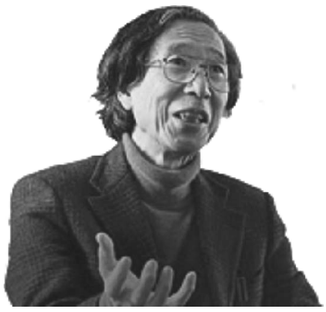
If artificial brain is possible and if human being is a mathematical form?

an interview with professor Shun-Ichi Amari

JAMRIS: Professor, your lecture at the ICANNGA conference concerned the MPL method of learning. Could we start with explaining it, like for a layperson?



Multilayer perceptron is a very classic model of the brain. It represents not the whole brain, but some piece of the processing of information from the sensory input in the brain to the output. Dynamics and also neural networks techniques are here.

J: But how long this structure can learn?

It depends, of course. We need mini example, because neural network responses not typical input, but they are many different types of input synapses. The model neural networks should learn from many different types of synapses. Here they learn and modify structure, the connection of neurons. The influence of one neuron on another neuron. We can modify that.

J: Just like human brain?

Of course, it's modelled on the human brain. Remember, brain has many functions. Signal transmission is changing by processing of synapses.

J: In science-fiction movies we can sometimes see that human brain is being mapped and we have a computer with human brain, just like that. Is it possible?

Modern computer is quite different from our brain.

J: So, maybe in the future?

I think about that, because the brain information processing is flexible. Computer can do very quickly but very simple; it has no intention. If the surroundings change, computer cannot adapt. Our brain is rather through. This is the function of mind – our emotions. In future maybe we can implement some machine, maybe electronically, but still assembling many elements at the same time, and connecting dynamics and interactions together. The future computer, I guess, can be consisting of two components. One component is like modern computer – quick, accurate – performing much better than human, however never flexible. The other is like a human – here we have some associations, some creativity, emotional approach – not exactly the same as human, but having a common component with human. We make all the neurons, but they're not the original neurons, they're artificial. In this type of machine, learning from the human brain is being imitated. Those two machines should cooperate.

J: I am a little scared, when you're talking about it, that these machines could replace humans. Will they?

No, they will not. We people, can construct machine like human, however the machine has always something path-oriented, so it will be housekeeping things, for example, in one time. We cannot do that, but we can do many other things. Therefore, those new machines, new robots can do special things very well, sometimes better than human, but they cannot integrate other thoughts like human. Anyway, it is very difficult question our technology is developing so fast.

J: What is the current direction in the history of artificial intelligence?

Twenty years before now we thought that our human mind is just a logical machine. We can do logical operations; nevertheless it is only one aspect. However, behind doing these things we have to think about the unconsciousness. Our brain works consciously and also unconsciously. Classical artificial intelligence has a conscious part in it, but we are thinking about unconsciousness.

Warsaw, 13th April 2007

Multilayer perceptron (MLP) – is feedforward neural network trained with the standard backpropagation algorithm. It learns how to transform input data into a desired response (MPLs are widely used for pattern classification). With one or two hidden layers, they can approximate virtually any input-output map. The first layer is called the input layer, the last one is the output layer, and in between there may be one or more hidden layers.
MPLs have been shown to approximate the performance of optimal statistical classifiers in difficult problems. Most neural network applications involve MLPs. More complex neural networks are often used in parallel distributed processing.

Shun-Ichi Amari (born 1936) is Director of Brain Science Institute, which is part of RIKEN – The Institute of physical and Chemical Research in Wako City Japan. After he had obtained doctorate in engineering in 1963 University of Tokyo, he worked for Department of Mathematical Engineering and Information Physics at this university. His research has focused on "trying to understand brain function through system theory", as he says. He uses "information geometry" – a branch of geometry dealing with information based on integrated mathematical theories, which he established in 1980' – to elucidate work of human brain. He has worked on mathematical model of the brain from over 40 years.

Amari has been recent many awards and honours, e.g. APNNA Special Award (he was also APPNA President in 1993), Japanese Statistical Society Special Award, Best Paper Award, IEEE Signal Processing, Caianiello Memorial Award, IEEE Emanuel R. Piore Award, IEEE Neural Networks Pioneer Award, Japan Academy Award.

Amari is fellow of IEICE and IEEE; President-Elect, IEICE and President of INNS (1996).