Prof.dr.ir. Wilfred van der Wiel

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Biography

Wilfred van der Wiel's research focuses on unconventional electronic devices for computing and sensing. He obtained his M.Sc. degree in Applied Physics (cum laude) from Delft University of Technology in 1997. He did his Ph.D. research on electron transport in quantum dots and electron interferometers both at Delft and NTT in Japan. He obtained his Ph.D. degree (cum laude) in 2002. After that he joined the University of Tokyo as a postdoc and was appointed Pioneer (Sakigake) Fellow of the Japan Science and Technology Agency (JST). In 2005 he moved to the University of Twente, where he led the interdisciplinary nanoelectronics program. Presently he is full professor of NanoElectroncis. In 2006 he was awarded the VIDI grant of the Dutch National Science Foundation (NWO). He was a member of the Young Academy of the Royal Netherlands Academy of Arts and Sciences (KNAW) from 2006 till 2012, and a member of the Global Young Academy (GYA) from 2012 till 2017, where he served two years in the Executive Committee. He received an ERC Starting Grant in 2009, and two ERC Proof of Concept Grants in 2014 and 2015. He is director of the BRAINS Center for Brain-Inspired Nano Systems. Van der Wiel is author of over 110 peer-reviewed journal articles, receiving over 6,300 citations.

Abstract - Material Learning

Natural and man-made information processing systems differ greatly. Evolution has resulted in living systems that utilize whatever physical properties are exploitable to enhance the fitness for survival. Nature thereby exploits the emergent properties and massive parallelism of highly interconnected networks of locally active components. Man-made computers, however, are based on circuits of functional units, following rigid design rules. In conventional computational paradigms, potentially exploitable physical processes to solve a problem, are possibly left out. Here, we propose to manipulate physical systems using Material Learning, to take full advantage of the computational power of nanomaterials.

We have shown that a designless network of gold nanoparticles can be evolved into Boolean logic gates. Now we demonstrate that the above principle is generic, and can be demonstrated in other material systems as well, at much higher temperatures. By exploiting the nonlinearity of a nanoscale network of dopants in silicon, it is possible to map a limited number of input data to a new, high-dimensional feature space, in which the data become linearly separable. Using a convolutional neural network approach, it becomes possible to use our device for handwritten digit recognition. Our approach illustrates the power of adaptive nanomaterial networks for solving complex computational tasks efficiently.