

TABLE III: Several example failures from the FAILURES4DEEPNAV catalogue. Each row represents a different failure that a trained model exhibited under deployment and the various metrics that characterize that failure.

	Model	Failure Characterization			
		Distance	Failure Type	Notable Characteristics	Significant Trace Values
1	M1	< 1/2 lap	Crash to obstacles	Starts from stable point 1. The robot performs left turn from the center of the path towards the wooden wall of the hallway. The robot then attempts to make a right turn to avoid the wall, but the correction comes too late.	angular_speed_z:{-0.237353384, -0.192075387, -0.786723077, -0.586144865, -0.522732854, -0.457421124, -0.581465662}
2	M1	<1 lap	Crash to obstacles	Starts from stable point 1. Crashes onto the glass wall of the conference room (left side)	angular_speed_z:{0.589778557, 0.97018379, 1.236114621, -0.046197832, -0.192197487, 0.998846054}
3	M1	<1 lap	Wrong path & crash	Starts from stable point 2. The robot twirls in the hallway after initially steering away with a left turn to avoid colliding with the wall. Eventually the robot crashes onto the glass wall of the conference room (left side)	angular_speed_z:{-0.181797162, 0.04306177, -0.243719146, 0.909314275, -0.019864216, -0.133465558}
4	M1	3/4 lap	Wrong path & crash	Starts from stable point 2. The robot performs left turn from the center of the path and directs itself to the wrong path heading to the elevator. The robot eventually crashes onto the corner of the wall.	angular_speed_z:{-0.42008999, 0.730430663, -0.13285847, -0.712219715, -0.13285847, -0.654026151}
5	M1	<1 lap	Crash to obstacles	Starts from stable point 3. Crashes onto the glass wall of the conference room (left side)	angular_speed_z:{0.6774141043424606, 0.29949677735567093, 0.12250994145870209, -0.184344009, -0.080569968, 0.036568187, 0.11153104528784752, -0.180635795, -0.165302634, -0.207284957, -0.041703619, -0.232473478, 0.37048924, -0.299781024, -0.318579018}
6	M1	3/4 lap	Wrong path & crash	Starting from stable point 3, the robot initiates a left turn in response to the wooden hallway wall ahead but continued turning left, veering off course and heading in the reverse direction. It eventually manages to turn around and return to the correct path near the previous corner. The robot ultimately collides with the wall of the kitchen lounge.	angular_speed_z:{-0.113903947, 0.378477395, -0.365711868, 0.159630969, 1.322974563, 2.00579989, 1.531323552, 1.584070265, 0.688783765, 1.055322737, 1.10551554}
7	M1	<1 lap	Wrong path & crash	Starts from stable point 4. The robot makes a right turn at the corner when it encounters the blue-tiled wall, steering itself onto the wrong path. It eventually collides with a table leg.	angular_speed_z:{0.587493852, 0.129622422, -0.046677586, -0.374339253, 0.628374696, -0.474604875, -0.446006387, -0.011029735, 0.163459774, -0.196762308}
8	M1	<1 lap	Wrong path & crash	Starts from stable point 4. The robot executes a turnabout in the hallway near the aisle leading to the elevator. The robot deviates from its path and frequently over-corrects, resulting in a zigzagging motion, and eventually crashes onto the wooden wall of the hallway (left side) after a left turn.	angular_speed_z:{2.375847816, 1.040704697, -0.337195665, -0.432127059, -0.22254692, -0.685242057, 0.104688529, 0.88930285, 0.028559754, -0.793562114, -0.571596324, -0.764114916, -0.632970989, -0.81813103}
9	M1	<1 lap	Crash to obstacles	Starts from stable point 5. The robot performs a left turn to the direction of the entrance of the elevator aisle and continues to steer left without entering the aisle, but ends up hitting the corner	angular_speed_z:{1.974759758, 3.000718832, -0.932445526, -0.932445526, -0.43249917, 0.33595252, -0.10882239, 0.435534194,

TABLE IV: Several example failures from the FAILURES4DEEPNAV catalogue. Each row represents a different failure that a trained model exhibited under deployment and the various metrics that characterize that failure.

	Model	Failure Characterization			Significant Trace Values
		Distance	Failure Type	Notable Characteristics	
Failure 1	M2	<1 lap	Constant Steering Output	The model produces a constant angular_speed_z output	angular_speed_z always equals 3.520420887070941e-05
Failure 1	M5	<1 lap	Constant Steering Output	The model produces a constant angular_speed_z output	angular_speed_z always equals 4.502280148699356e-06

TABLE V: Several example failures from the FAILURES4DEEPNAV catalogue. Each row represents a different failure that a trained model exhibited under deployment and the various metrics that characterize that failure.

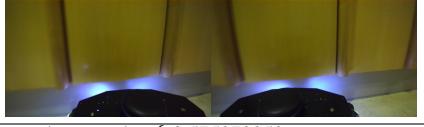
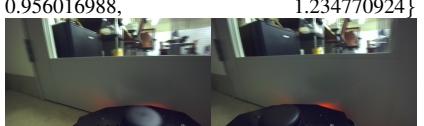
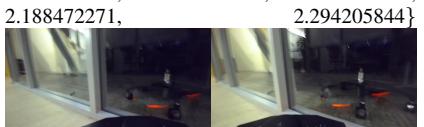
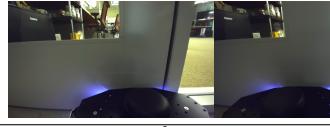
	Model	Notable Characteristics			
		Distance	Failure Type		
Failure 1	M3	<1 lap	Crash to obstacles	Starts from stable point 1. The robot performs a sharp left turn from the center of the path and crashes onto the left side of the hallway wooden wall.	angular_speed_z:{-0.122300379, 2.212948501, 2.212948501, -0.652125061, -0.652125061, -0.739412248, 0.739412248, -0.862496138, -1.15740633} 
Failure 2	M3	<1 lap	Crash to obstacles	Starts from stable point 1. The robot makes a sharp left turn from the center of the path and tries to execute a right turn when the wooden wall on the left side hallway is close. However, it reacts too late and still crashes into the wall.	angular_speed_z:{-0.575972259, 0.744597375, -0.795975745, 0.740892828, 0.313312836, 0.915080011, -0.912718117, -1.097150803} 
Failure 3	M3	<1 lap	Twirl & Crash	Starts from stable point 2. The robot makes a sharp left turn from the center of the path and successfully executes a right turn, moving away from the glassy door with a metal frame on the left side of the hallway. After a short distance, it begins to twirl for about five rounds in the center of the hallway. It then moves forward briefly before making another sharp left turn from the center of the path and crashing into the left-side wall.	angular_speed_z:{-1.132802844, 1.143349886, -1.143349886, -1.113196731, -0.995750129, -0.995750129, 0.88667953, -0.88667953, -0.769093573} 
Failure 4	M3	<1 lap	Twirl & Crash	Starts from stable point 2. The robot makes a sharp left turn from the center of the path and attempts a right turn to move away from the glassy door with a metal frame on the left side of the hallway. However, it soon starts turning sharply left again after the right turn, causing it to twirl in front of the door. Eventually, it crashes into the left-side wall during one of the left turns in the twirl.	angular_speed_z:{-0.360249877, 0.647906095, 0.910706878, 0.787072957, 0.956016988, 1.234770924} 
Failure 5	M3	<1 lap	Twirl & Crash	Starts from stable point 3. The robot makes a left turn from the center of the path and successfully performs a right turn to move away from the left side wooden hallway wall. However, it soon starts turning sharply left again after the right turn, causing it to twirl in center of the hallway. After a left turn, the robot crashes into the wall regardless the late attempt to execute a right turn when the wooden wall on the left side hallway is close.	angular_speed_z:{1.000253767, 2.207070351, 1.014859468, 1.81516993, 1.571308136, 1.649547637, -0.694380581, -0.811773419, -1.05962944, -1.241372824, -1.075560331} 
Failure 6	M3	<1 lap	Crash to obstacles	Starts from stable point 3. The robot performs a sharp left turn from the center of the path and crashes onto the left side of the hallway wooden wall.	angular_speed_z:{2.214259565, 1.995642185, 1.698541939, 1.362513721, 2.985446155, 2.101010263, -0.661450326, -0.7287907, -0.759216845, 0.442936465, -0.422392398, 0.195703849, -0.755064189, -0.841157377, -0.872636735, -0.886302352, -1.003563166} 
Failure 7	M3	<1 lap	Twirl & Crash	Starts from stable point 4. The robot makes a sharp left turn from the center of the path, causing it to twirl in approximately 4 rounds before the robot crashes into the left-side glass wall during one of the left turns in the twirl.	angular_speed_z:{-0.637992561, 0.225244612, 0.791246295, 1.085612744, -0.739274085, -0.072614647, 0.315429866, 2.399511158, 1.639117062, 2.188472271, 2.294205844} 

TABLE VI: Several example failures from the FAILURES4DEEPNAV catalogue. Each row represents a different failure that a trained model exhibited under deployment and the various metrics that characterize that failure.

	Model	Failure Characterization			Significant Trace Values
		Distance	Failure Type	Notable Characteristics	
Failure 1	M4	<1 lap	Crash to left wall; turning	Starts from stable point 1. The robot makes a sharp left turn to correct its position after a previous right turn but crashes into the left side of the hallway wall when it attempts to steer right again with the wall very close.	angular_speed_z:{-0.751716554, 0.751716554, -0.751716554, 0.680034101, -0.680034101, 0.1450.145155005, 0.924210548, 0.9240.185124077, 0.185124077, -0.271342874, -0.271342874, -0.271342874}
Failure 2	M4	<1 lap	Crash to left wall corner; straight	Starts from stable point 1. The robot makes a sharp left turn to correct its position after a previous slight right turn and crashes into the corner of the left side hallway wall.	angular_speed_z:{0.025411712, 0.0250.025411712, -0.286374211, -0.286370.454366118, -0.454366118, -0.078650.078652486, -0.038621876, -0.038620.038621876, -0.188553542, -0.188553542}
Failure 3	M4	<1 lap	Crash to right wall; straight	Starts from stable point 2. The robot makes a sharp left turn at start from the center of the path and successfully executes a right turn, moving away from the glassy door with a metal frame on the left side of the hallway. However, the robot continues steering to right, moves towards the right side of the hallway, and ends up hitting onto the wooden door on the right side wall.	angular_speed_z:{-0.13689521, 0.13689521, -0.13689521, 0.150.15185266, 1.251958966, 1.2512.251958966, 1.12803492, 1.120.706308246, 0.706308246}
Failure 4	M4	<1 lap	Crash to wall in robot's left side in reverse; turning	Starts from stable point 2. The robot makes a sharp left turn during its zigzag behavior and turns around as it steers left and proceeds in the reverse direction. After traveling a short distance, the robot attempts to steer left but crashes into the white-painted wall on its left side, despite its late efforts to turn further left to avoid the collision, as it is too close to the wall.	angular_speed_z:{angular_speed_z:{-0.473147973, -0.155956715, -0.155956715, 1.395568907, 1.3951.400421292, 1.400421292, 0.9110.911298394, 1.938842475, 1.9381.44954899, 1.44954899, 1.3602}
Failure 5	M4	<1 lap	Crash to left wall; turning	Starts from stable point 3. The robot makes a sharp left turn to correct its position after a previous right turn but crashes into the left side of the hallway wooden wall when it attempts to steer right again with the wall very close.	angular_speed_z:{0.214639574, 0.214639574, 0.8150.584518924, 0.584518924, 0.8980.898419499, 1.558785439, 1.5580.847302228, 0.847302228, -0.029564941, -0.029564941, 0.4710.471517503, -0.499933749, -0.499-0.638418436, -0.638418436, 0.548292696, -0.548292696, -0.548292696}
Failure 6	M4	<1 lap	Crash to door corner in robot's left side while in reverse; turning	Starts from stable point 3. The robot makes a sharp left turn to correct its position after a previous right turn, but it successfully steers right when the wall is close, avoiding a collision with the left side of the hallway's wooden wall. However, as the robot continues steering right and approaches the right side of the hallway's white-painted wall, it performs a sharp left turn, turns around, and proceeds in reverse. After traveling a short distance, the robot turns left to correct itself from the earlier right turn. It continues steering left and drives forward into the open office room on its left, crashing into the corner of the open door.	angular_speed_z:{0.611086607, 0.611086607, 0.1970.197135389, 1.290431678, 1.2900.268010147, 0.268010147, 0.2680.461435437, 0.461435437, -0.1854}
Failure 7	M4	<1 lap	Crash to wall corner in robot's right side while moving in reverse; turning	Starts from stable point 4. The robot makes a sharp left turn at start from the center of the path, but it successfully steers right when the left side wall is close. After a short distance, the robot oversteers at the corner turn to the left, causing it to travel backward in the reverse direction and collide with the corner of the	angular_speed_z:{-0.126087636, 0.126087636, 0.5660.061715003, 0.061715003, 0.061-0.029422373, -0.029422373, 0.289498374, 0.289498374, 0.4137}

TABLE VII: Several example failures from the FAILURES4DEEPNAV catalogue. Each row represents a different failure that a trained model exhibited under deployment and the various metrics that characterize that failure.

	Model	Failure Characterization			Significant Trace Values	
		Distance	Failure Type	Notable Characteristics		
Failure 1	M6	<1 lap	Crash to right wall in reverse; turning	Starts from stable point 1. The robot initially steers to the right, but as it nears the wall, it makes a sharp left turn to avoid crashing. It keeps steering left and turns around, and as it approaches the wall again, it repeats the left-turn maneuver to avoid a collision, causing the robot to twirl while moving in the reverse direction. During one of these twirls, the robot eventually hits the wooden door on the right side of the hallway.	angular_speed_z:{0.447348431, 0.4 0.447348431, 0.047186868, 0.0 0.047186868, -0.026201781, -0.0 -0.026201781, -0.436163306, -0.4 -0.436163306, -0.436163306 0.183235362, -0.183235362, -0.1 2.431949794, 2.431949794, 2.43}	
Failure 2	M6	<1 lap	Crash to left wall; turning	Starts from stable point 1. The robot makes a sharp left turn to avoid a collision with the right side of the hallway wall after a previous sharp right turn but crashes into the corner of the left side of the hallway wall. The robot then moves forward to the left, heading toward the entrance of the elevator aisle. At the entrance, the robot makes a left turn and crashes into the metal bottom frame of the left wooden wall.	angular_speed_z:{-0.381277114, 0.4 0.466371015, 0.466371015, 0.4 0.432207584, 0.432207584, 0.6 0.610161871, 0.610161871, 0.6 0.772369087, 0.772369087, 0.77}	
Failure 3	M6	<1 lap	Crash to left wall; straight	Starts from stable point 2. The robot makes a sharp left turn at start from the center of the path and straightly crash onto the glassy door with a metal frame on the left side of the hallway.	angular_speed_z:{0.322095729, 0.3 0.322095729, 0.704939872, 0.7 0.704939872, -0.055271171, -0.0 -0.055271171, -0.113742143, -0.1 -0.113742143, -0.113742143, 0. 0.29955136, 0.29955136, 0.4 0.478679091, 0.478679091, 0.47}	
Failure 4	M6	<1 lap	Crash to left wall; straight	Starts from stable point 2. The robot makes a sharp left turn at start from the center of the path and straightly crash onto the glassy door with a metal frame on the left side of the hallway	angular_speed_z:{-0.327962279, -0.3 -0.327962279, 0.439045295, 0.4 0.439045295, 0.923244953, 0.9 0.923244953, 0.10804509, 0. 0.10804509, 0.10804509, 0.1 0.143868439, 0.143868439, 0.14}	
Failure 5	M6	<1 lap	Crash to left wall; turning	the robot makes a sharp left turn to correct its position after a previous right turn and moves forward to the left. As it gets close to the left wall, the robot steers left again until it turns back heading forward at an angle toward the right. When it approaches the right wall again, it repeats the left-turn maneuver to avoid a collision, moves forward to the left wall, and eventually crashes into the metal bottom frame of the left wooden wall.	angular_speed_z:{-0.087697655, 0.087697655, -0.087697655, -0.2 -0.283475935, -0.283475935, -0. -0.26971975, -0.26971975, 1.4 1.409726769, 1.409726769, -0.2 -0.251405001, -0.251405001, -0.25}	
Failure 6	M6	<1 lap	Crash to left wall; turning	Starts from stable point 3. The robot steers to the left while in the center of the path and then crashes into the metal bottom frame of the left wooden wall.	angular_speed_z:{1.424308062, 1.4 1.424308062, 1.10785532, 1. 1.10785532, 1.265731752, 1.2 1.265731752, -0.468167901, -0.4 -0.468167901, -0.468167901, -0.6 -0.618397236, -0.618397236, -0. -0.4375934, -0.4375934, -0.458236456, 0.458236456, -0.458236456, 0.2 0.269734159, 0.269734159, -0.3 -0.351654172, -0.351654172, 2.1}	
Failure 7	M6	<1 lap	Crash to left wall corner; turning	Starts from stable point 4. The robot makes a sharp left turn at start from the center of the path, but it continues to steer more to left and makes the robot turns back to the forward direction when the left side wall is close. After	angular_speed_z:{0.995048136, 0.9 0.995048136, 0.995048136, -0.3 -0.378765047, -0.378765047, -0. -0.18452166, -0.18452166, 0.1 0.199429728, 0.199429728, 0.1}	