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BSCS – 3

**Structure and Function of Turing Machine**

**Introduction:**

A Turing machine is made up of an infinite tape divided into cells, each of which may carry a symbol from a finite alphabet as well as a head that can read write and move left and right. The machine works in a finite number of states which include a start and halt state. Its behavior is determined by a transition function which describes what actions to do based on the current state and the symbol under the head. The machine computes by following these transitions updating the tape and changing states until it comes to a standstill. The Turing machine's function is to determine whether a particular input string is accepted or rejected by the machine according to its design.

**Methods:**

A Turing machine is an abstract computing model that reads from and writes to an infinite tape. Turing machines provide a powerful computational model for solving computer science problems and evaluating computational boundaries are there problems that cannot be solved. Turing machines are comparable to finite automata and finite state machines, except they have infinite memory. They are capable of emulating common computers; any problem that a common computer can solve with enough memory may also be solved by a Turing machine, and vice versa. Alan Turing an accomplished computer scientist invented Turing machines in 1936.

**Results:**

A Turing machine may replicate any computational process due to its structure, which includes an unlimited tape a read and write head and a set of states defined by a transition function. Its role is to alter symbols on the tape in accordance with these transitions until it reaches a halting state indicating whether an input is accepted or denied. This model exhibits computational universality indicating that a Turing machine can perform any computable function. It also underscores the concepts of decidability and undecidability emphasizing situations that are solvable or unsolvable within this framework. Turing machines also serve as the foundation for complexity theory which helps classify issues based on the resources necessary to solve them.

**Discussion:**

The Discussion of this Turing Machine that invented Alan Turing. One of the significant objectives of artificial intelligence is to design learning algorithms that are executed on general-purpose computational machines inspired by the human brain. Neural Turing Machine (NTM) is a step towards realizing such a computational machine. In the literature, a variety of approaches have been presented for the NTM; however, there is no existing comprehensive survey and taxonomy for NTM methods. This article presents an overview of taxonomies characterizing the critical concepts of the NTM through a comprehensive survey on the related research activities. This in-depth analysis of taxonomies can provide researchers, designers, and application developers with a clear guideline to compare NTM methods. The taxonomy of machine learning, neural networks, and the Turing machine is introduced. The NTM is also inspected in terms of concepts, structure, implemented tasks, and related works. The article further presents research discussions and future challenges in this area.

**References:**

[A Review on Neural Turing Machine (NTM) | SN Computer Science (springer.com)](https://link.springer.com/article/10.1007/s42979-020-00341-6)

[Turing Machines (Stanford Encyclopedia of Philosophy) (sydney.edu.au)](https://plato.sydney.edu.au/entries/turing-machine/)

[Turing machine | Definition & Facts | Britannica](https://www.britannica.com/technology/Turing-machine)