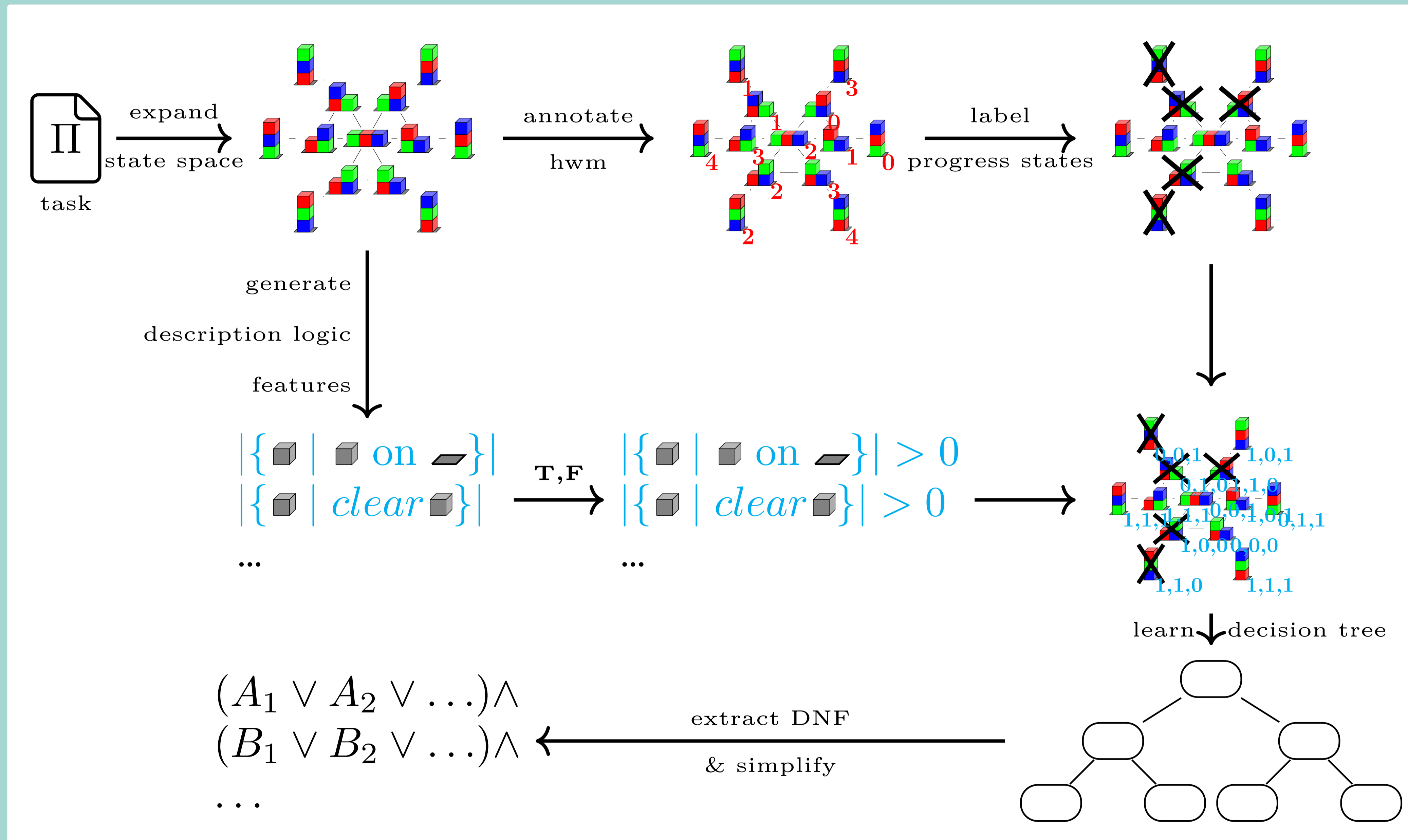
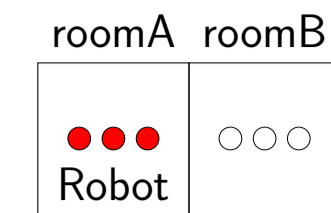


# Generalized search space knowledge can be learned, described compactly, and improves search!



## Handcrafted Progress State Formula for $h^+$



$$(|at_s(\cdot, roomA)| = 0) \vee$$

$$((|at\_robby_s(roomA)| > 0) \wedge (|free_s(\cdot)| > 0)) \vee$$

$$((|at\_robby_s(roomB)| > 0) \wedge (|carry_s(\cdot)| > 0))$$

## Generated Description Logic Features

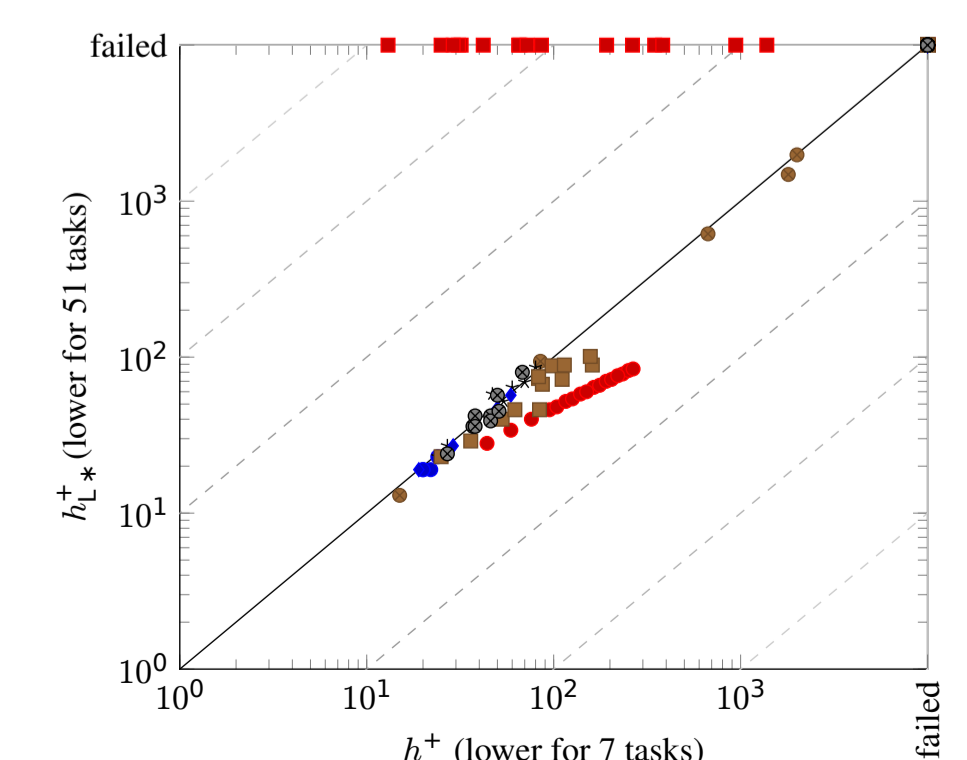
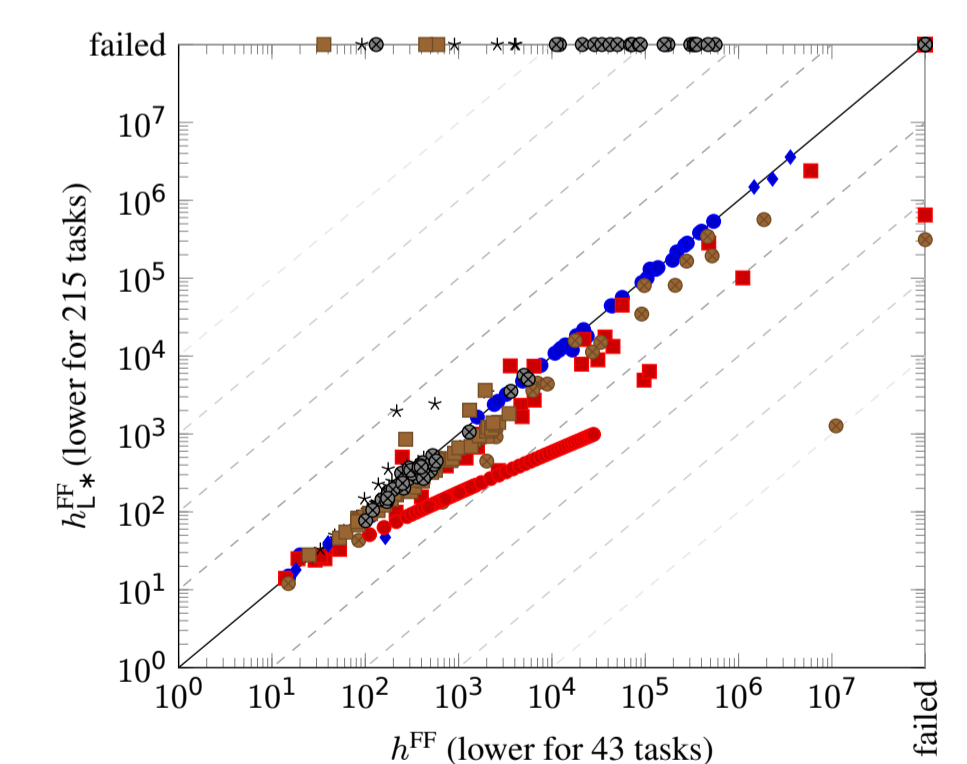
Domain	Max. Complexity					# Features	
	1.	2.	3.	4.	5.	Min	Max
BARMAN	7	6	6	6	6	1218	2455
BLOCKSWORLD	10	10	10	10	10	15332	16611
CHILDSNACK	8	8	7	7	7	444	532
DRIVERLOG	9	8	8	7	7	892	1313
FLOORTILE	8	8	7	7	7	1644	3441
GRIPPER	12	12	9	9	9	422	1656
MICONIC	8	8	7	7	7	332	494
VISITALL	12	12	11	11	11	1692	2118

## Validation F1 score for $h^{FF}$

Domain	1	2	3	4	5
BARMAN	79	80	<b>81</b>	79	77
BLOCKSWORLD	<b>83</b>	-	-	-	-
CHILDSNACK	70	65	73	<b>81</b>	72
DRIVERLOG	81	81	<b>89</b>	85	85
FLOORTILE	75	85	85	85	<b>88</b>
GRIPPER	96	96	96	<b>98</b>	98
MICONIC	98	98	97	98	<b>99</b>
VISITALL	70	70	<b>73</b>	73	73

## Expansions with Formulas for Tie-Breaking

Domain	$h^+$	$h^+_{Handcrafted}$	$h^+_{Learned}$
GRIPPER (17)	137.68	57.03	57.03
MICONIC (14)	82.17	51.07	53.15



## Learning and Exploiting Progress States in Greedy Best-First Search

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