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Processing information by symmetric inductive machines

To reflect important properties of computers, Marcin Schroeder introduced a new model of computation - symmetric Turing machines or S-machines. In a conventional Turing machine, the head (processor) performs operations with data in the memory (tape) using a fixed system of instructions â€“ its program. In a symmetric Turing machine, information processing goes not only from the head to the memory but also backward. On the one hand, the head (processor) performs operations with data in the memory using a fixed system of instructions â€“ its program. On the other hand, the memory performs operations with instructions from the head (processor). It is also possible to carry out this computational approach using two types of memory â€“ data memory and program memory â€“ with a processor that performs operations with data based on information stored in the program memory and performs operations with the program based on information stored in the data memory. Physical computers also perform operations with their programs using special tools such as interpreters, compilers and translators. There are also program optimizers, which improve characteristics of programs transforming them. Automata that perform transformations with their programs are called reflexive Turing machines. It was proved that these machines have the same computing power as Turing machines but could be much more efficient. Using similar technique, we prove that functioning of a symmetric Turing machine can be simulated by a conventional Turing machine with three tapes and three heads. Thus, symmetric Turing machines have the same computing power as Turing machines. At the same time, we prove that symmetric Turing machines can be much more efficient than Turing machines. To achieve higher computing power, we introduce and study inductive symmetric machines, which further develop the structure and possibilities of inductive Turing machines allowing modeling natural computations in various situations.