MOTION PLANNING IN AUTONOMOUS DRIVING - INTRO

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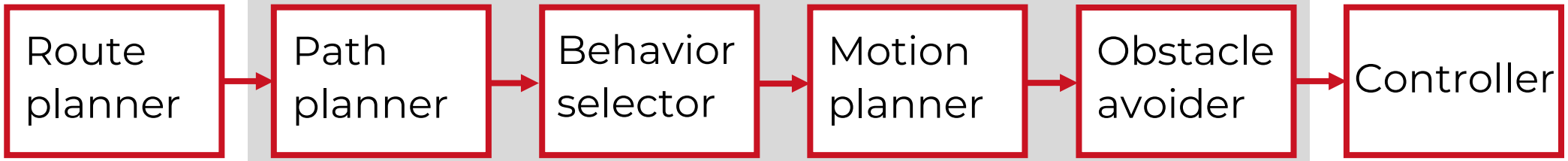
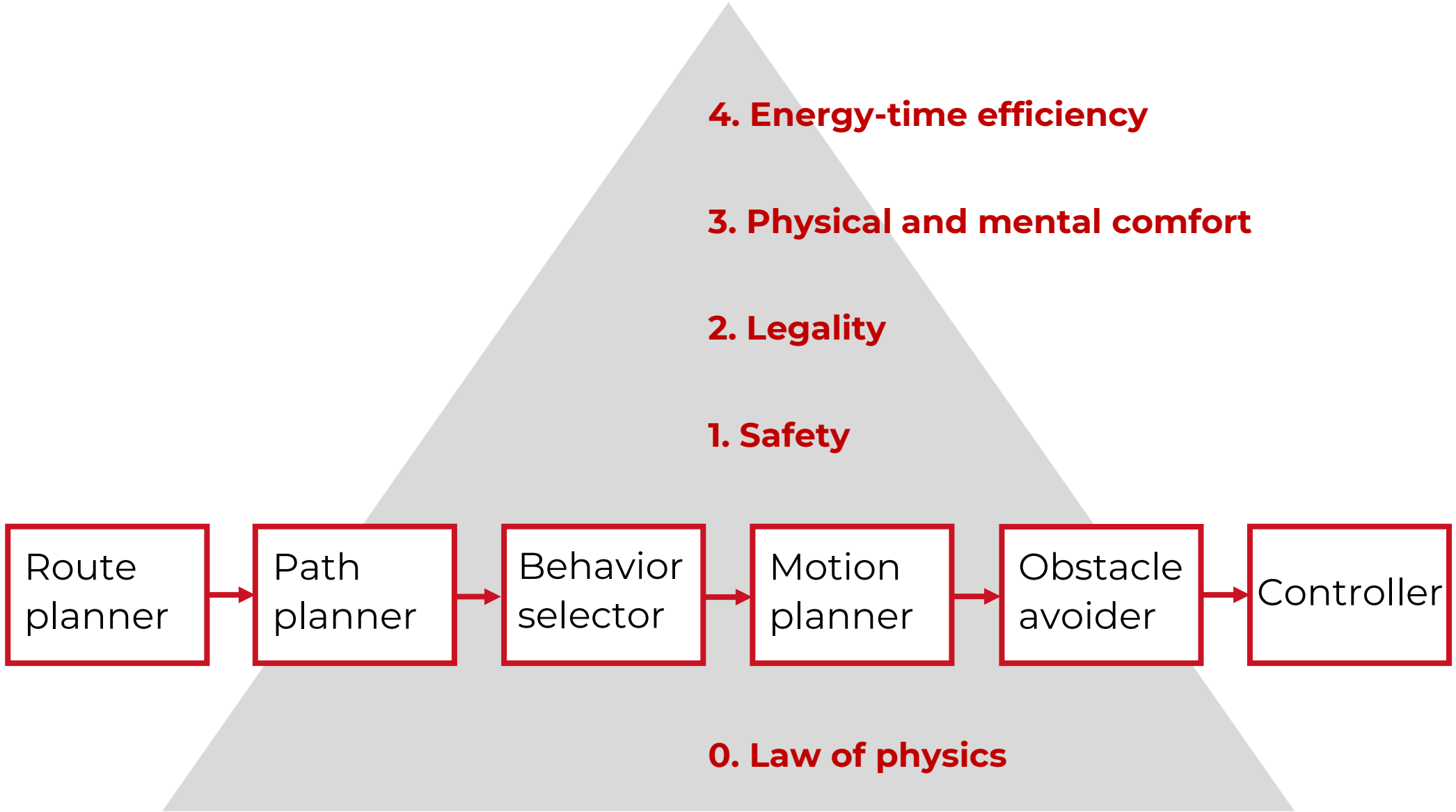
Scope for motion planning

Decides the most convenient motion strategy for some chosen criteria




4. Energy-time efficiency
3. Physical and mental comfort
2. Legality
1. Safety
Route planner
Path planner
Behavior selector
Motion planner
Obstacle avoider
Controller
0. Law of physics

CLASSIFICATION

More details in Claussmann et al., 2019, freely available here:

https://www.researchgate.net/publication/333124691_A_Review_of_Motion_Planning_for_Highway_Autonomous_Driving

CLASSIFICATION

Type of output	A space, a path, a trajectory, a maneuver, a symbolic representation
Space-time property	Predictive or reactive nature
Mathematical domain	The philosophy of the approach and the framework of the solver

CLASSIFICATION

Type of output	Set-algorithm

The algorithm returns only a decomposition, rather than a reference

PROs – more natural representation

CONs – a complementary algorithm needs to be added

CLASSIFICATION

Type of output	Solve algorithm

The algorithm returns a trajectory

PROs – trajectory readily available

CONs – less intuitive in some cases

CLASSIFICATION

The algorithm plans ahead. Used upstream for planning

PROs – better performance

CONs – computationally demanding

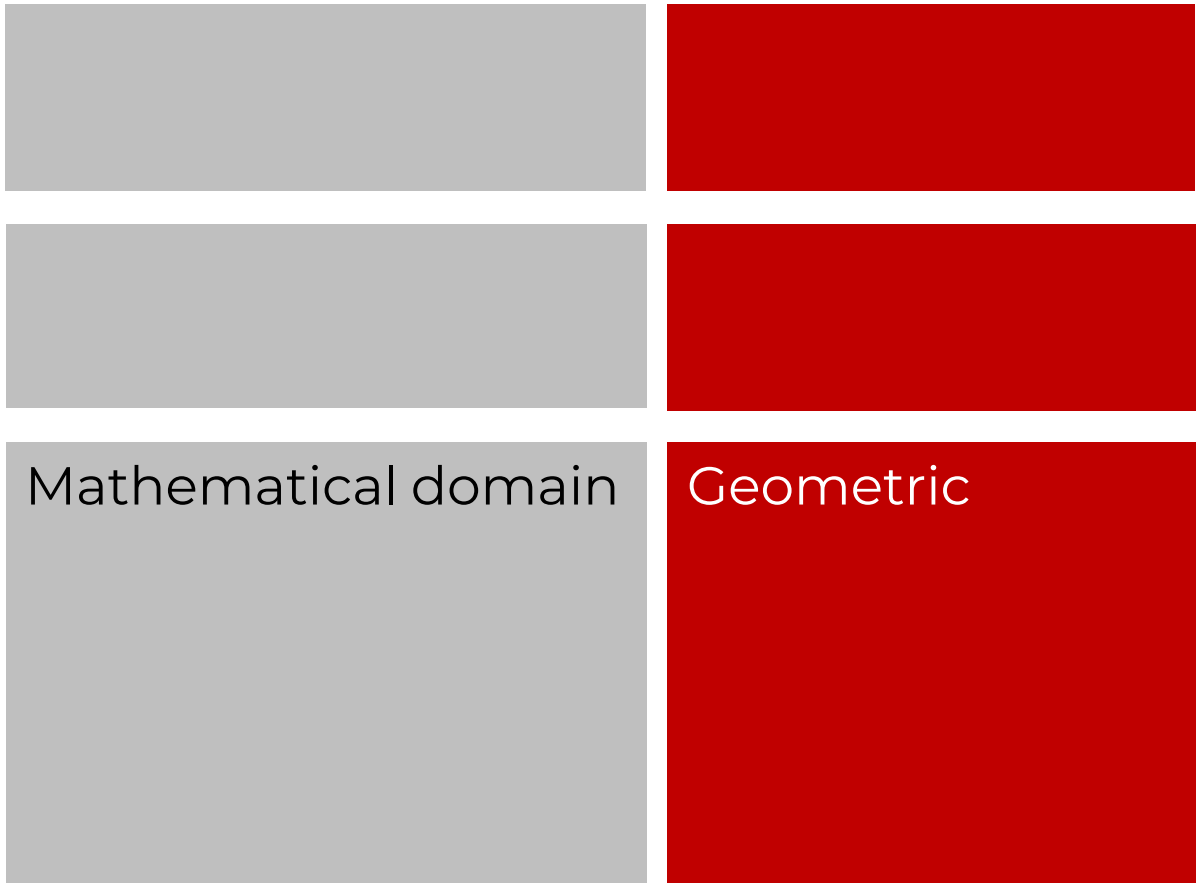
CLASSIFICATION

Traditional feedback control

PROs – simple to implement

CONs – Only really suitable for tracking

CLASSIFICATION

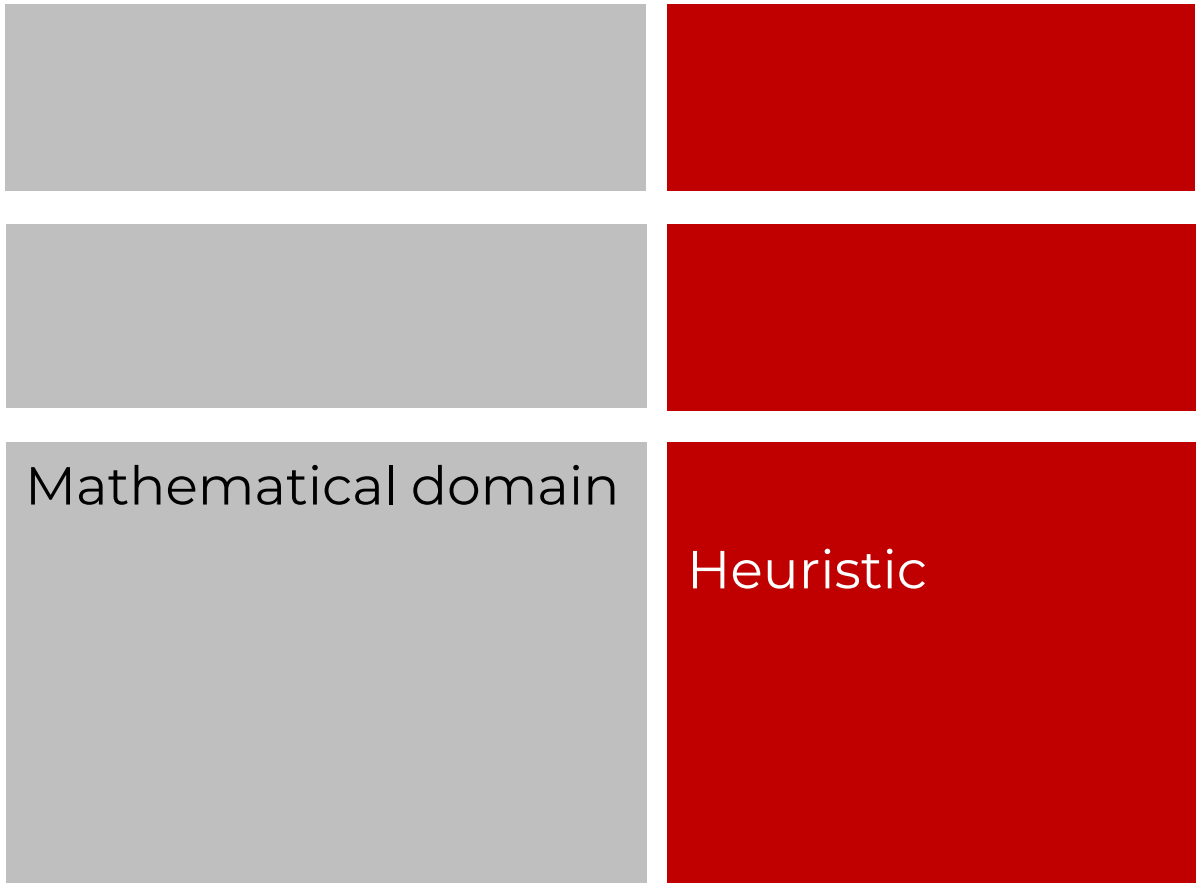


Uses property of space

PROs – It works directly with space constraints

CONs – Dealing with large space exploration

CLASSIFICATION

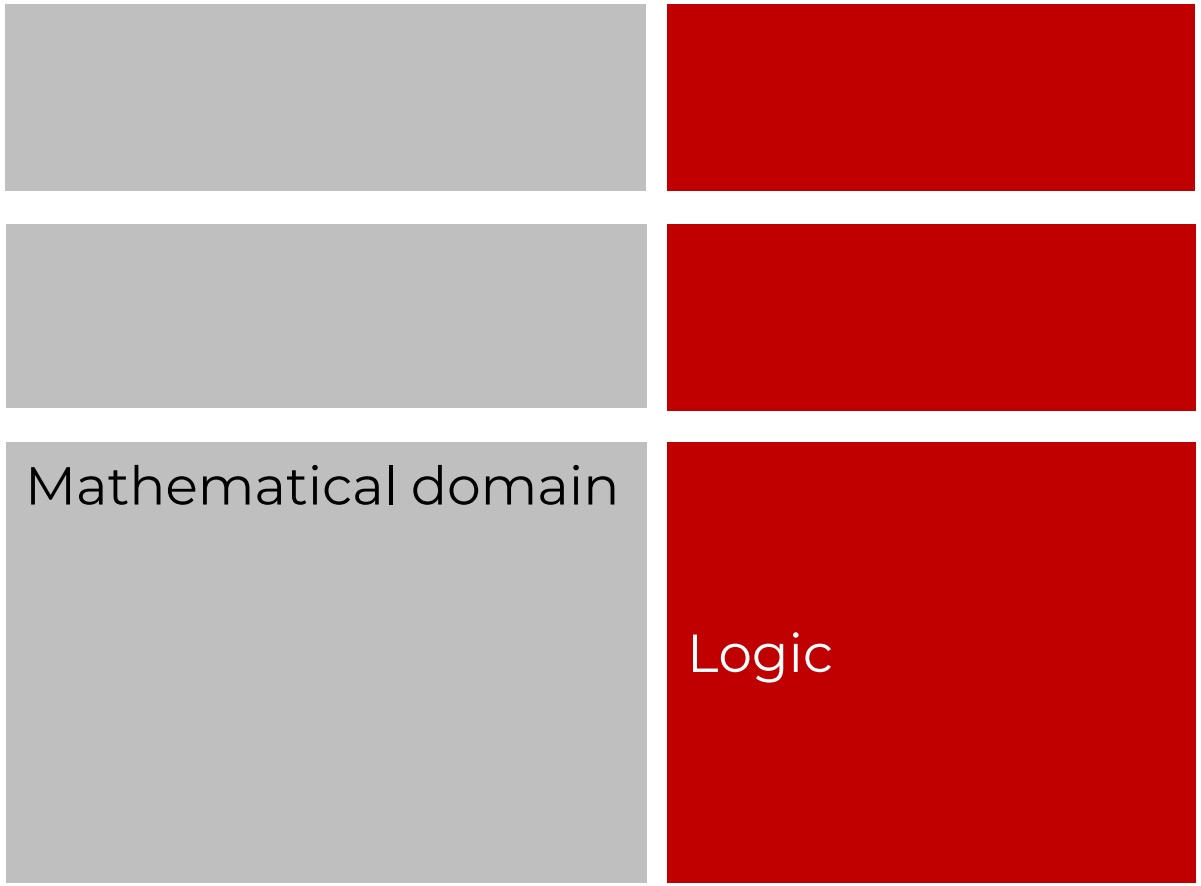


Depends on problem specific knowledge

PROs – Solves more quickly

CONs – No optimality guarantees

CLASSIFICATION

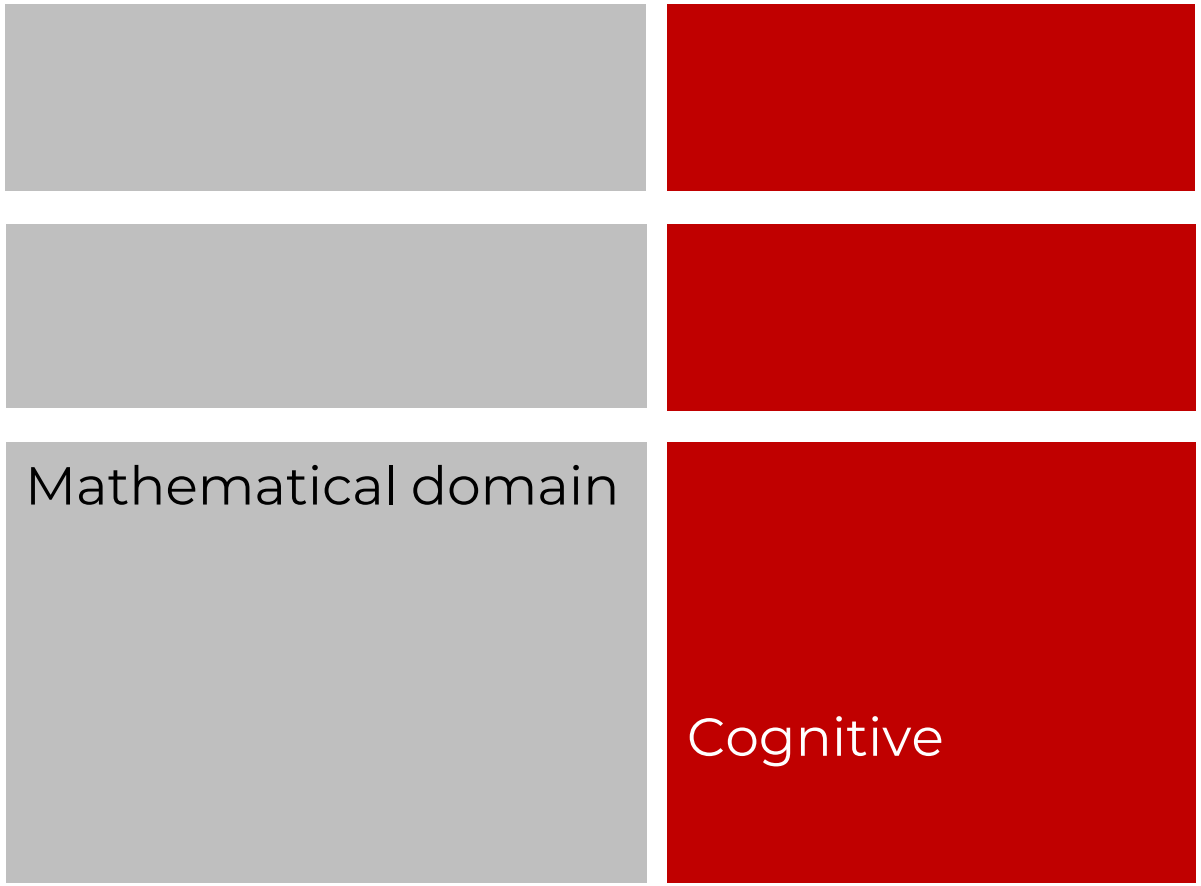


Deductive approaches built on assertions

PROs – Cause-effect link is clear

CONs – Combinatorial explosion

CLASSIFICATION

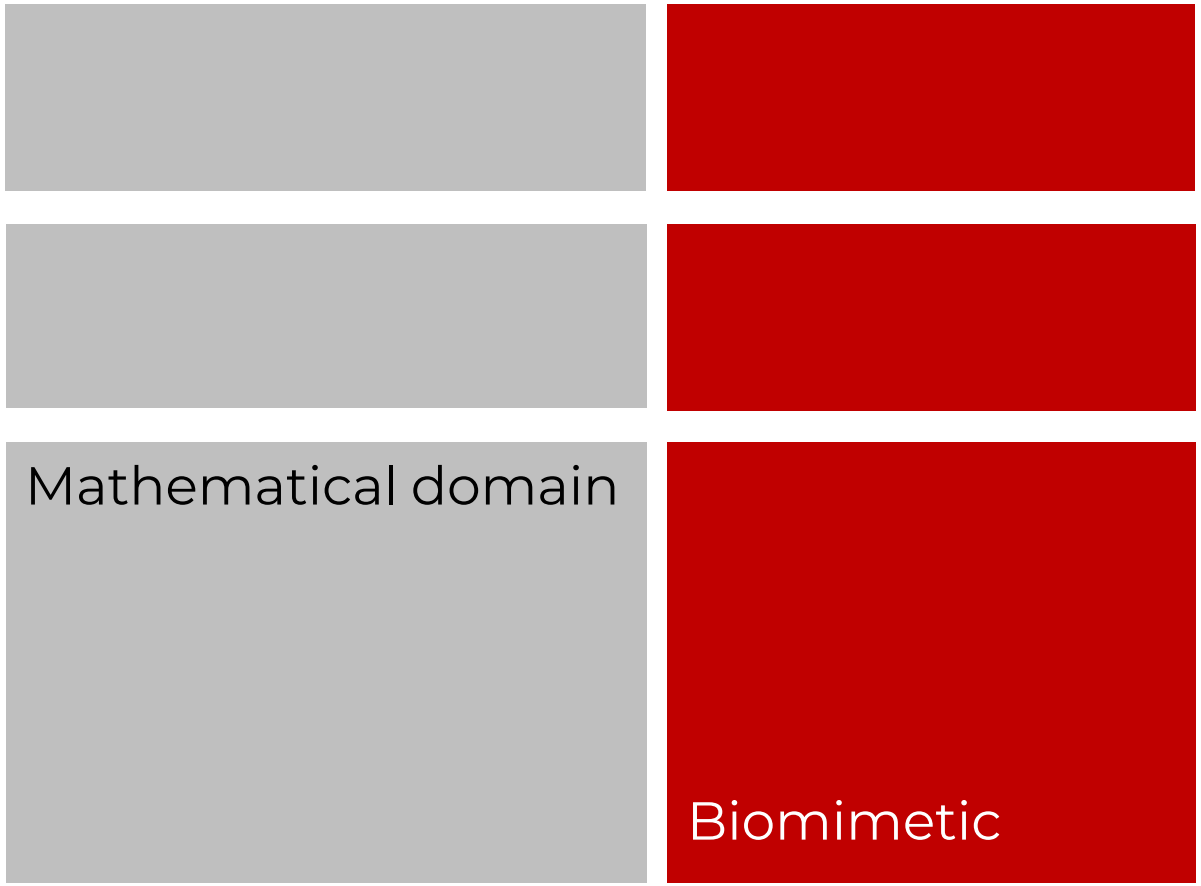


Evaluation of a situation based on previous knowledge

PROs – Ability to use existing knowledge to gather new information

CONs – Difficult to validate

CLASSIFICATION



A physics-inspired approach

PROs – Intuitive

CONs – Suboptimal, can generate unxpected behavior

CLASSIFICATION

Type of output	Set-algorithm Solve algorithm
Space-time property	Predictive horizon Reactive horizon
Mathematical domain	Geometric Heuristic Logic Cognitive Biomimetic

TAKE AWAY POINTS

- Hierarchy of decision making
- Algorithm classification into 9 domains

NEXT

Algorithm types

1. Space configuration
2. Pathfinding algorithms
3. Attractive and repulsive forces
4. Parametric and semi-parametric curves
5. Artificial intelligence
6. Numerical optimization

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