The Japan Statistical Society

July 11, 2022

The Institute of Statistical Mathematics (ISM) The Japan Statistical Society (JSS)

<u>Announcement of the Awardee of</u> <u>the Fourth Akaike Memorial</u> <u>Lecture Award</u>



Awardee/Speaker: Professor Aapo Hyvärinen (University of Helsinki, Finland)

Lecture Title: "Identifiability of latent-variable and structural-equation models: from linear to nonlinear" Time and Date: 16:00-18:00 Monday, September 5, 2022 (*)

- Dr. Hyvärinen's lecture will be presented at the plenary session of the Japanese Joint Statistical Meeting 2022.
 - Dr. Hyvärinen will speak online from Finland.
- The Japanese Joint Statistical Meeting 2022 will be held in a hybrid format with online and in-person participation options.

Venue: Seikei University (https://www.seikei.ac.jp/university/eng/aboutus/access_campus.html)

Professor Aapo Hyvärinen

Born in 1970, Professor Hyvärinen is currently a professor at the University of Helsinki, Finland. He has contributed many outstanding achievements in machine learning and computational neuroscience, including the development of well recognized statistical techniques for signal processing and image analysis. His research style, characterized by conceptualizing and refining powerful methodologies with a particular focus on their practical application, relates to that of the late Dr. Akaike. Professor Hyvärinen has co-authored peer-reviewed scientific articles with more than 20 Japanese researchers, thereby extensively contributing to the Japanese statistical community. Among the works in those articles, causal discovery using non-Gaussianity, blind separation of independent nonstationary signals, and simplified estimation for non-Gaussian statistical models are cornerstones of recent advancements in a field of statistics.



Dr. Hirotugu Akaike (https://www.ism.ac.jp/akaikememorial/index-e.html)

The late Dr. Akaike was a statistician who proposed the Akaike Information Criterion (AIC). He established a novel paradigm of statistical modeling, characterized by a predictive point of view, that was completely distinct from traditional statistical theory. Dr. Akaike's research has greatly influenced a wide range of research areas. To recognize his achievements, the Akaike Memorial Lecture Award was established in May 2016.

(*) Detailed information will be uploaded on the websites of ISM (http://www.ism.ac.jp/index_e.html) and related organizations.

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Announcement of the Awardee of the Fourth Akaike Memorial Lecture Award

♦ Summary

In May 2016, the Institute of Statistical Mathematics (ISM) and the Japan Statistics Society (JSS) jointly launched the Akaike Memorial Lecture Award program. The purpose of this award is to commemorate the achievements of the late Dr. Akaike, who established a novel paradigm to evaluate the predictive accuracy of statistical modeling. He proposed a metric for model selection, the Akaike Information Criterion (AIC), based on an approach completely different from the statistical theories common at the time. Dr. Akaike's ideas have influenced a wide range of theoretical and applied research areas.

The Fourth Award goes to Professor Aapo Hyvärinen of the University of Helsinki, Finland. Professor Hyvärinen has contributed numerous outstanding achievements in machine learning and computational neuroscience, including the development of well recognized statistical techniques in signal processing and image analysis. Among his accomplishments, his contributions to the development of independent component analysis (ICA) are well recognized and valued in the statistics and machine learning communities. His academic interests and research style are closely related to those of the late Dr. Akaike. Professor Hyvärinen is a renowned international leader in pure and applied statistical science and deserves the Akaike Memorial Lecture Award.

Because of the COVID-19 pandemic and related overseas travel restrictions, Professor Hyvärinen will present his lecture online at the plenary session of the Japanese Joint Statistical Meeting (JJSM) 2022 which will be held on September 5 at Seikei University, Tokyo.

Reasons for the Award

Professor Hyvärinen has contributed many outstanding achievements in machine learning and computational neuroscience, including the development of well recognized statistical techniques for signal processing and image analysis. He has also made great contributions in causal discovery, whereby observed data are analyzed to identify their possible cause-and-effect relationships. Moreover, he has advanced the development of estimation methods for complex statistical models that usually require data normalization. Among his achievements, Professor Hyvärinen's contributions to the development of the ICA are well recognized and valued in the statistics and machine learning communities. His original articles have been cited more than 20,000 times. His research style, characterized by his ability to conceptualize and organize powerful ideas with a particular focus on practical applications, is similar to that of the late Dr. Akaike. He has developed a new type of information criterion based on the AIC, thereby expanding the paradigm pioneered by Dr. Akaike.

Notably, Professor Hyvärinen has conducted joint research with many Japanese junior and senior statistical scientists, co-authoring peer-reviewed journal articles with more than 20 of them. His works on causal discovery using non-Gaussianity, blind separation of independent nonstationary signals, and simplified estimation for non-Gaussian statistical models have been cornerstones of recent advancements in a field of statistics. His numerous contributions to statistical science and the Japanese statistical community



demonstrate that Professor Hyvärinen deserves the award.

On the basis of these considerations, the nomination committee has selected Professor Hyvärinen, a renowned global leader in theoretical and applied statistical science, as the fourth awardee of the Akaike Memorial Lecture Award.

♦ The Fourth Awardee: Professor Aapo Hyvärinen Academic Achievements

Professor Hyvärinen has made many outstanding contributions to the fields of signal processing, image analysis, machine learning, computational neuroscience and mathematical statistics. Among his achievements, Professor Hyvärinen's contributions to the development of the ICA are well recognized and valued in the statistics and machine learning communities. His original articles have been cited more than 20,000 times. The ICA represents a method for separating independent signals from their mixtures. The ICA has had far-reaching influences on a wide range of scientific topics, such as identifying major sound sources from noise-corrupted speech signals and extracting relevant neural signals from brain-wave data. The unique approach of the ICA, which is based on a minimum set of assumptions, is distinctly different from many conventional statistical methodologies. Its initial publication was reportedly met with astonishment and praise from the statistical community.

Professor Hyvärinen improved and generalized his ICA algorithms to apply them to a wide range of scientific areas. With minor modifications, they have also been applied to causal discovery research. As one of the many applications of his idea, the development of the noise contrastive estimation (NCE) method is described here. The NCE method enables powerful parameter estimation for complex, unnormalized statistical models that represent conditions where analytical normalization is almost impossible. The development of the NCE method showcases the creative talents of Professor Hyvärinen. Because the peculiarities of the NCE method prevent the use of the AIC for model selection, a group of researchers including Professor Hyvärinen has recently developed an information criterion applicable to the NCE method. Because the new criterion was derived from the AIC, it is considered an NCE version of the AIC. The group's work has expanded the paradigm proposed by the late Dr. Akaike.

Title Authur	Number of Citations as of May 30, 2022	Year
<u>Independent component analysis</u> A Hyvärinen, J Karhunen, E Oja John Wiley & Sons	<u>21265</u>	2001
<u>Fast and robust fixed-point algorithms for independent component analysis</u> A Hyvarinen IEEE Transactions on Neural Networks 10 (3), 626-634	<u>7846</u>	1999
<u>A fast fixed-point algorithm for independent component analysis</u> A Hyvärinen, E Oja Neural Computation	<u>4578</u>	1997
Noise-contrastive estimation: A new estimation principle for unnormalized statistical models M Gutmann, A Hyvärinen Proceedings of the Thirteenth International Conference on Artificial Intelligence and Statistics	<u>1326</u>	2010

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Validating the independent components of neuroimaging time series via clustering		
and visualization J Himberg, A Hyvärinen, F Esposito	<u>1130</u>	2004
Neuroimage 22 (3), 1214-1222		
<u>A linear non-Gaussian acyclic model for causal discovery</u> S Shimizu, PO Hoyer, A Hyvärinen, A Kerminen, M Jordan Journal of Machine Learning Research 7 (10)	<u>1116</u>	2006
<u>Natural Image Statistics: A probabilistic approach to early computational vision</u> A Hyvärinen, J Huni, PO Hoyer Springer-Verlag, New York	<u>815</u>	2009
Estimation of non-normalized statistical models by score matching. A Hyvärinen Journal of Machine Learning Research 6 (4)	<u>677</u>	2005
<u>Information criteria for non-normalized models</u> T Matsuda, M Uehara, A Hyvärinen Journal of Machine Learning Research		2021
Unsupervised feature extraction by time-contrastive learning and nonlinear ica AHyvarinen, H Morioka Advances in Neural Information Processing Systems, 3765-3773		2016

By Google Scholar

CV

Name: Aapo Johannes Hyvärinen

Current Position: Professor, Department of Computer Science, University of Helsinki, Finland

Born: 1970

Education: Ph.D. degree in Information Science at the Helsinki University of Technology, Finland in 1997		
	(Doctoral Thesis: "Independent component analysis: A neural network approach")	
Professional Summary:		
2003-	University of Helsinki	
2008-	Professor, Department of Computer Science, University of Helsinki	
2016-2019	Professor, Gatsby Computational Neuroscience Unit, University College London, UK	

Details of the Fourth Akaike Memorial Lecture

Under the sponsorship of JSS, the Fourth Akaike Memorial Lecture will be jointly hosted by ISM and the Organizing Committee for JJSM 2022. The lecture will be delivered online at the plenary session of JJSM 2022.

颎	The Institute	of	Statistical	Mathematics
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Session Title:	The plenary session of JJSM 2022: the Akaike Memorial Lecture		
Speaker:	Professor Aapo Hyvärinen, University of Helsinki, Finland		
Lecture Title:	Identifiability of latent-variable and structural-equation models: from linear to nonlinear		
Moderator:	Professor Tomoyuki Higuchi (Director General, the Japanese Federation of Statistical Science Associations / President, JSS)		
Chair:	Professor Hiroe Tsubaki (Director-General, ISM)		
Panelists:	Dr. Takeru Matsuda (Unit Leader, Statistical Mathematics Unit, RIKEN Center for Brain Science)		
	Dr. Hiroshi Morioka (Postdoctoral Researcher, RIKEN Center for Advanced Intelligence Project)		
	*The entire session will be presented in English.		
Time and Date:	16:00 p.m. to 18:00 p.m., Monday, September 5, 2022		
Venue:	Seikei University 3-3-1 Kichijoji-Kitamachi, Musashino-shi, Tokyo, 180-8633, Japan (https://www.seikei.ac.jp/university/eng/aboutus/access_campus.html) *The lecture will be held in a hybrid format with online and in-person participation options.		

For more details of the lecture, please visit the official web sites of the following organizations:

- ISM (https://www.ism.ac.jp/index e.html),
- JJSM 2022 (https://confit.atlas.jp/guide/event/jfssa2022/top), and
- JSS (https://www.jss.gr.jp/en/).

The Purpose of the Akaike Memorial Lecture Award

In 2014, ISM and JSS started discussions to launch the Akaike Memorial Lecture Award as their joint program to commemorate the late Dr. Hirotugu Akaike's achievements and impact in statistical science. (*)

The Awardee of this award will deliver the lecture (hereinafter referred to as the "Akaike Memorial Lecture"). This award aims to provide Japanese and other statistical scientists with opportunities to network and interact with each other, nurture junior researchers, and advance statistical science.

Once every two years, one awardee will be selected from among international researchers who have made far-reaching and pioneering achievements similar to those of the late Dr. Akaike. The scope of nomination covers pure and applied research in mathematical science, mathematical engineering, and other statistical sciences (including, for example, system control and optimization algorithms). The awardee will receive an honorarium of 100,000 yen, a commemorative award plaque, and travel expenses.

As a means for researcher development, several discussants selected from among promising graduate students and junior researchers will have an opportunity to participate in a question-and-answer session



with the awardee. Each lecture presentation and a summary of subsequent discussions will be published as an invited article in the *Annals of the Institute of Statistical Mathematics*.

(*) About the Late Dr. Hirotugu Akaike

Dr. Akaike was born in Shizuoka Prefecture, Japan, on November 5, 1927. After graduating from the Naval Academy of Japan, the First High School, and the Department of Mathematics, School of Science, The University of Tokyo, he joined ISM in 1952.

In the 1960s, he made pioneering contributions in the field of time-series analysis. He developed new methodologies for spectral analysis, multivariate time-series analysis, and statistical system control, contributing to the development of the Time Series Analysis and Control (TIMSAC) software package. In the 1970s, he launched the Akaike Information Criterion (AIC), which led to a new paradigm of statistical modeling that enables estimations of the goodness of predictive fits. This approach was a radical departure from the statistical approaches common at the time and profoundly influenced a wide array of research fields. In the 1980s, he developed methods that facilitate the practical application of Bayesian modeling. His works paved a path to novel information processing analytics in the "big data" era. For his widely acknowledged and long-lasting contributions to the statistical sciences, he received the Purple Ribbon Medal of Honor, the Gold and Silver Star (Second Class) of the Sacred Treasure, the Kyoto Prize, and many other prestigious awards.

Serving as the Director-General of ISM from 1986, he was also engaged in postgraduate education when the Graduate University for Advanced Studies known as SOKENDAI (Kanagawa, Japan) launched the Department of Statistical Science. After his term expired in 1994, he became Professor Emeritus both at ISM and at the Graduate University for Advanced Studies. After Dr. Akaike retired from full-time posts, his passion for statistical research remained insatiable and he continued to work on Bayesian and other statistical approaches. He published several journal articles analyzing the relationship between golf-swing motion parameters and driving distance as an illustrative example of mathematical modeling. From January 1989 to December 1990, he also served as the 19th President of JSS.

On August 4, 2009, he passed away at the age of 81 in Ibaraki Prefecture. On November 5, 2017, a commemorative doodle was posted on the Google search screen in 16 countries and regions to celebrate "Hirotugu Akaike's 90th Birthday"

(source: https://www.google.com/doodles/hirotugu-akaikes-90th-birthday).

Hirotugu Akaike Memorial Website:

https://www.ism.ac.jp/akaikememorial/index_e.html

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