AUTOMATA THEORY

CHRISTIAN STEWART

OVERVIEW

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AUTOMATA THEORY

STUDY OF ABSTRACT COMPUTING DEVICES

a branch of computer science and mathematics that deals with the **study of abstract computing devices**, also known as automata.

An automaton is a mathematical model that represents a system that can perform a sequence of predetermined operations based on a set of inputs. These operations may involve changing states, producing outputs, or making decisions based on some input.

ALAN TURING

FATHER OF MODERN COMPUTER SCIENCE

- **British Mathematician**

and computer scientist who is widely considered to be one of the most important figures in the history of computing.

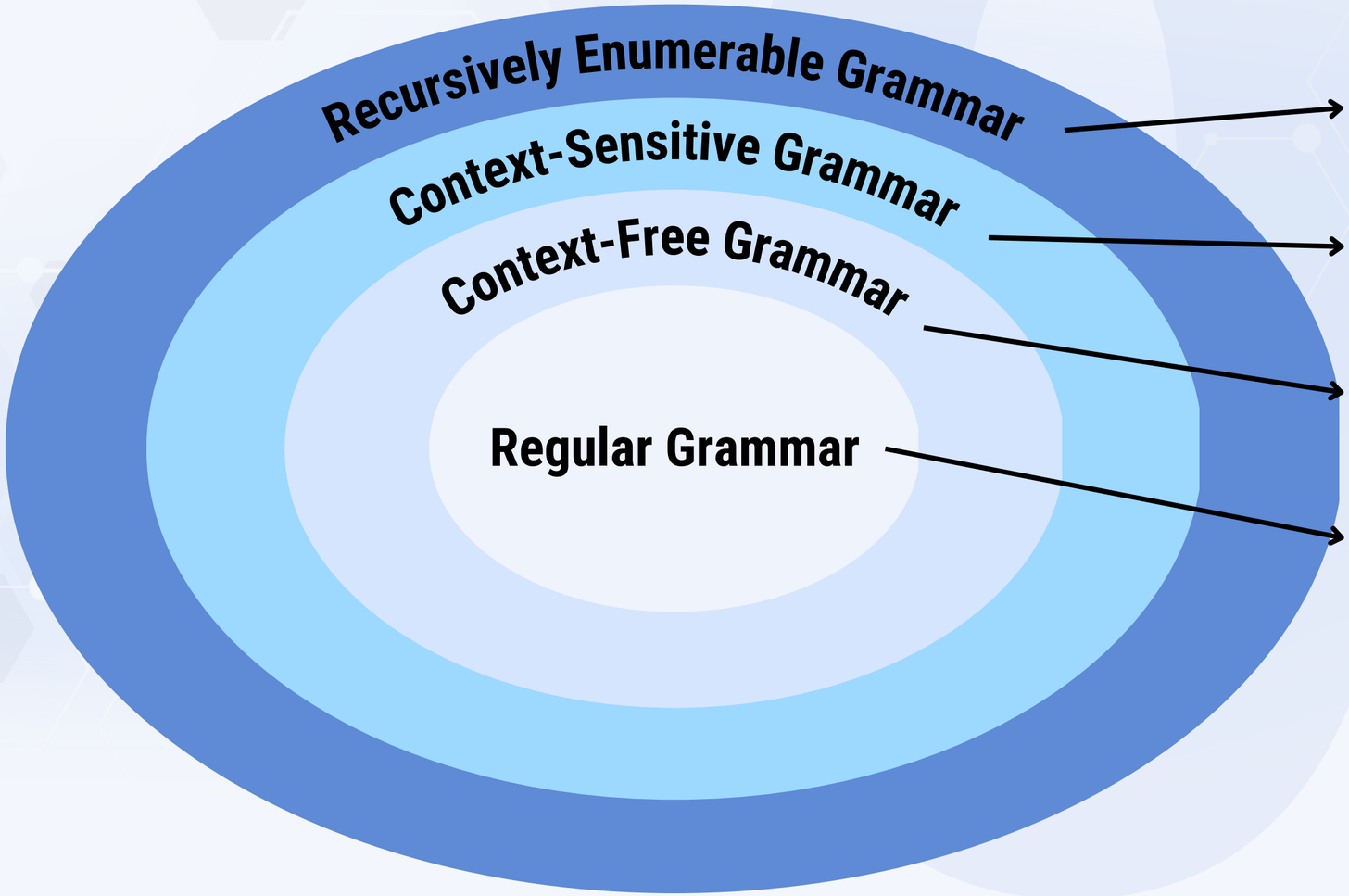
- **Turing Machine**

credited with developing the concept of a universal machine.

- **Turing Test**

proposed the idea of a machine that could simulate human intelligence

CHOMSKY HIERARCHY



- TURING MACHINE
- PUSHDOWN AUTOMATON
- LINEAR BOUNDED AUTOMATON
- FINITE DETERMINISTIC AUTOMATON

FINITE STATE MACHINE

01

a mathematical model used to represent a system that can be in one of a finite number of states at any given time

02

can transition from one state to another based on a set of input signals

03

consists of a set of states, a set of input symbols, a set of output symbols, a transition function, and an output function

04

can be represented using a state diagram

commonly used in **digital electronics** to **design circuits** and **control systems**, and they are also used in computer science to **model** and **analyze algorithms** and **programs**. They are particularly useful in situations where there is a **limited amount** of **memory** or **processing power** available, as they can be implemented with a relatively small amount of hardware or software.

FSM APPLICATIONS

LANGUAGE TYPES

CLASSIFICATION OF FORMAL GRAMMARS AND LANGUAGES BY NOAM CHOMSKY

TYPE 0

Recursively Enumerable Grammar

These grammars generate all possible languages over the given alphabet. These grammars have no restrictions on the form of their productions.

TYPE 1

Context-Sensitive Grammar

The productions must be of the form $\alpha A \beta \rightarrow \alpha \gamma \beta$, where A is a non-terminal symbol, α and β are strings of symbols, and γ is a non-empty string of symbols.

TYPE 2

Context-Free Grammar

The productions in these grammars must be of the form $A \rightarrow \beta$, where A is a non-terminal symbol, and β is a string of symbols.

TYPE 3

Regular Grammar

The productions in these grammars must be of the form $A \rightarrow aB$ or $A \rightarrow a$, where A and B are non-terminal symbols, and a is a terminal symbol.

THANK YOU