistical Association, the Institute of Mathematical Statistics, the IEEE and the Japan Statistical Society.

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