Computers can do virtually everything, often better than humans. Even a thirty-year-old calculator can beat any man at maths. However, the way today’s computers are constructed has one major downside: the entire process is handled one step at a time, sequentially. Our brain, on the other hand, can do thousands of things at once in parallel. Our brain’s neural network is extensively branched and interwoven. Neurons fire when they receive a stimulus, which in turn activates other neurons. This allows us to recognize patterns or faces or evaluate situations in the blink of an eye,” Van der Wiel explains.

“Neurons fire when they receive a certain stimulus, which in turn activates other neurons. That allows us to recognize patterns or faces or evaluate situations in the blink of an eye,” Van der Wiel explains.

Of course, if you want a computer to perform a complicated task that consists of multiple simultaneous processes, e.g. driving a car, you could theoretically link hundreds of computers together and have each one perform a single small task very quickly. “Aside from the fact that this quantity of hardware could never fit into e.g. a smartphone or an airplane, it is also a tremendous waste of energy. Our brain has another major advantage besides its parallel processing capacities: it is exceptionally efficient and requires just ten to twenty Watt. To compare, a simple laptop uses between one and two hundred Watt. By creating connections similar to the human brain’s neural network, we can make our computers far more energy-efficient and effective.” This process is called neuromorphic engineering. As part of the research programme, physicists Van der Wiel and three colleagues in his department focus on unravelling the electronic connections that allow our brain to transmit signals so efficiently.

Should the MESA+ institute have any IT research, it should focus on the many wonderful potential applications, for example in the medical world. “We focus on the many wonderful potential applications, for example in the medical world”.

Wilfred van der Wiel, professor of nanoelectronics, is working on a computer that functions similarly to the human brain – or, fed with big data, can even outperform our brain. “If we pull this off, the possibilities are endless.”

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"How can we translate our brain’s rapid, efficient processes into usable and efficient hardware?"