

The Planner Ensemble: Motion Planning by Executing Diverse Algorithms

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A helicopter has to fly through **diverse** set of environments



Trees, Towers



Mountains, Canyons

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There is no “best” planner - performance depends on environment



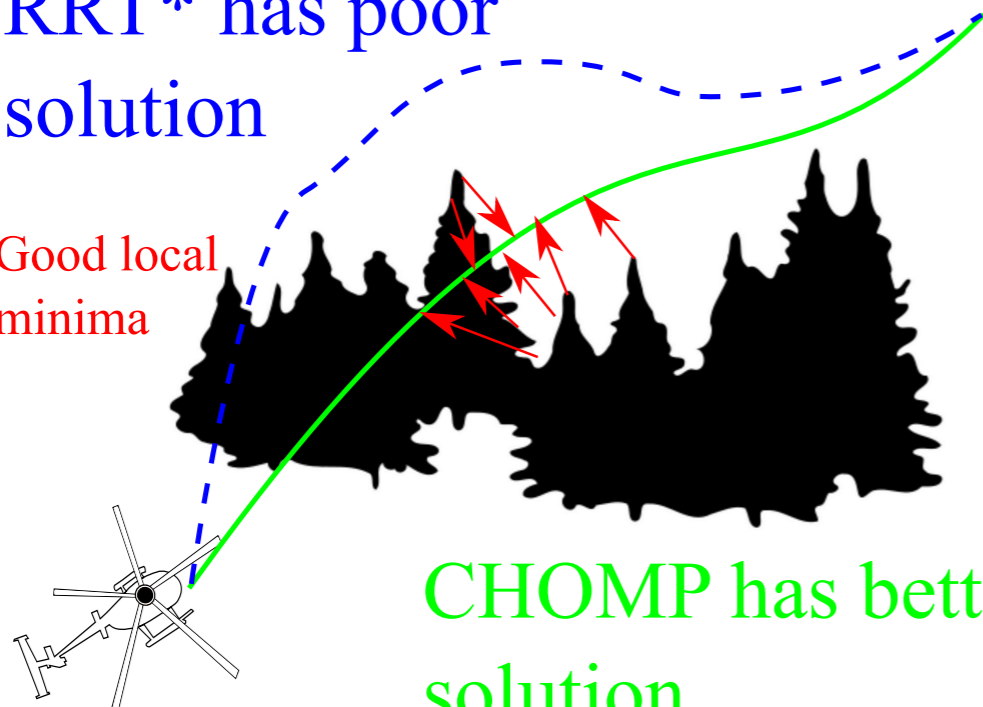
Trees, Towers



Mountains, Canyons

RRT* has poor solution

Good local minima



CHOMP has better solution

There is no “best” planner - performance depends on environment



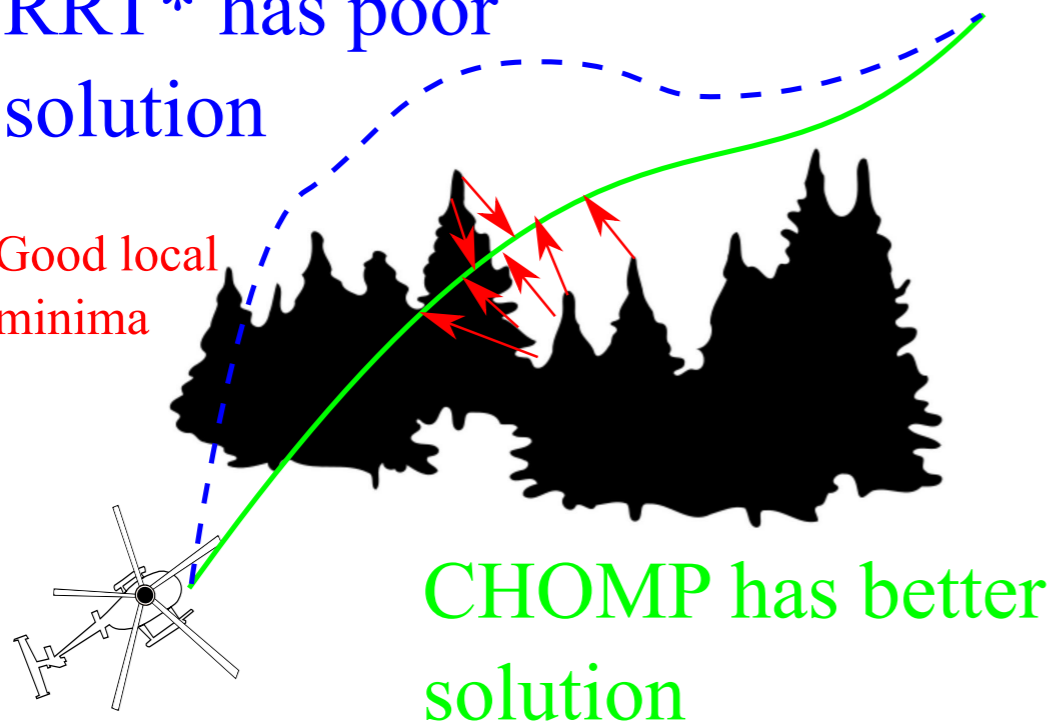
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RRT* has poor solution

Good local minima

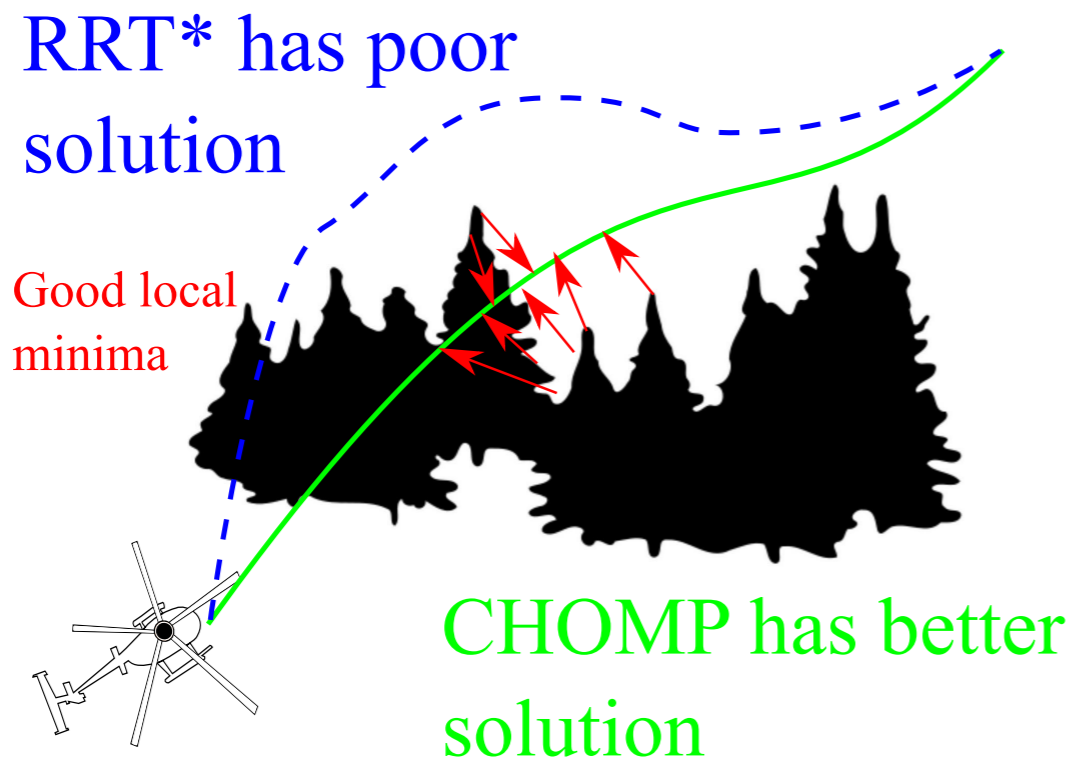


CHOMP has better solution

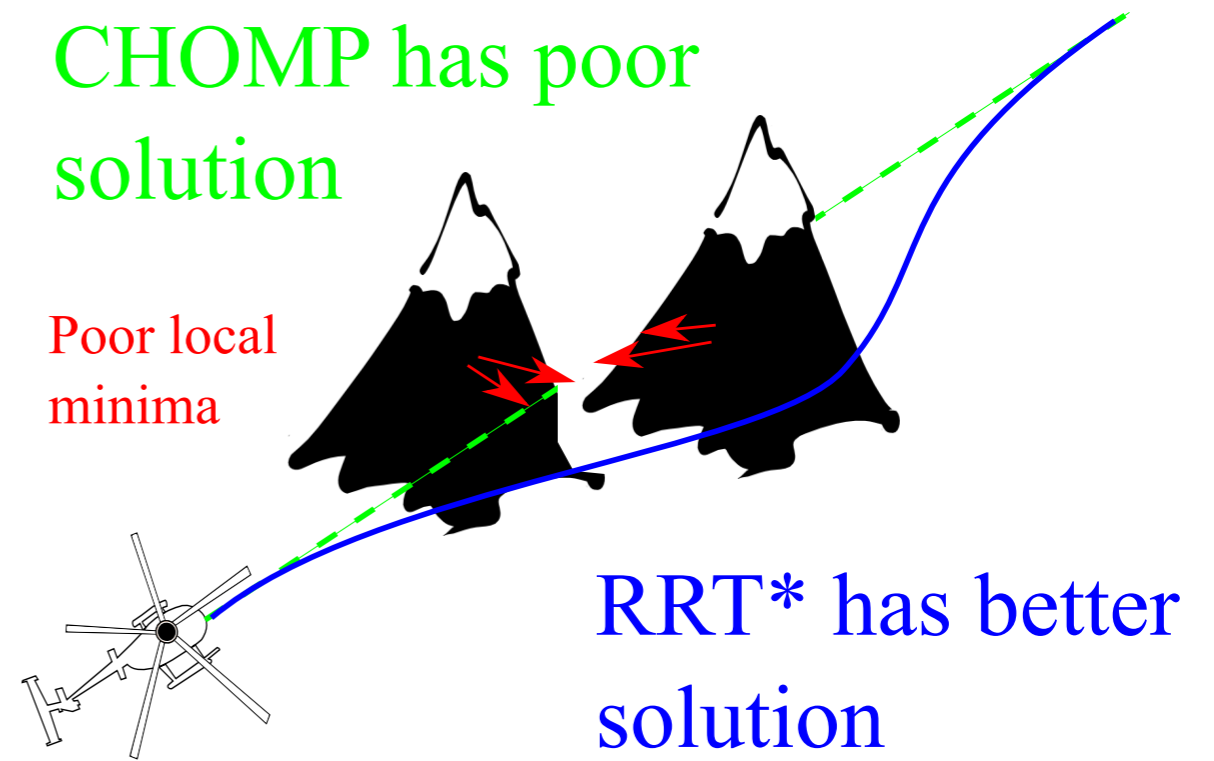
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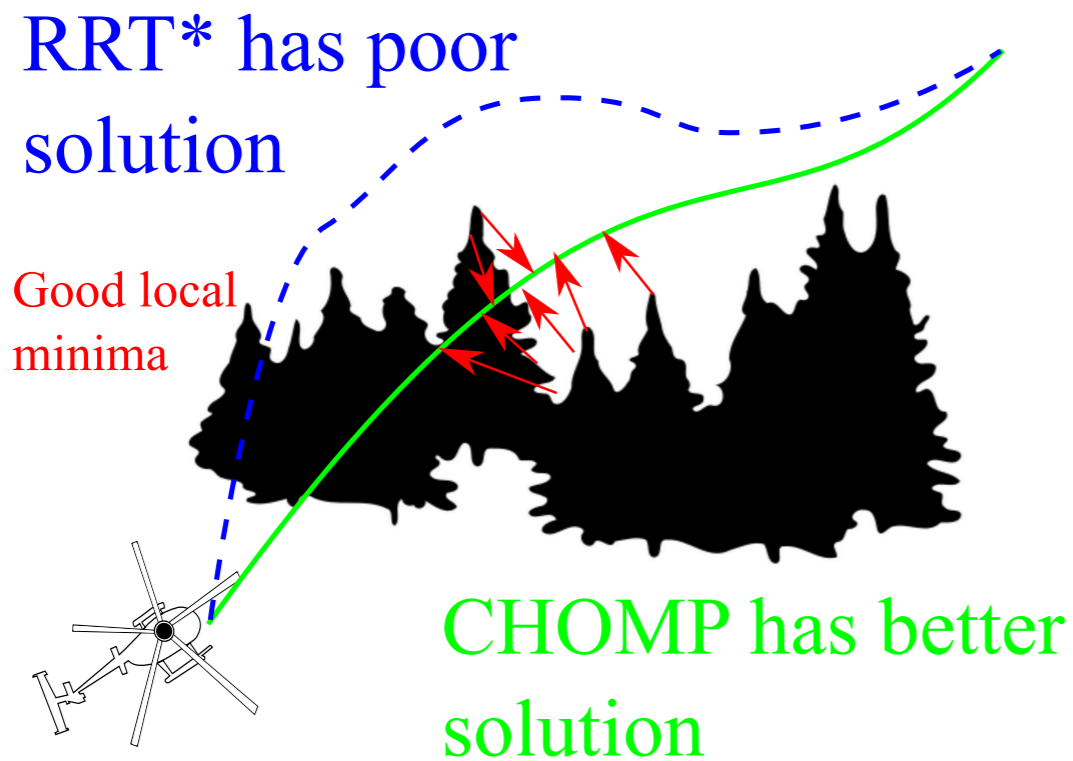
Mountains, Canyons



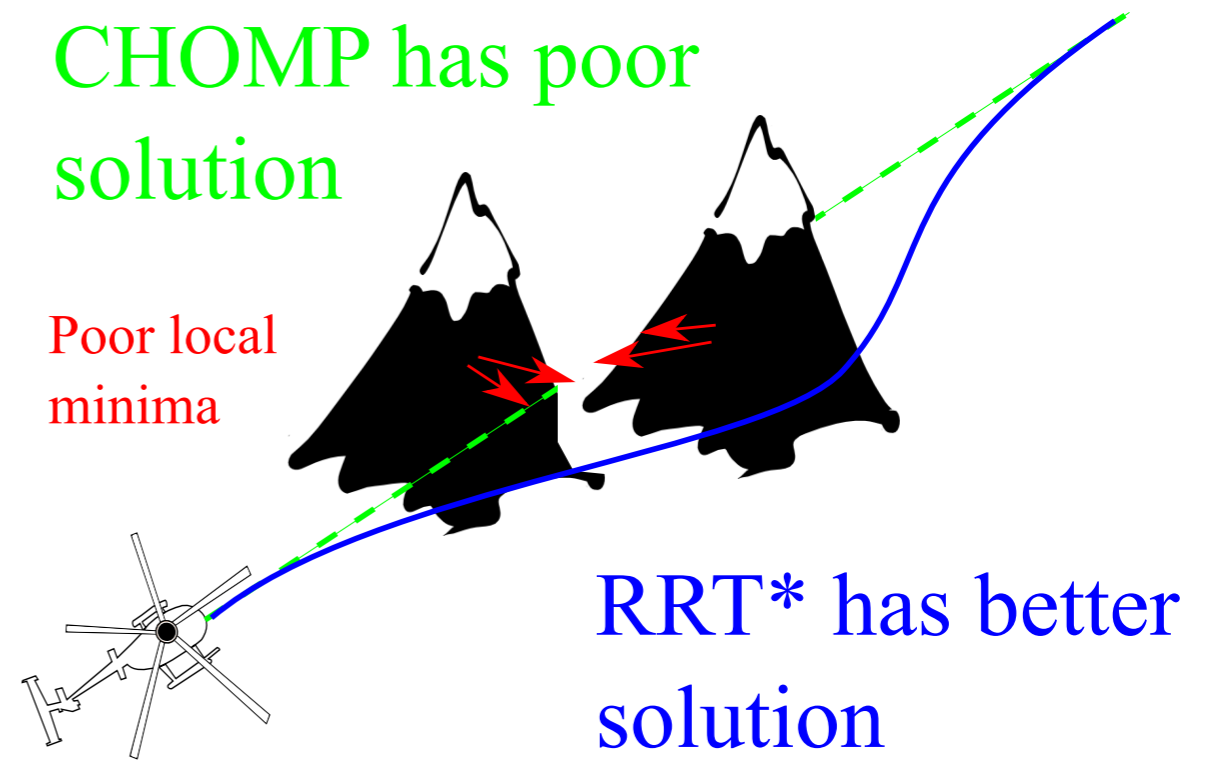
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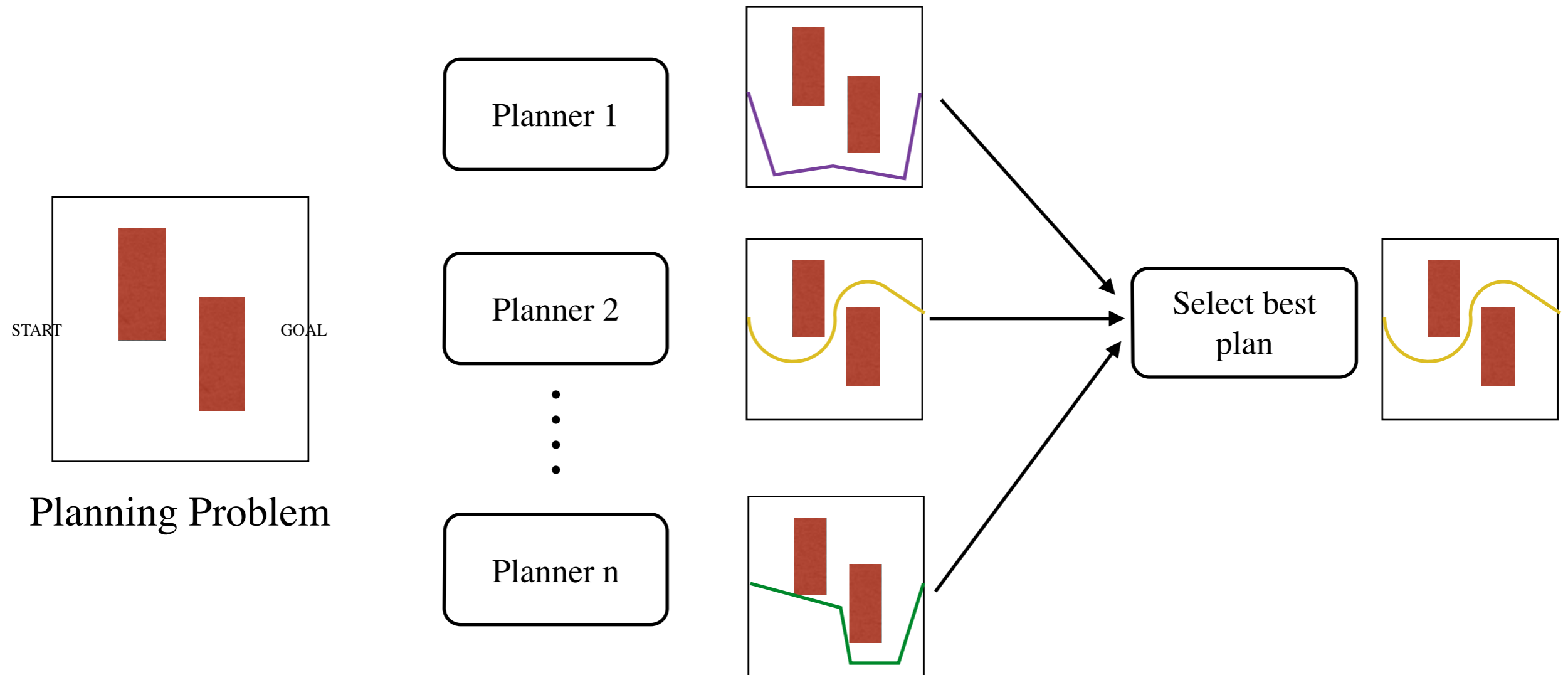
Trees, Towers



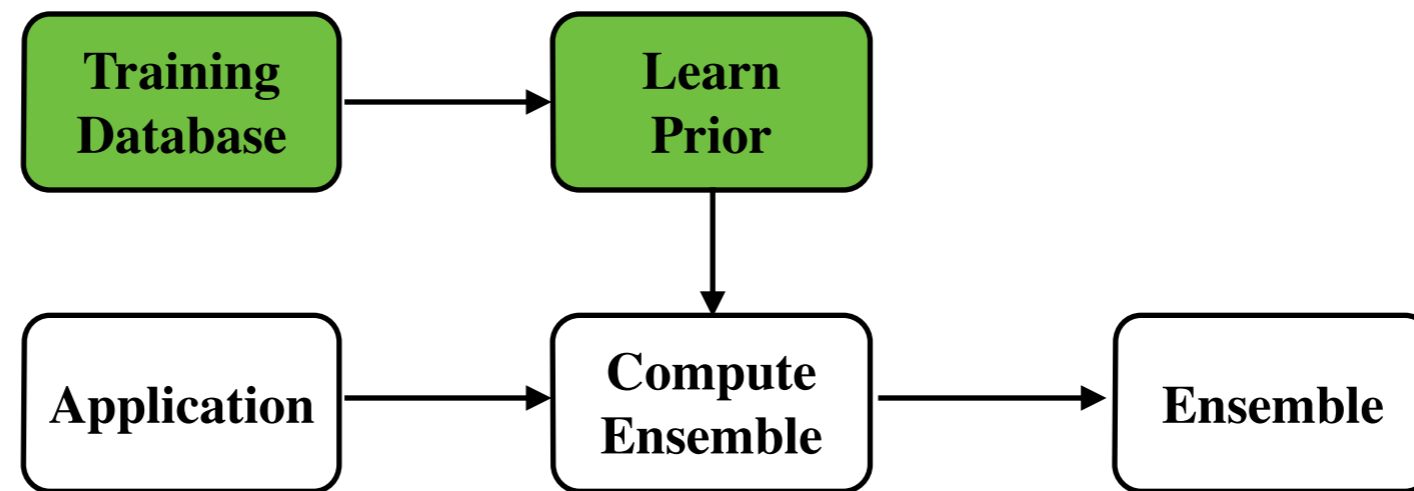
Mountains, Canyons



Planner Ensemble is a set of **complimentary** planners

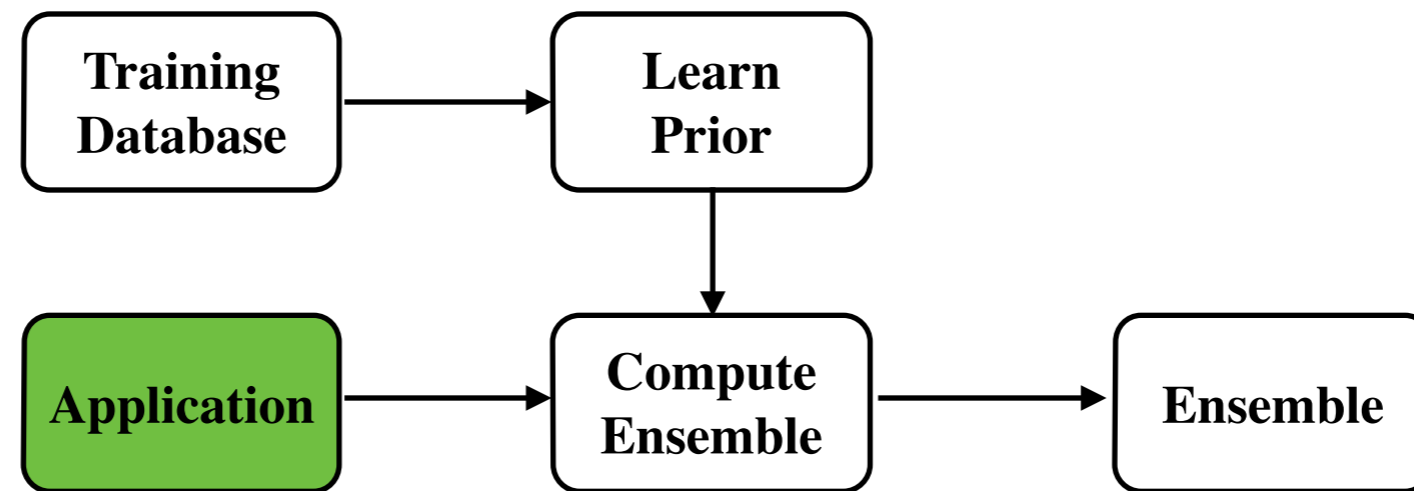


How to learn an **optimal** ensemble?



Learn planner performance given **features** about the environment

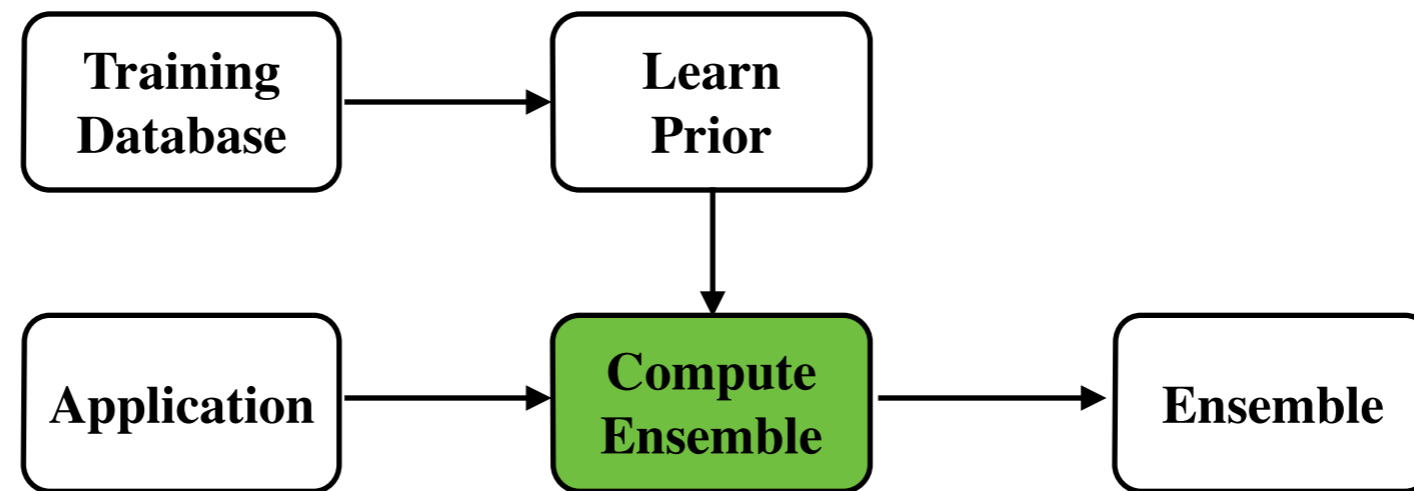
How to learn an **optimal** ensemble?



Collect features from an **application**, e.g, City



How to learn an **optimal** ensemble?



Greedily select the planner with the highest **marginal gain**, **evaluate** it and **add** if it is still the best

Planner	Marginal Gain	Ensemble
CHOMP	0.30	
RRT*	0.50	
Informed RRT*	0.80	
A*	0.70	

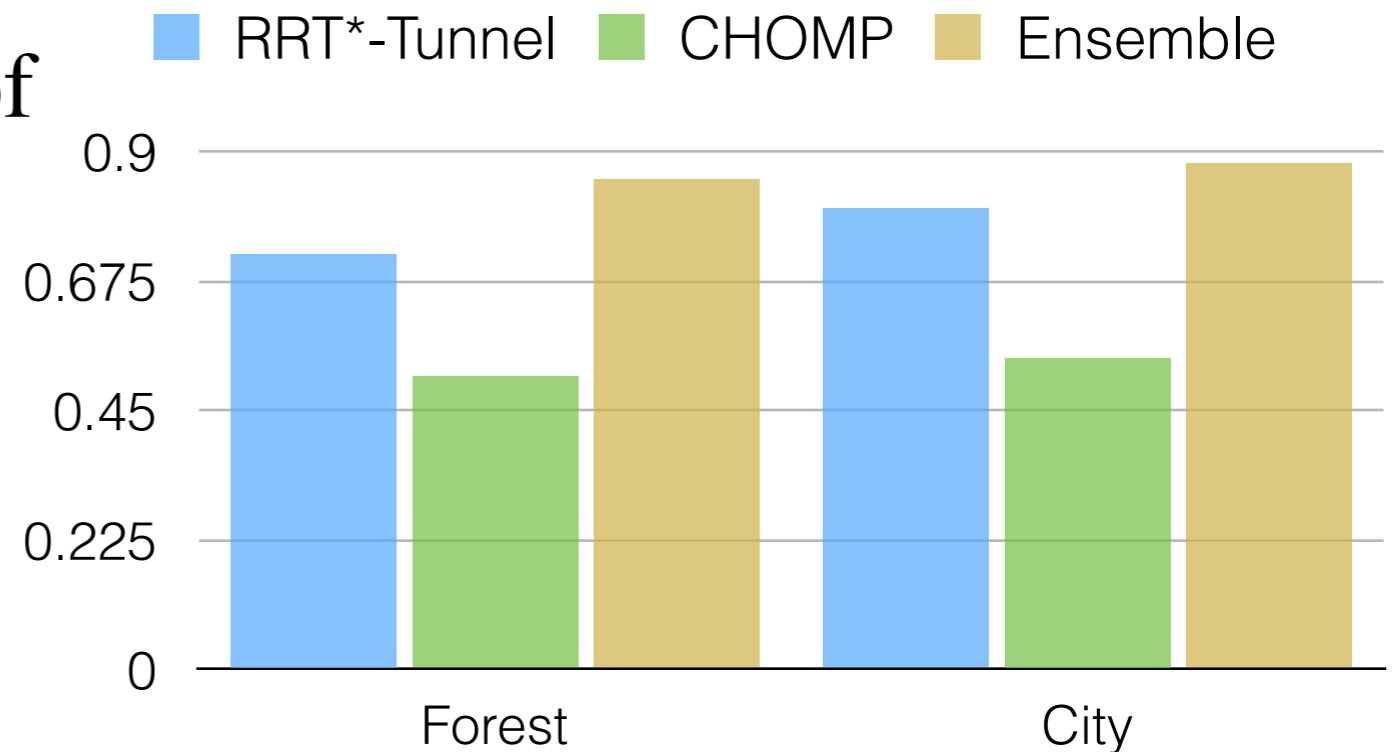
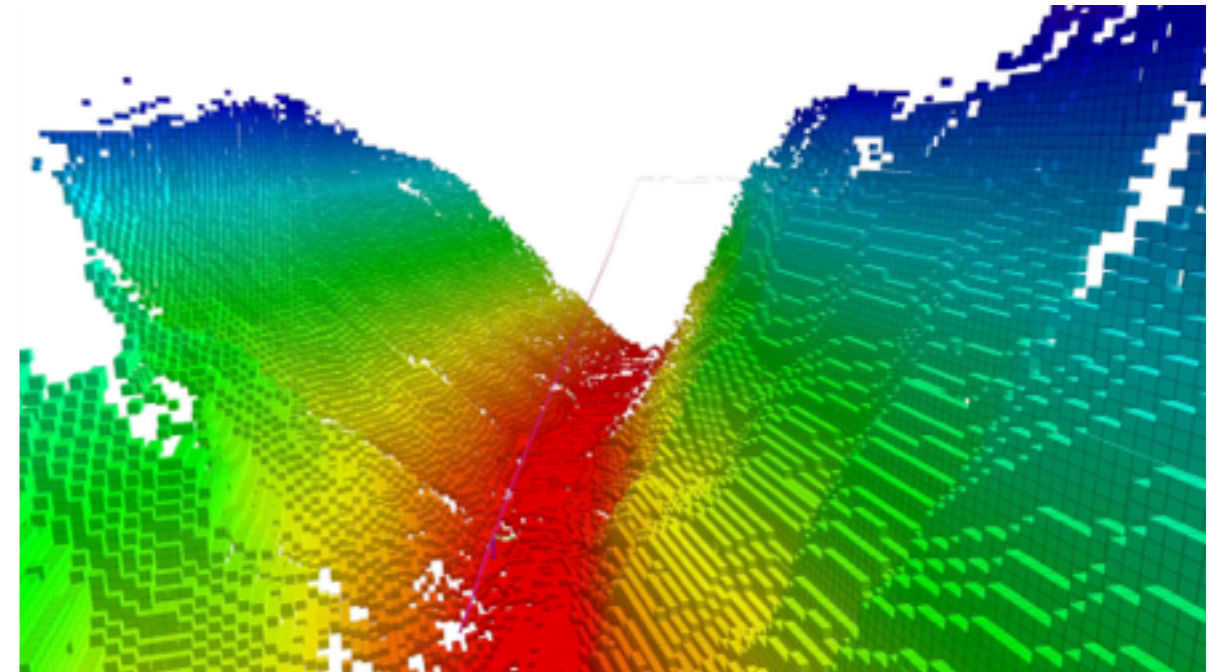
Planner	Marginal Gain	Ensemble
CHOMP	0.15	Informed RRT*
RRT*	0.02	
Informed RRT*	0.00	
A*	0.05	

Planner	Marginal Gain	Ensemble
CHOMP	0.00	Informed RRT*
RRT*	0.01	CHOMP
Informed RRT*	0.00	
A*	0.04	

Planner Ensemble significantly increases planning success

Results from a **full scale helicopter** operating in mountains, canyons and urban areas with speed of upto 50 m/s

Simulation results provide insight into interdependencies of planner and environment



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