ATTACHMENT 2: Profile of the Group B Recipient of the 2013 C&C Prize

Prof. Vladimir Vapnik

Current Position

Professor, Columbia University;
Fellow, NEC Laboratories America, Inc.

Personal History (born in 1936)

1958 MS, Uzbek State University
1964 Ph.D., Institute of Control Sciences, Moscow
1961-1990 Institute of Control Sciences, Moscow (became head of Computer Science Research Department)
1990-1996 Research Scientist, AT&T Bell Labs, Holmdel, New Jersey
1995-present Professor, Royal Holloway, University of London
1996-2002 Leading Researcher, AT&T Labs, Lucent Technologies
2002-present Fellow, NEC Laboratories, Princeton
2003-present Professor, Columbia University

Major Awards

2005 Gabor Award, International Neural Network Society
2006 Election to United States National Academy of Engineering
2008 ACM Paris Kanellakis Theory and Practice Award
2010 IEEE Neural Networks Pioneer Award
2012 IEEE Frank Rosenblatt Award
2012 Benjamin Franklin Medal in Computer and Cognitive Science

–Achievements–

Recent rapid development of computer technologies and communications network technologies has made the accumulation of huge amounts of data possible. In this kind of situation, machine learning has attracted attention as a significant technology for analyzing data and acquiring useful knowledge from it. Machine learning is a technology that can extract useful rules, knowledge representations, and discrimination criteria from data. The applications of this technology include signal processing, natural language processing, audio processing, image processing, biology, robot control, financial engineering, and data-mining. To his credit, Prof. Vapnik established an innovative theory for machine learning and invented high-performance and practical learning algorithms.

The theoretical study of machine learning started in the 1960s. A learning model called the Perceptron, in which human visual and brain functions were modeled in a simple manner, was proposed at an early stage. In the 1980s, an improved model called the Multilayer Perceptron was developed and applied in various fields. However, it had some problems, such as the convergence to undesirable local optima.

Prof. Vapnik proposed the well-known Support Vector Machine (SVM) to solve these problems in 1995. The SVM is a learning machine that was proposed under Statistical Learning Theory (SLT) and is considered to be one of the best learning models in pattern recognition.

The breakthroughs made by Prof. Vapnik were extremely significant. His major academic achievements can be summarized as follows.

1. He proposed an evaluation theory concerning unlearned-data discrimination error (i.e., generalization error) based on SLT and showed that the SVM has high generalization performance.
2. In addition, in constructing the theory, he proposed the Vapnik-Chervonenkis (VC) dimension as a measure of the capacity of statistical classification algorithms.
3. He also proposed definite criteria that maximize the margin between sets of data to effectively minimize the generalization error. The conventional methods did not have any such criteria.
4. His method does not need parameter adjustment for performance optimization and is easy to combine with existing optimization tools. Thus, the SVM spread worldwide in practical use as well as in research.
5. Although his first version of the SVM, published in 1963, was applicable only to linearly separable problems, he proposed a method to solve complicated pattern recognition problems in 1995 by mapping the target onto high-dimensional space and linearly separating it using a kernel function. Therefore, this SVM also provides excellent performance in linearly non-separable problems. It is a contribution that shows the usefulness of kernel functions in machine learning. Consequently, after his proposal, various conventional linear methods were kernelized and widely applied to linearly non-separable problems.

These achievements are well known in advanced areas of information processing, and his writings (including *Statistical Learning Theory*) have been cited in tens of thousands of other publications. As a result, the SVM now has an advantage, even in practical use, for solving the high-dimensional separation problem compared with conventional statistical methods and has established the SVM's position as a standard method for pattern recognition.

Moreover, Prof. Vapnik has continuously proposed new learning methods. They include Support Vector Regression (SVR) for application to regression problems for data prediction and Transductive Learning for minimizing the recognition error in unsupervised learning. He has therefore made significant contributions to the development of machine learning technology.

In recent years, machine learning technology has become one of the significant

fundamental technologies for the development of ICT (such as the realization of various Web-based services and social services, the expansion of the integration areas of ICT, and the utilization of Big Data). The NEC C&C Foundation thus highly praises Prof. Vapnik for his contributions to the advancement of information and communications technology.