

1	What is Computer Science?	3
2	Research Areas of Computer Science (CS)	9
2.1	Theoretical Computer Science	15
2.2	Programming Languages	16
2.3	Computer Structures	17
2.4	Operating Systems	18
2.5	Pattern Recognition	19
2.6	Database Systems	20
2.7	Communication Systems	21
2.8	Artificial Intelligence	22
2.9	Computer Graphics	23
2.10	System Simulation	24
2.11	Computers and their Environment	25
2.12	Computational "X"	26
3	New Frontiers of Computing?	27
4	Learning the Computers' Languages	28
5	Conjuring the Spirits of the Computer ...	29

1 What is Computer Science?

1 What is Computer Science?

to compute: (French *computer* or Latin *computare*; as COM-, *putare* 'reckon')

Computer Science = Science of how to **Calculate** ???

1 What is Computer Science?

to compute: (French *computer* or Latin *computare*; as COM-, *putare* 'reckon')

Computer Science = Science of how to **Calculate** ???

computer:

1. a **person who computes** or makes calculations (originally, well-trained mathematicians performing complex computations to set up logarithmic and trigonometric tables in the 18th century)

1 What is Computer Science?

to compute: (French *computer* or Latin *computare*; as COM-, *putare* 'reckon')

Computer Science = Science of how to **Calculate** ???

computer:

1. a **person who computes** or makes calculations (originally, well-trained mathematicians performing complex computations to set up logarithmic and trigonometric tables in the 18th century)
2. a usually electronic device for **storing** and **processing data** (usually in binary form), according to instructions given to it in a variable program¹

1. The Concise Oxford Dictionary, Ninth Edition

1 What is Computer Science?

to compute: (French *computer* or Latin *computare*; as COM-, *putare* 'reckon')

Computer Science = Science of how to **Calculate** ???

computer:

1. a **person who computes** or makes calculations (originally, well-trained mathematicians performing complex computations to set up logarithmic and trigonometric tables in the 18th century)
2. a usually electronic device for **storing** and **processing data** (usually in binary form), according to instructions given to it in a variable program¹

Computers are machines for the **processing of information:**

- storage
- retrieval
- analyzation
- generation
- transformation
- ...

1. The Concise Oxford Dictionary, Ninth Edition

Computer Science

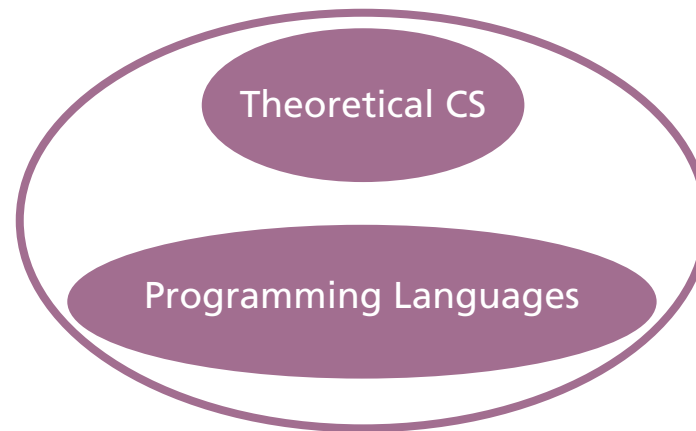
=

Science of Processing Information by Computers

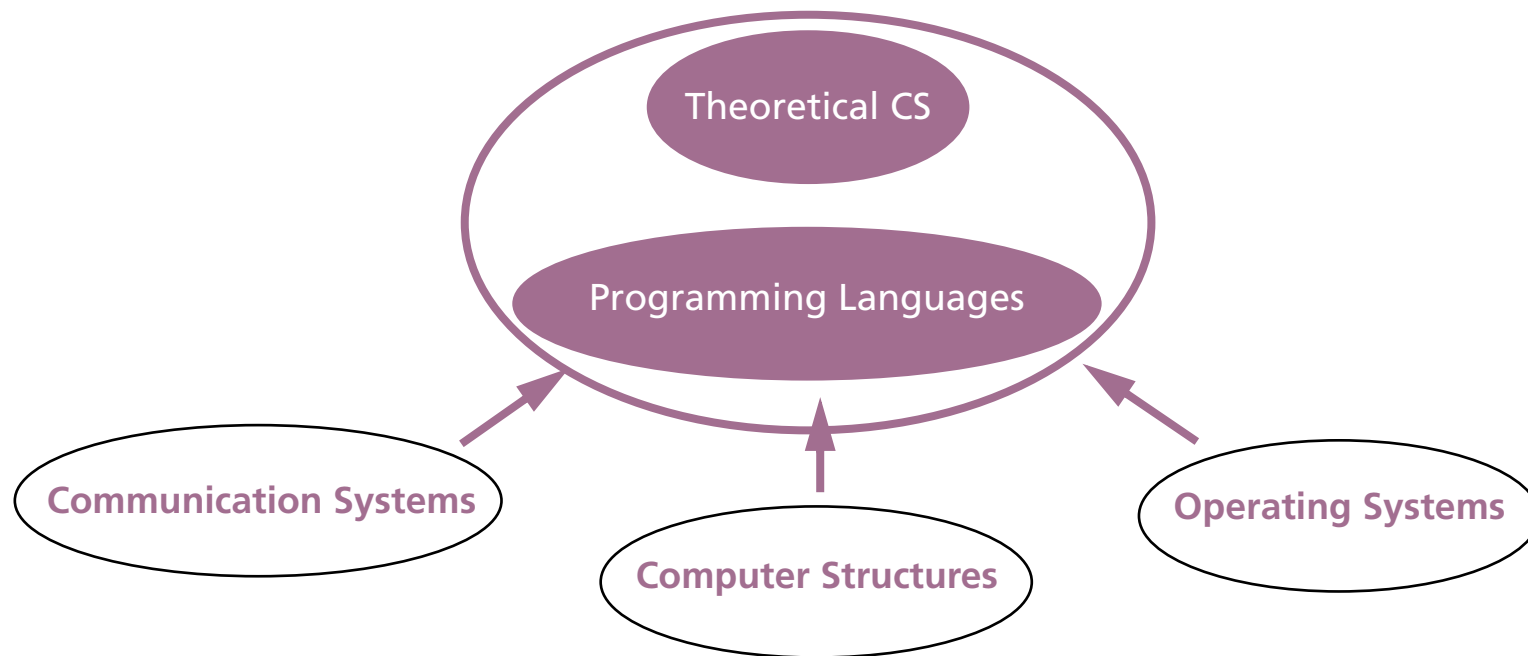
=

Informatics

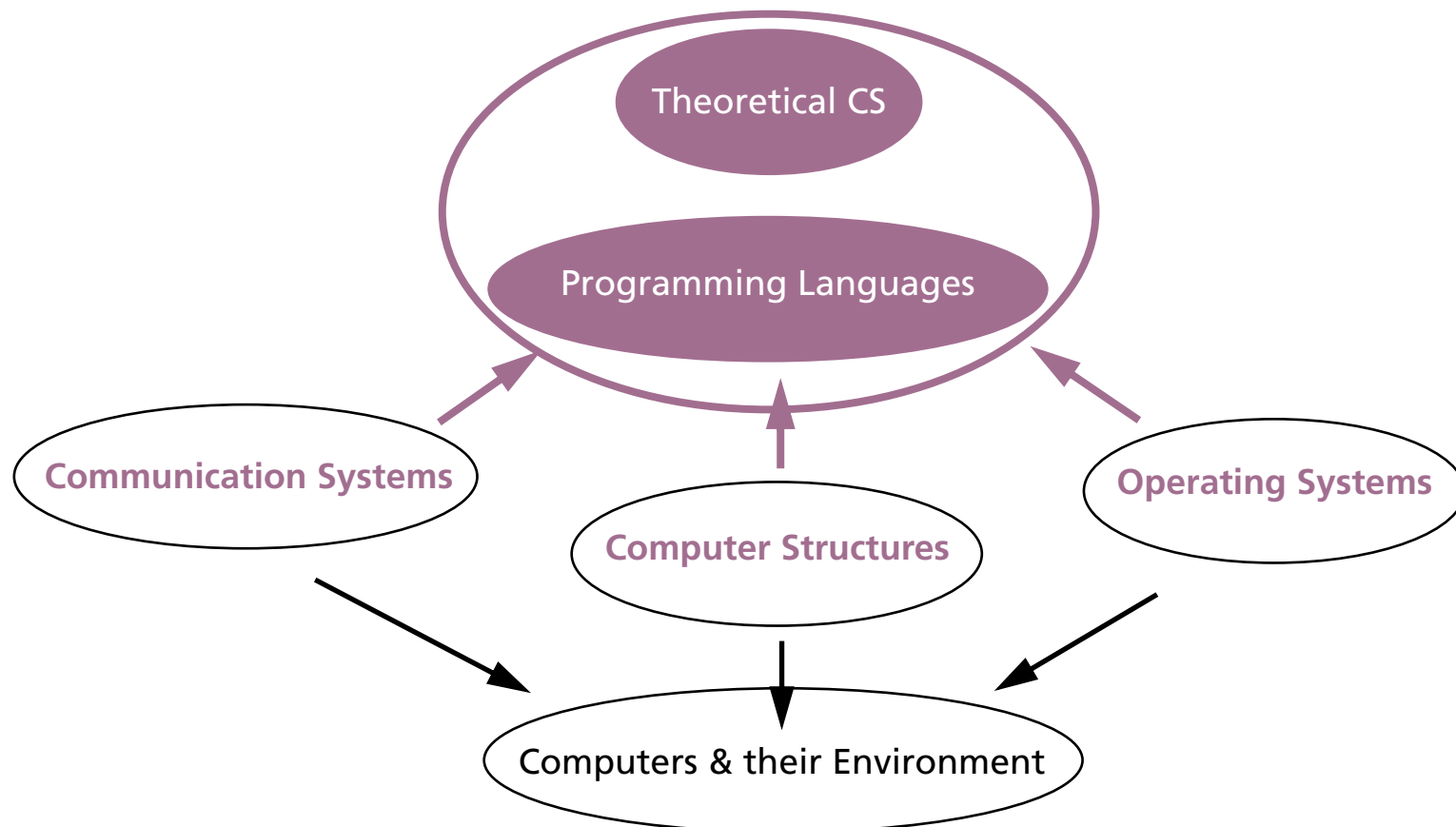
2 Research Areas of Computer Science (CS)



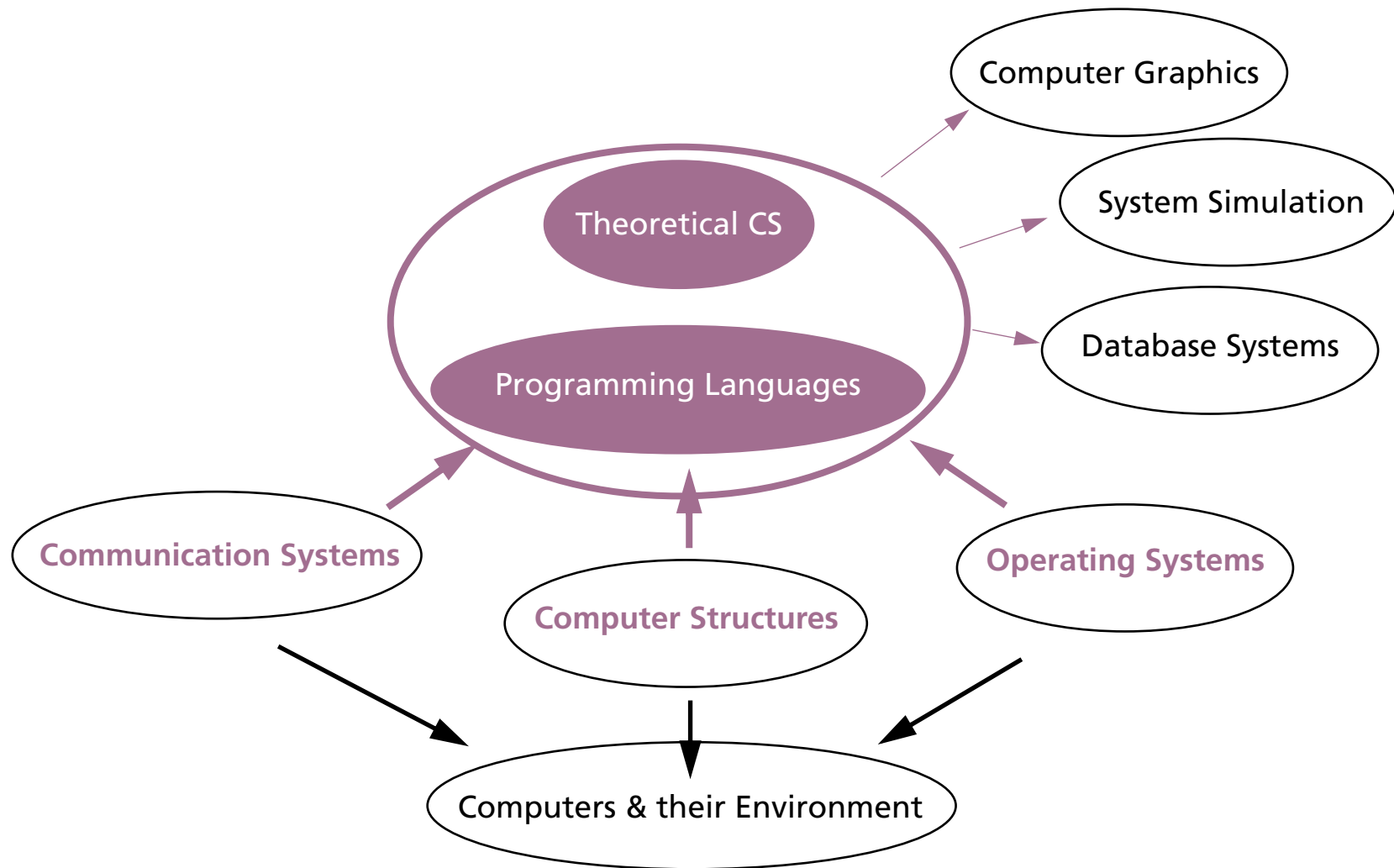
2 Research Areas of Computer Science (CS)



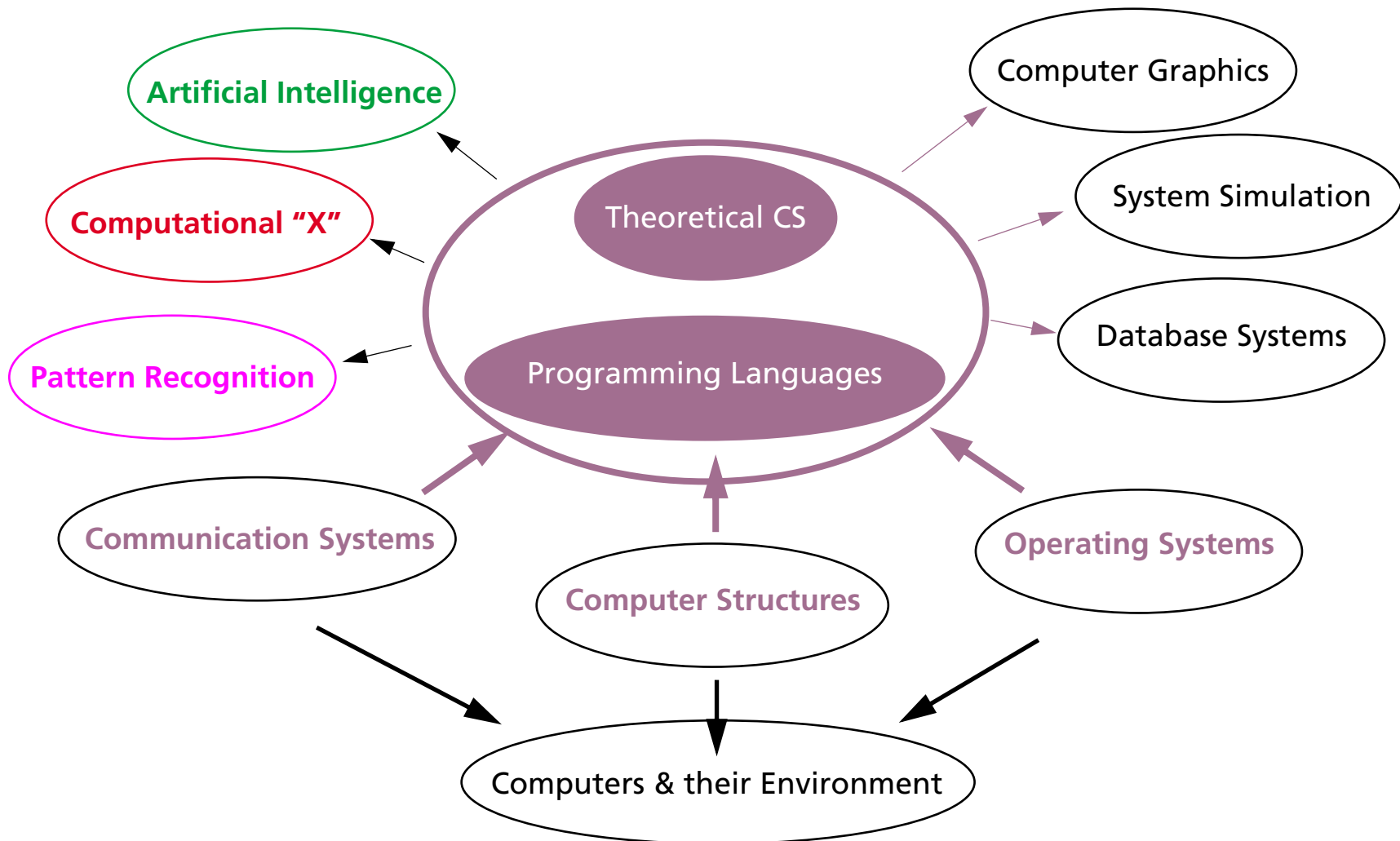
2 Research Areas of Computer Science (CS)



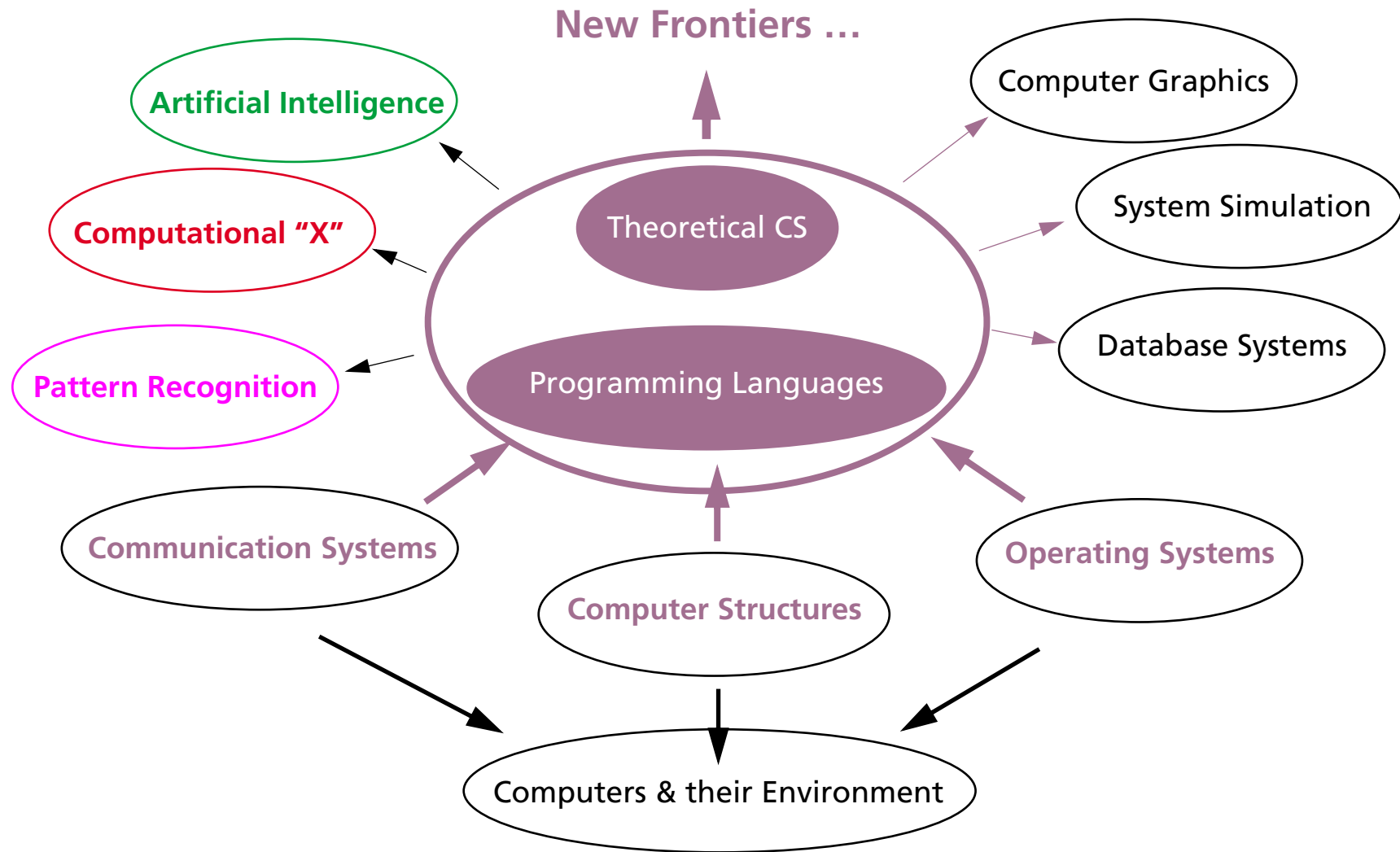
2 Research Areas of Computer Science (CS)



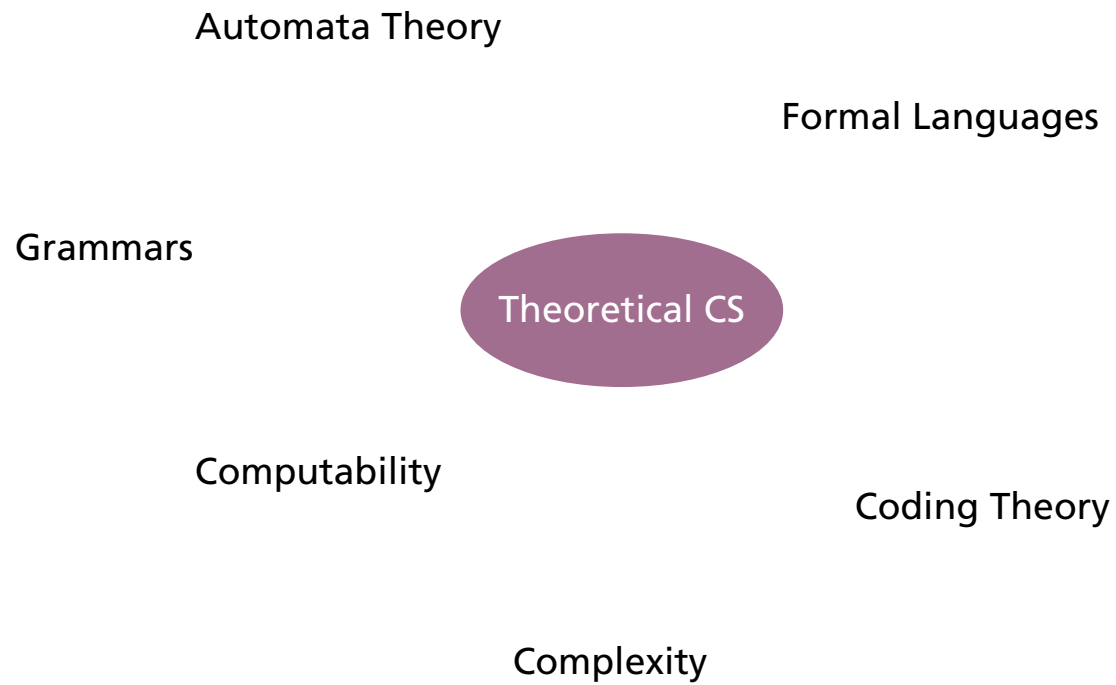
2 Research Areas of Computer Science (CS)



2 Research Areas of Computer Science (CS)

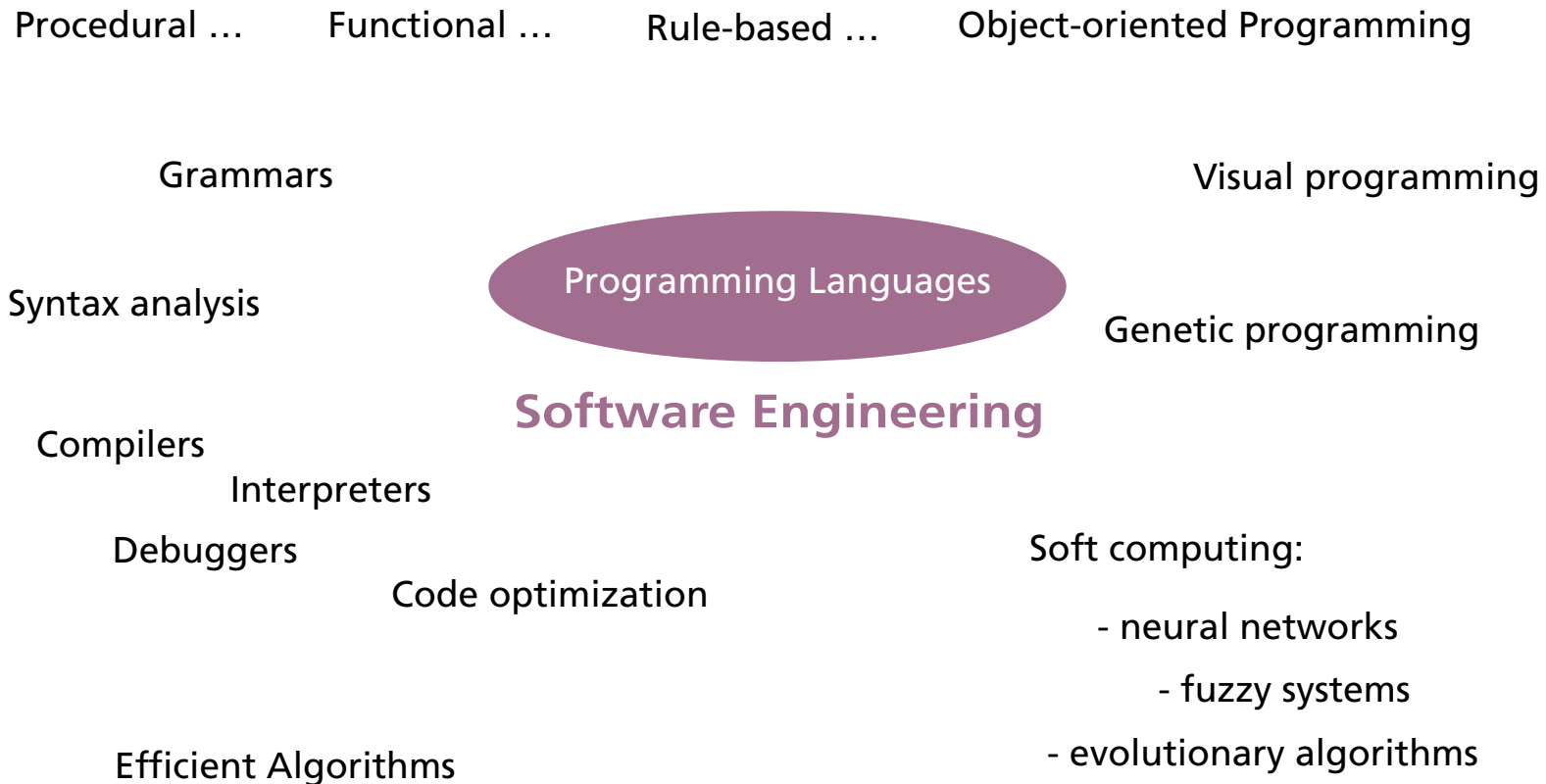


2.1 Theoretical Computer Science

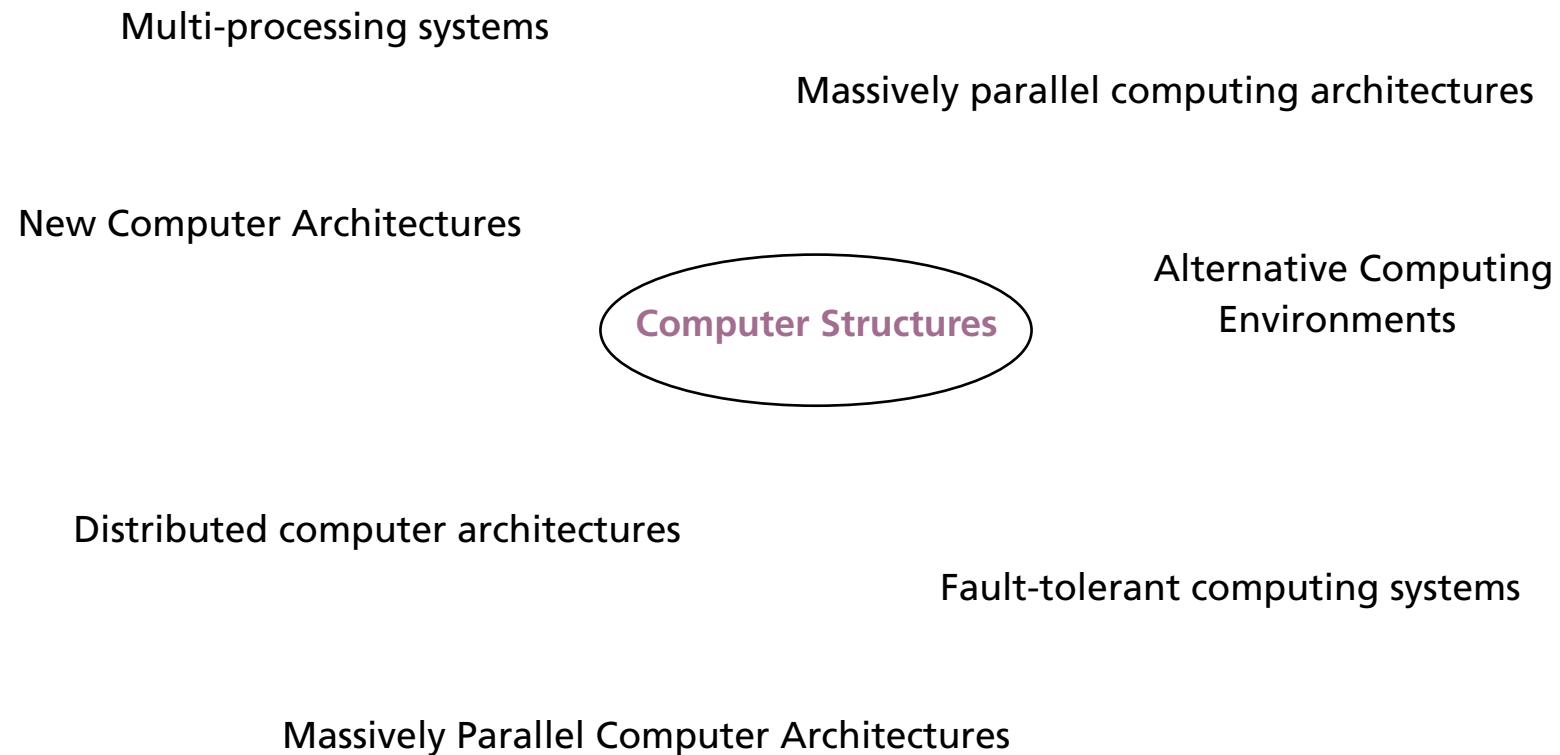


2.2 Programming Languages

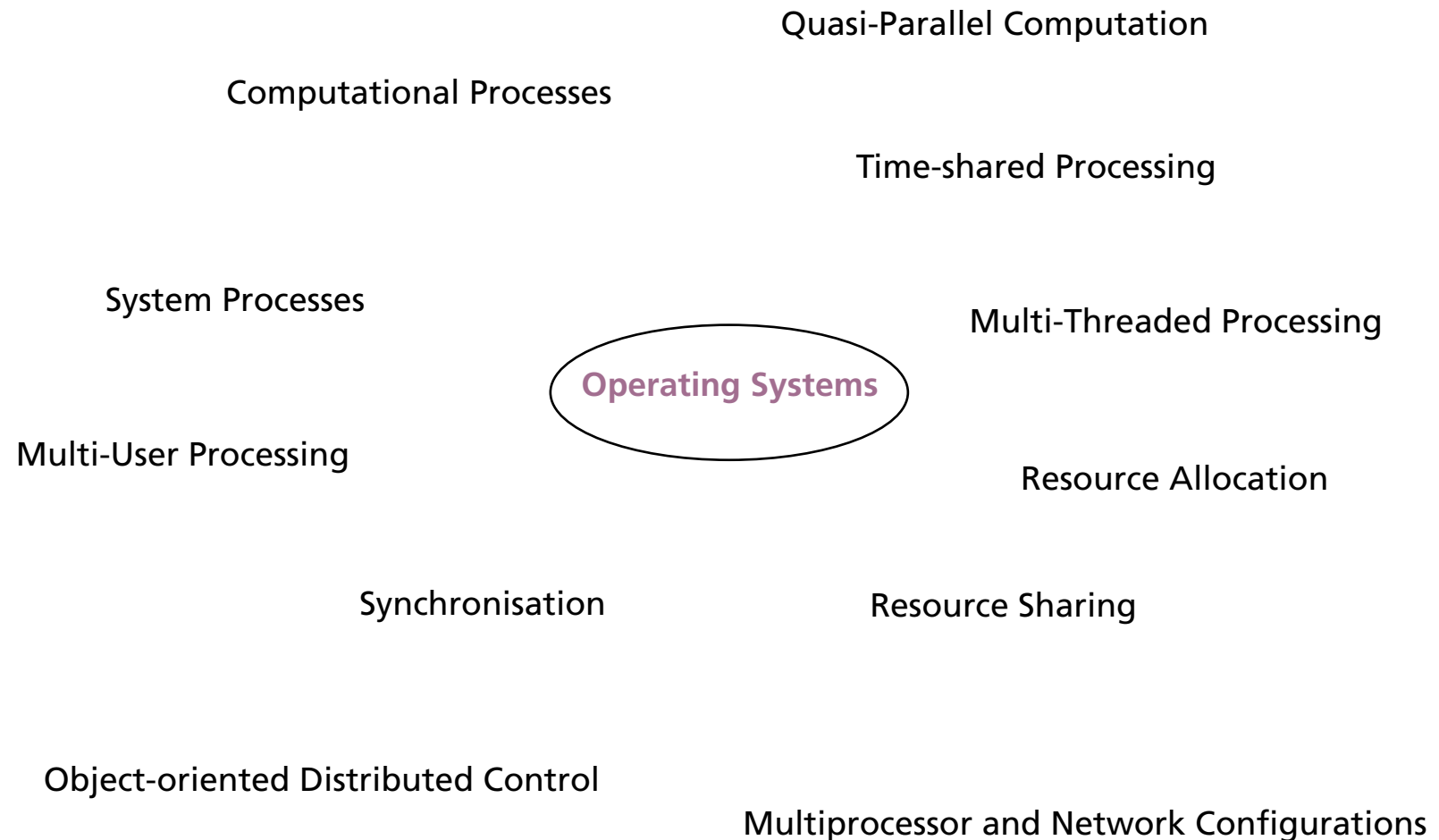
Modern programming languages and concepts



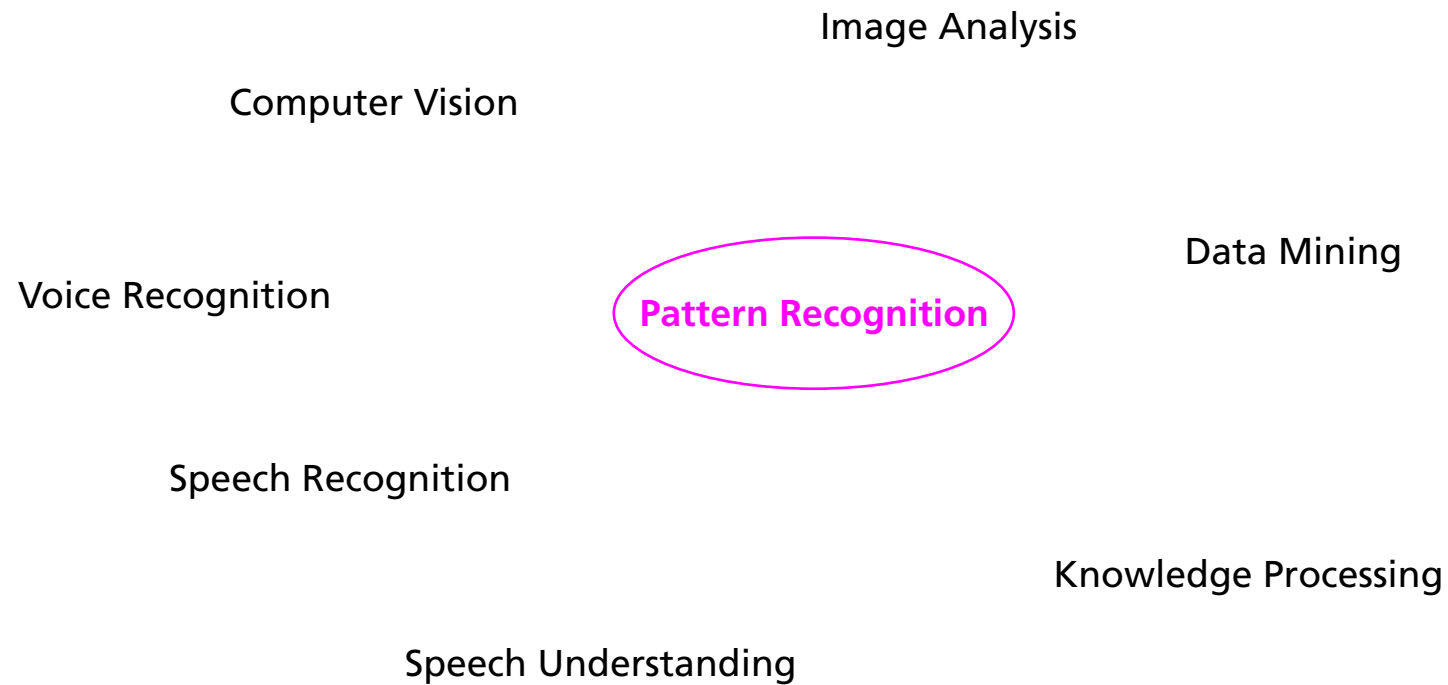
2.3 Computer Structures



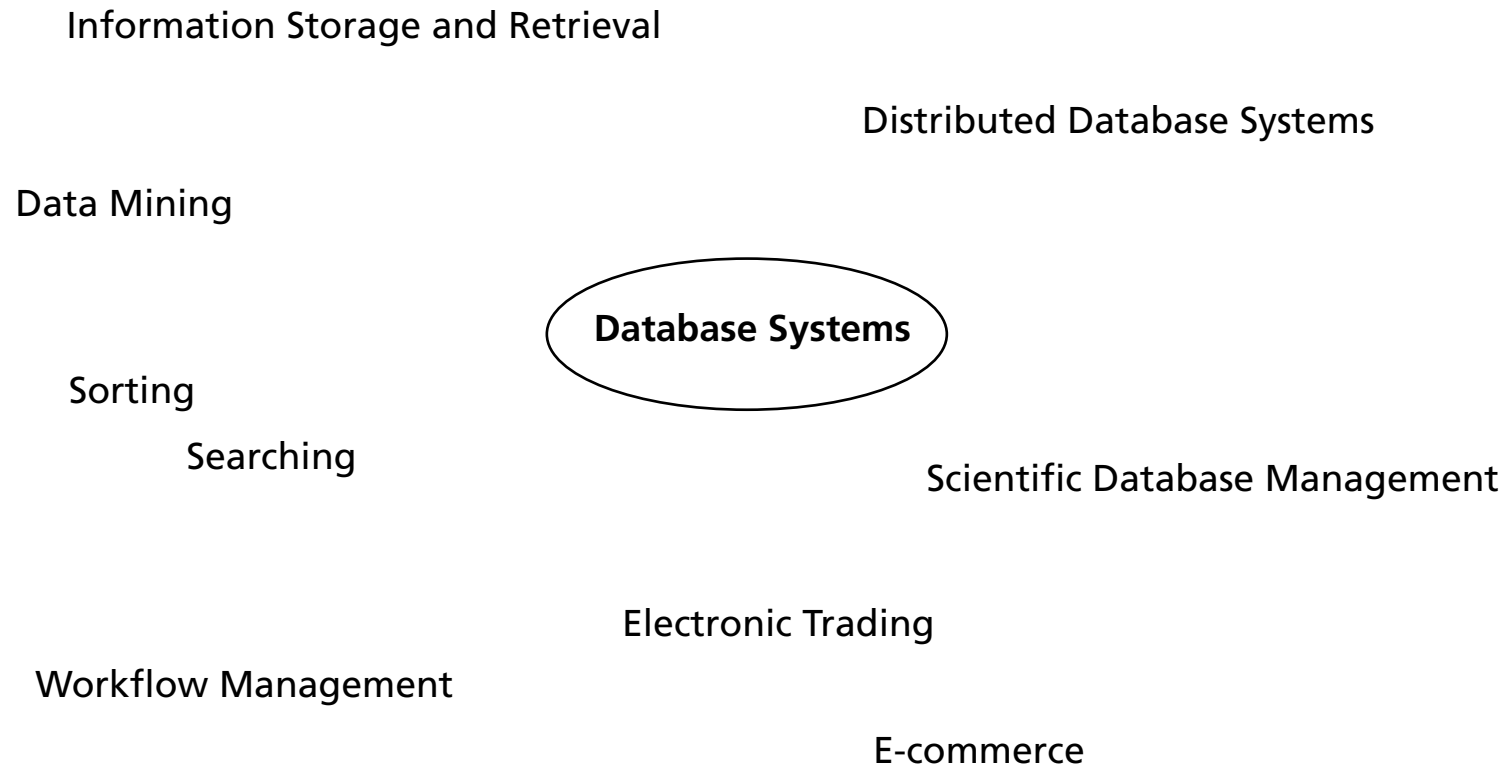
2.4 Operating Systems



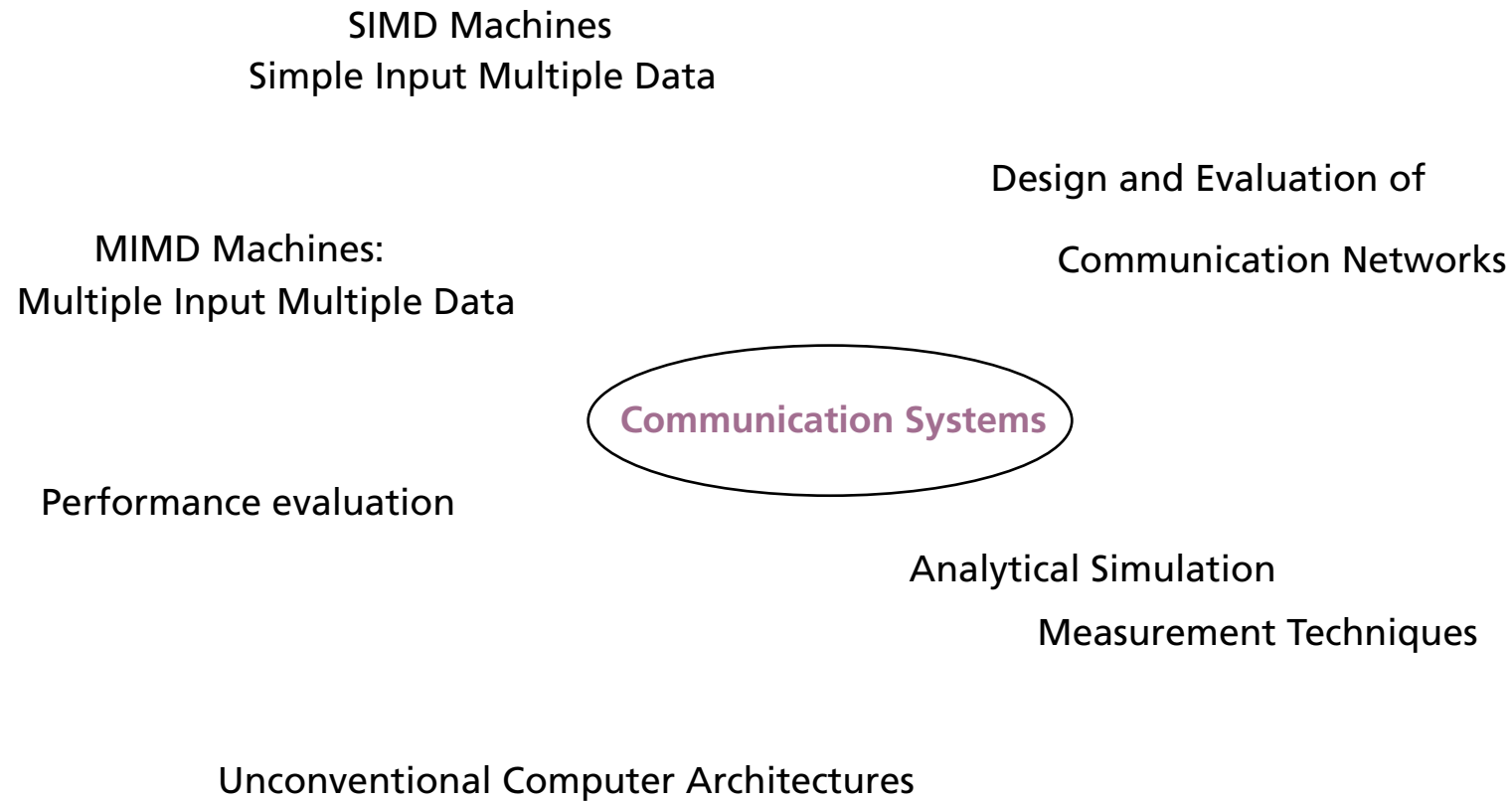
2.5 Pattern Recognition



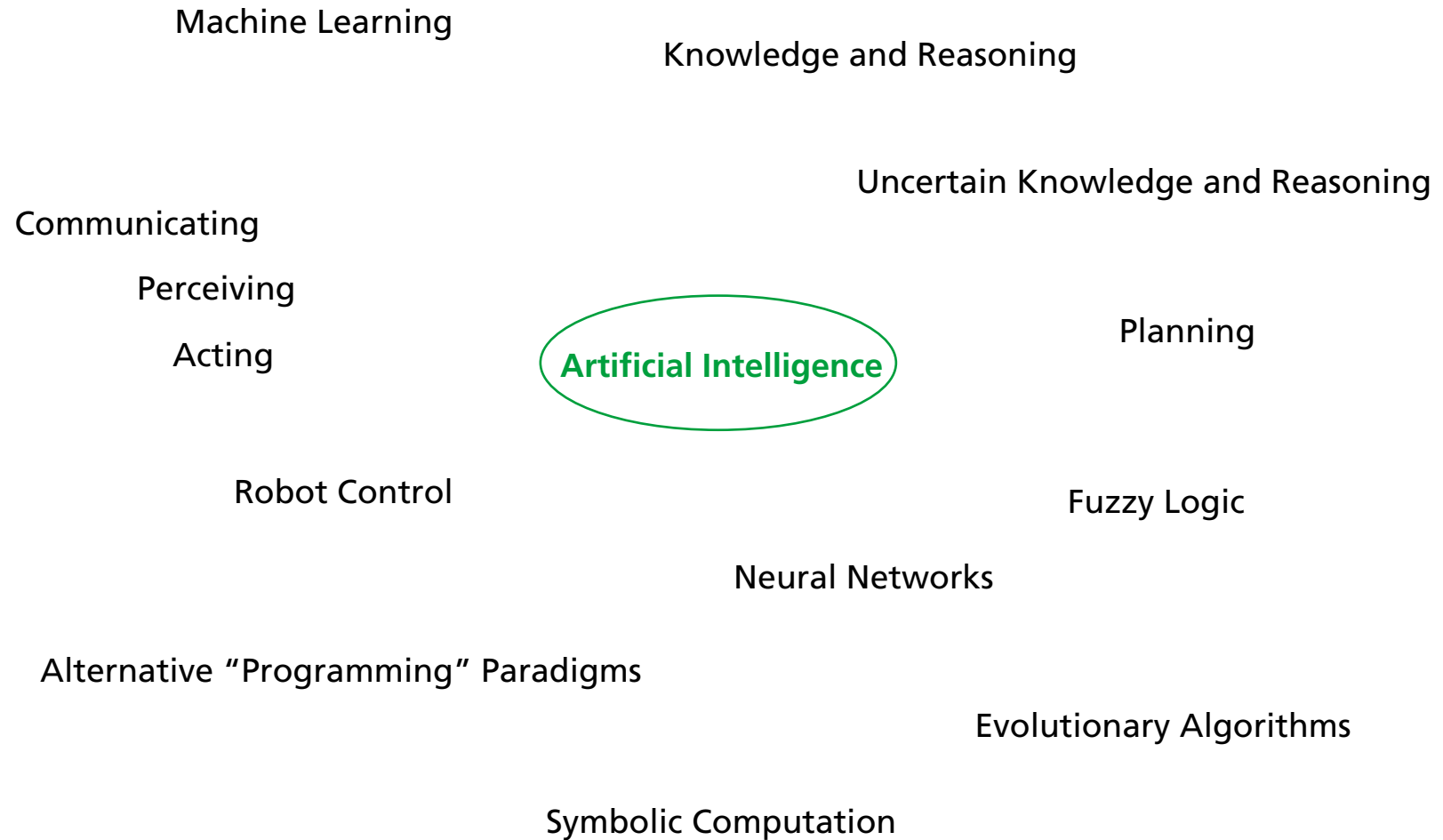
2.6 Database Systems



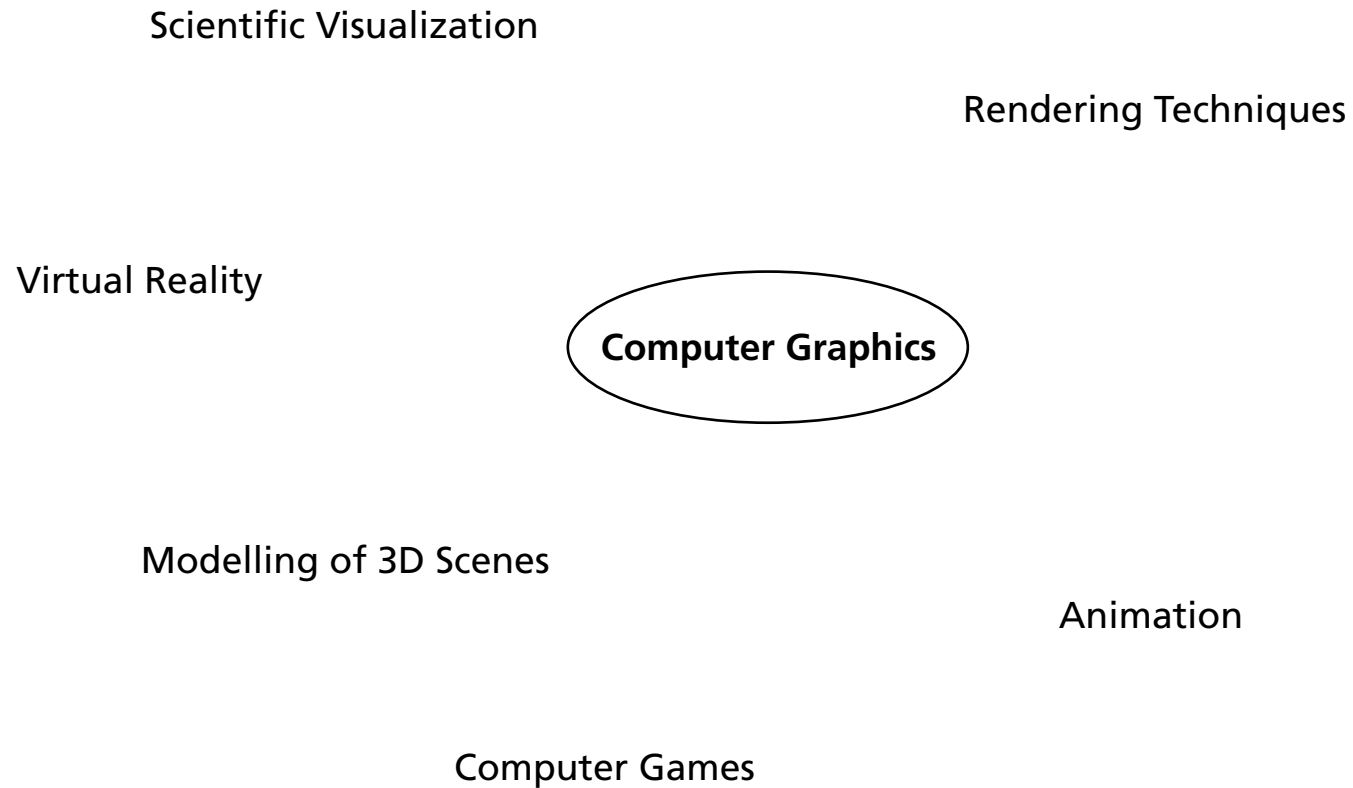
2.7 Communication Systems



2.8 Artificial Intelligence



2.9 Computer Graphics



2.10 System Simulation

Simulation in Science and Engineering

Discrete Simulation

Stochastic Simulation and Modeling

Continuous Simulation

System Simulation

Multi-Level Methods

Self-Organizing Systems and Parallel Computation

High-Performance Programming Techniques

Numerical Simulation of Fluids

Parallel Finite Elements

Algorithms for High-Performance Computers

2.11 Computers and their Environment

Human-computer interaction

Computers & their Environment

Design of “intelligent” computers

Interface design

2.12 Computational "X"

Computational Biology, Bioinformatics

Computational Physics

Computational Mechanics

Computational "X"

Computational Chemistry

Computational Mathematics

Symbolic Computation

Computer Algebra

3 New Frontiers of Computing?

Quantum Computing

DNA Computing

Evolutionary Computing

Agent-based, Distributed Computing

Massively Parallel Computing

...

4 Learning the Computers' Languages

I always worked with programming languages because it seemed to me that until you could understand those, you really couldn't understand computers.

Understanding them doesn't really mean only being able to use them.

A lot of people can use them without understanding them.

Christopher Strachey (1916-1975)¹

1. Christopher Strachey was the first leader of the Programming Research Group (PRG), part of the Oxford University Computing Laboratory (OUCL), founded in 1965. He was the first Professor of Computation at Oxford, succeeded by Tony Hoare in 1977 after his untimely death. With Dana Scott he founded the field of denotational semantics, providing a firm mathematical foundation for programming languages.

5 Conjuring the Spirits of the Computer ...

We are about to study the idea of a **computational process**.

Computational processes are abstract beings that inhabit computers.

As they evolve, processes manipulate other abstract things called **data**.

The evolution of a process is directed by a pattern of rules called a **program**.

People create programs to direct processes.

“In effect, we conjure the spirits of the computer with our spells.”¹

1. H. Abelson and G. J. Sussman, *Structure and Interpretation of Computer Programs*, MIT Press, 1991.