Motion planning – advanced methods

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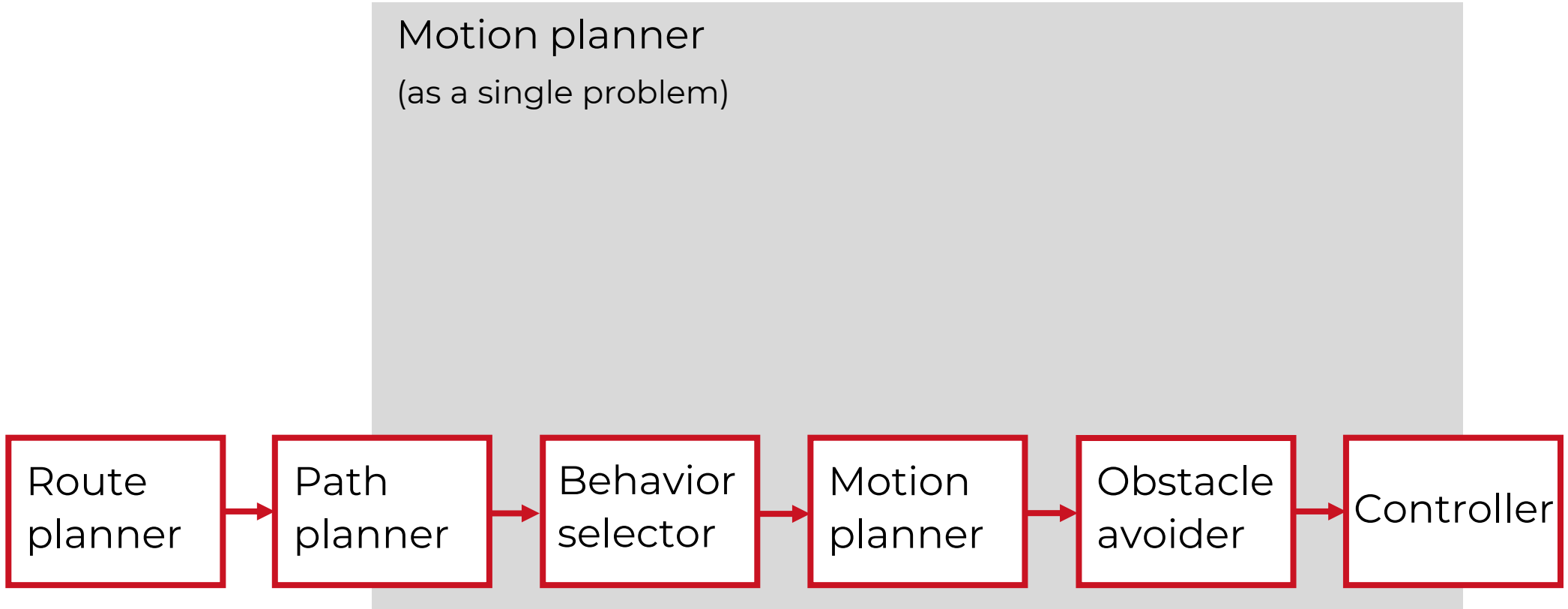
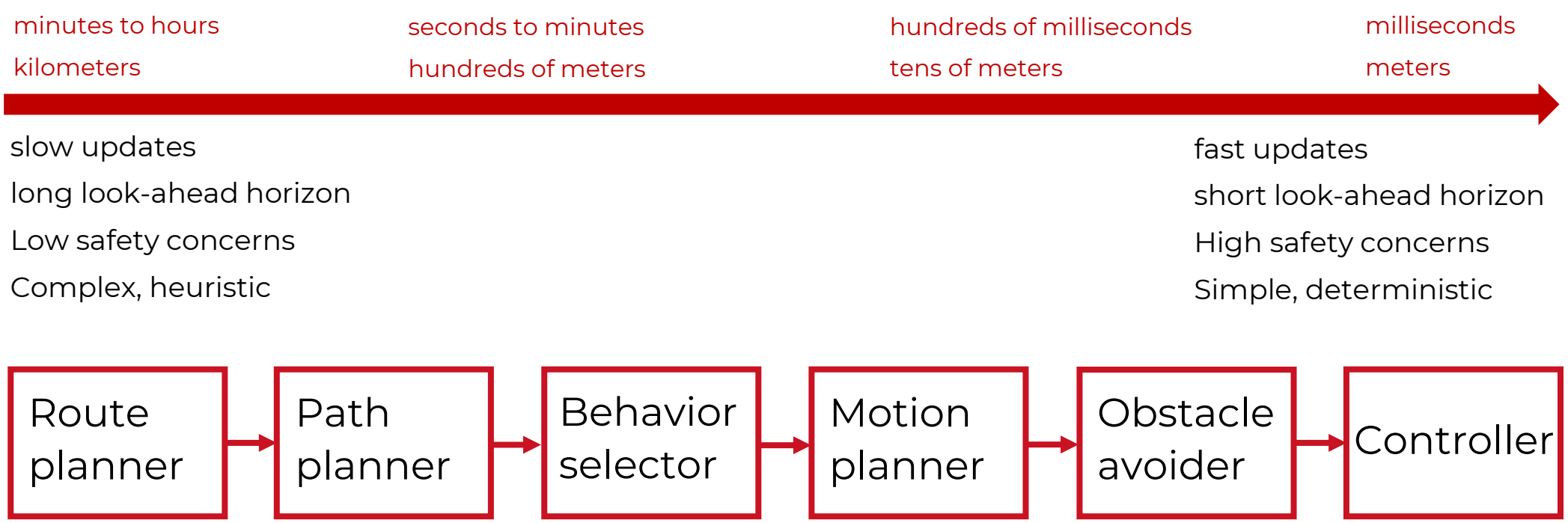

Motion planner
(as a single problem)
Route planner
Path planner
Behavior selector
Motion planner
Obstacle avoider
Controller


minutes to hours
kilometers
seconds to minutes
hundreds of meters
hundreds of milliseconds
tens of meters
milliseconds
meters
slow updates
long look-ahead horizon
Low safety concerns
Complex, heuristic
fast updates
short look-ahead horizon
High safety concerns
Simple, deterministic
Route planner
Path planner
Behavior selector
Motion planner
Obstacle avoider
Controller

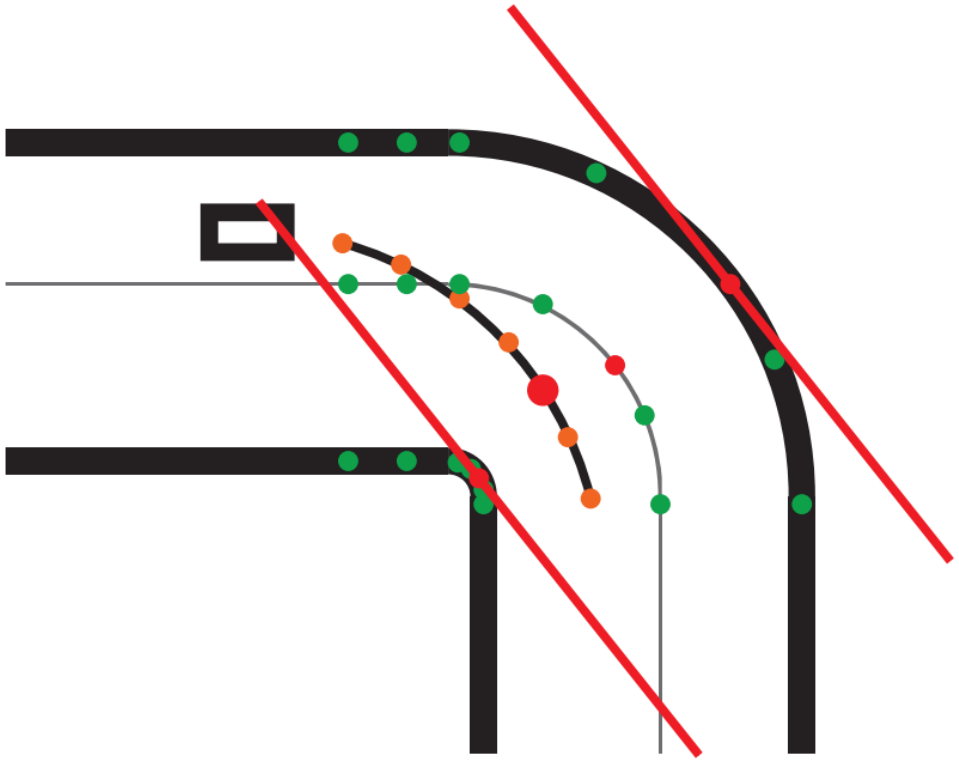
Liniger et al., Optimization-Based Autonomous Racing of 1:43 Scale RC Cars. https://arxiv.org/abs/1711.07300

Path planning and path tracking as a single problem

A nonlinear MPC formulation

For obstacle avoidance a pre-processing is needed

NO OBSTACLES



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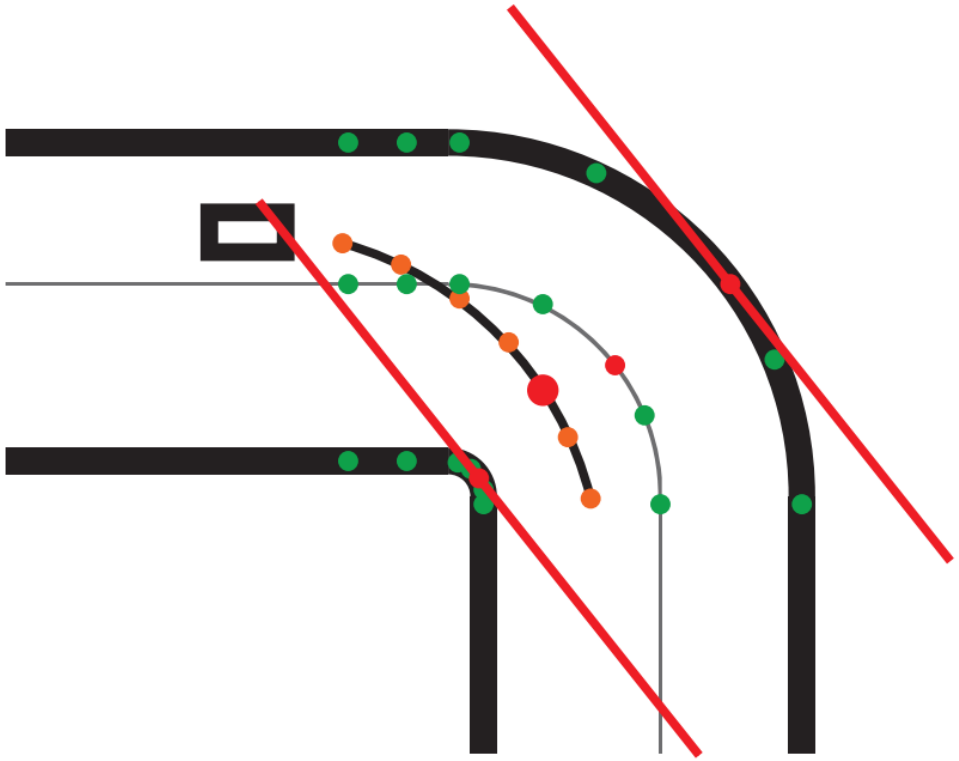
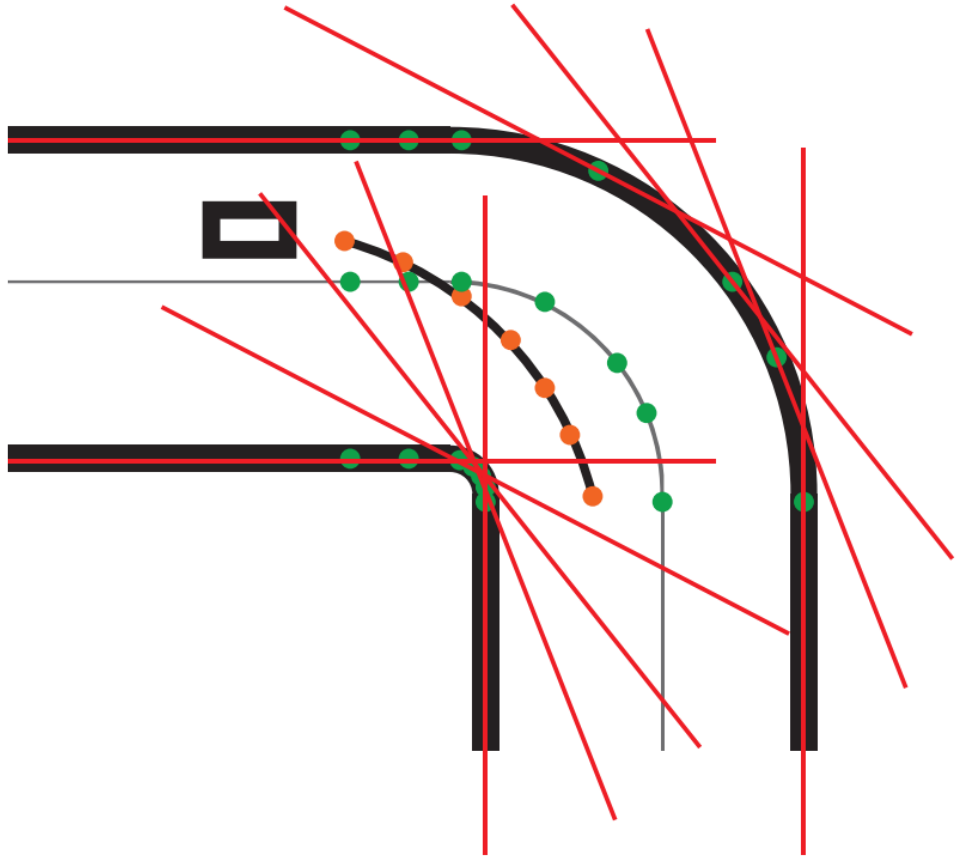
NO OBSTACLES





https://arxiv.org/abs/1711.07300

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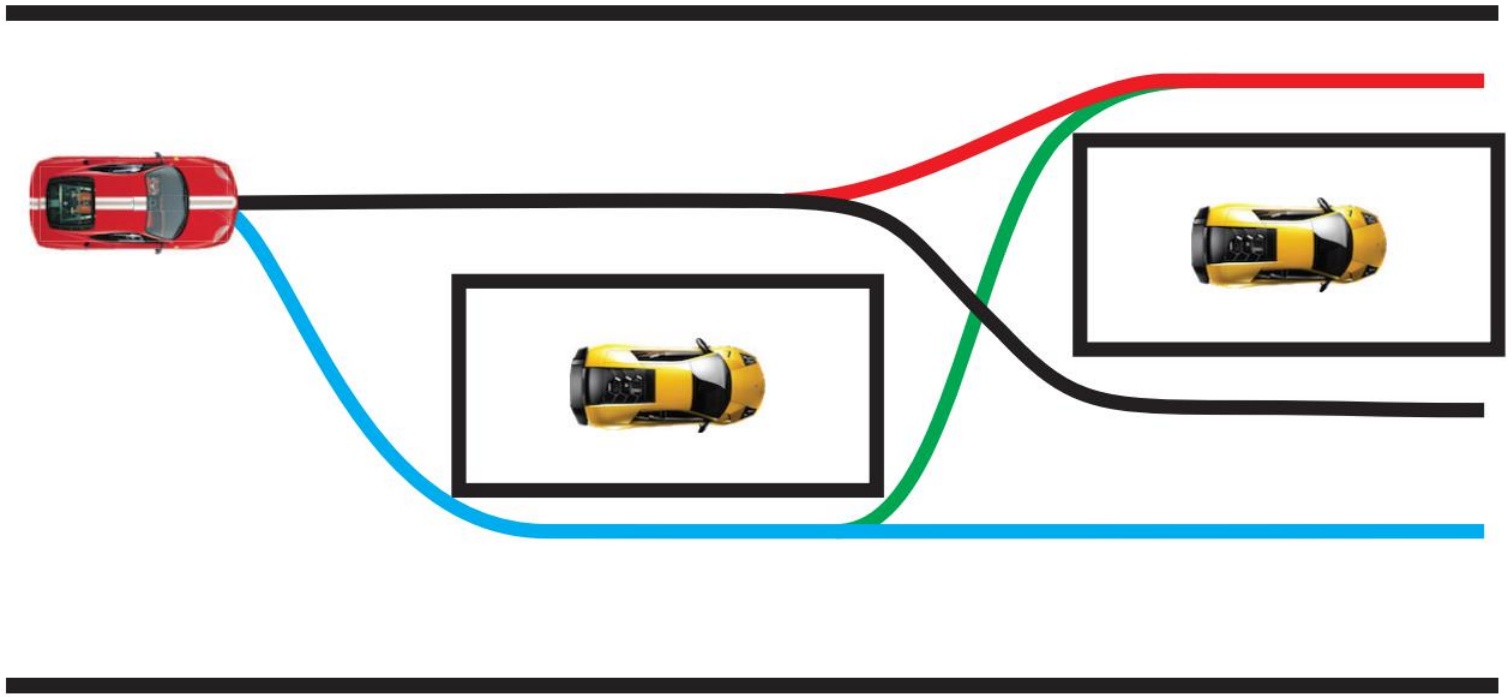
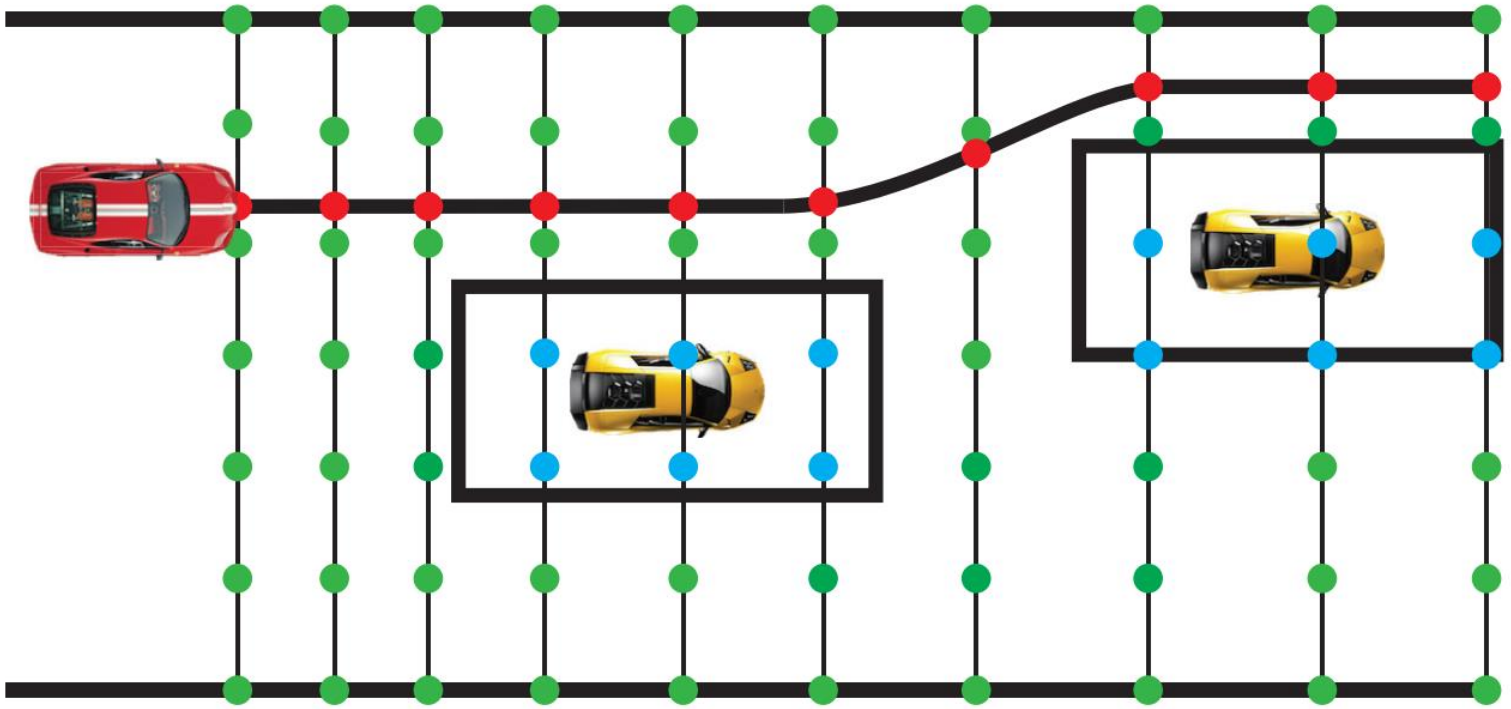
WITH OBSTACLES



https://arxiv.org/abs/1711.07300

WITH OBSTACLES



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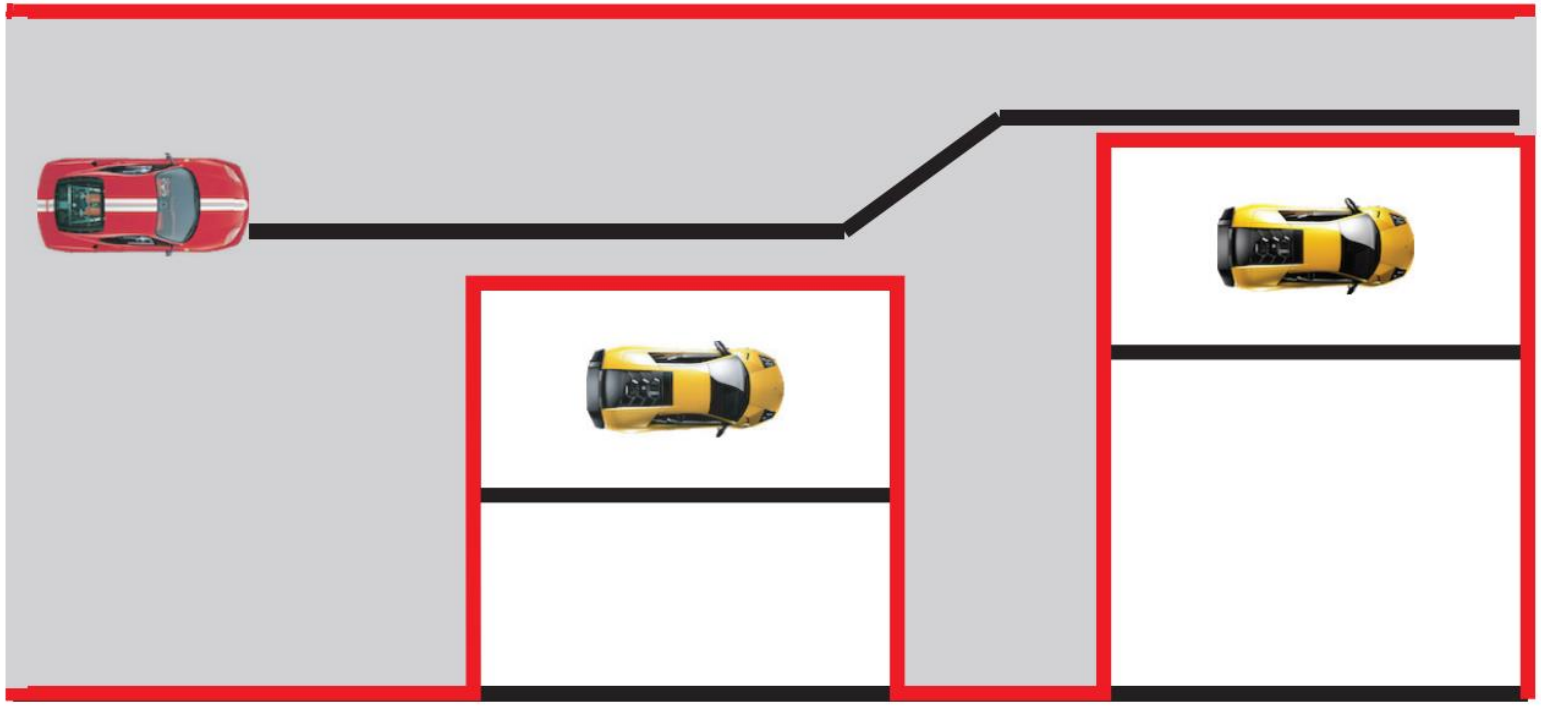
WITH OBSTACLES



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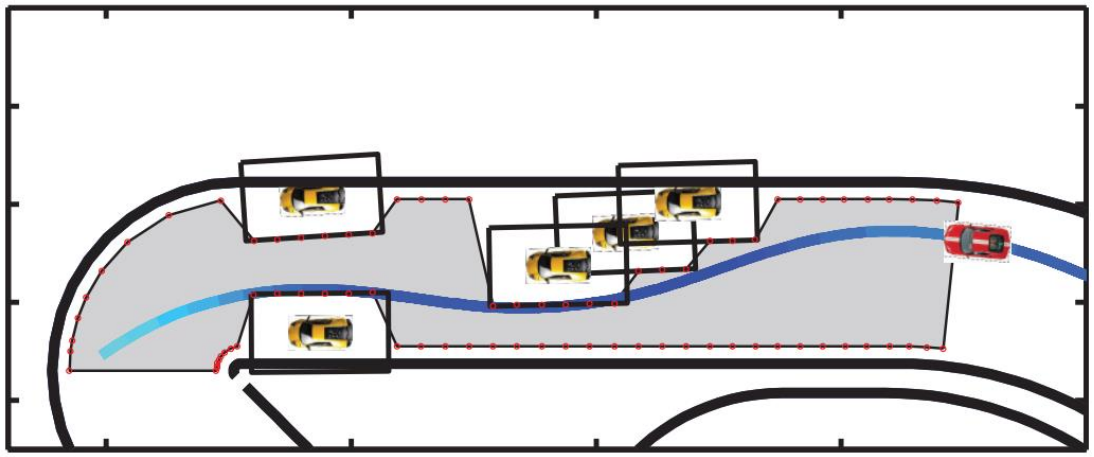
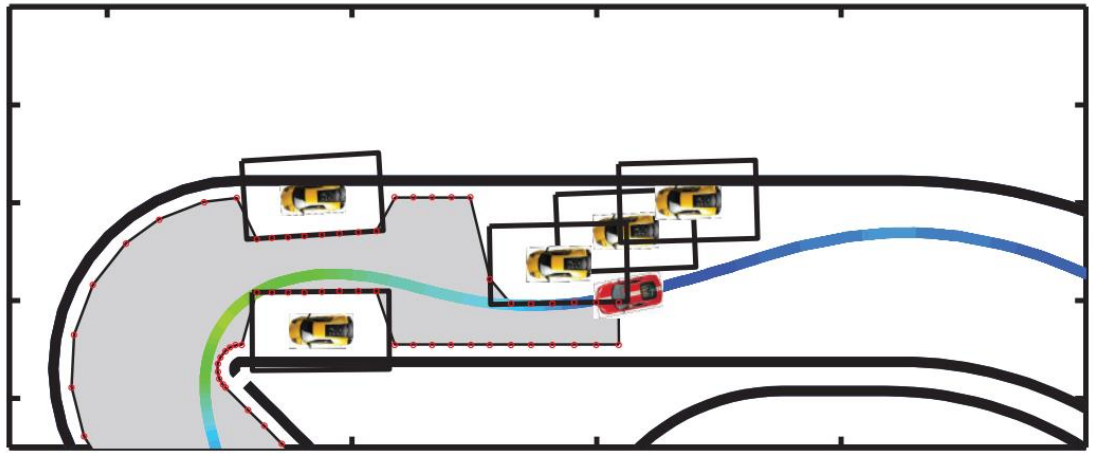
WITH OBSTACLES





https://arxiv.org/abs/1711.07300

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TAKE AWAY POINTS

- The motion planning problem can be solved in less steps
- Path planning and path tracking as a single problem
- A fast solver for the nonlinear MPC is needed

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