

TABLE I
SENSORS AVAILABLE FROM A SIMULATED CAR OF THE RACING SIMULATOR TORCS [26].

| Name | Range/Units | Description |
|----------------------|--|--|
| α | $[-\pi, \pi]/\text{rad}$ | orientation of car relative to the current street orientation |
| distFromStart | $[0, \infty]/\text{m}$ | distance from start line to current position of car measured along race track |
| distRaced | $[0, \infty]/\text{m}$ | total distance traveled since beginning of race |
| t_{curLap} | $[0, \infty]/\text{s}$ | elapsed time on current lap |
| t_{lastLap} | $[0, \infty]$ | time elapsed for last lap |
| racePos | 1, 2, ... | current rank of car in race |
| damage | $[0, \infty]/\text{point}$ | total damage incurred to car |
| fuel | $[0, \infty]/\text{l}$ | fuel left in fuel tank |
| gear | $\{-1, 0, 1, \dots, 6\}$ | current gear position (-1: backwards, 0: neutral) |
| rpm | $[2000 - 7000]/\text{rpm}$ | rounds per minute of the motor |
| d_y | $[-1, 1]$ | displacement of car from center of track (normalized to 1) |
| v_x | $[-\infty, \infty]/\frac{\text{km}}{\text{m}}$ | velocity of car in track direction |
| v_y | $[-\infty, \infty]/\frac{\text{km}}{\text{m}}$ | velocity of car perpendicular to track direction |
| $v_{\text{wheel},i}$ | $[0, \infty]/\frac{\text{rad}}{\text{s}}$ | velocity of wheel $i \in \{1, 2, 3, 4\}$ |
| S_i | $[0, 100]/\text{m}$ | dist. to track boundary measured by 19 sensors $i \in \{0, \dots, 18\}$ as shown in Figure 2 |
| O_i | $[0, 100]/\text{m}$ | distance to opponents measured by 18 sensors $i \in \{1, \dots, 18\}$ |

TABLE II
ACTUATORS OF A SIMULATED CAR OF THE RACING SIMULATOR TORCS [26].

| Name | Range | Description |
|--------------|------------------|--|
| gas pedal | $[0, 1]$ | acceleration |
| brake pedal | $[0, 1]$ | brake (0: don't brake, 1: full brake) |
| steering | $[-1, 1]$ | orientation of steering wheel (-1: maximum left, 1: maximum right) |
| gear | -1, 0, 1, ..., 6 | shift into gear as specified |
| meta control | 0, 1 | meta control flag (0: do nothing, 1: restart race) |

TABLE III
SET OF TERMINAL SYMBOLS AND ELEMENTARY FUNCTIONS OF TREE 1 WHICH WAS USED TO STEER THE CAR.

| Name | Arguments | Description |
|--------|-----------|---|
| ERC1 | 0 | ephemeral random constant with range $[-1, 1]$ |
| ERC150 | 0 | ephemeral random constant with range $[-150, 150]$ |
| c_p | 0 | constant for hand-crafted proportional controller $c_p = -0.0234$ |
| LR0 | 0 | average difference between left and right track sensors $\frac{1}{2}(S_{15} + S_{14}) - \frac{1}{2}(S_3 + S_4)$ |
| abs | 1 | absolute value of argument |
| + | 2 | sum of both arguments |
| - | 2 | difference of both arguments |
| * | 2 | product of both arguments |
| / | 2 | protected division |

TABLE IV
SET OF TERMINAL SYMBOLS AND ELEMENTARY FUNCTIONS OF TREE 2 WHICH WAS USED TO OPERATE GAS AND BRAKES.

| Name | Arguments | Description |
|-------|-----------|---|
| ERC1 | 0 | ephemeral random constant with range $[-1, 1]$ |
| ERC50 | 0 | ephemeral random constant with range $[-150, 150]$ |
| c_1 | 0 | first constant (used by hand-crafted gas/brake controller) $c_1 = -0.022$ |
| c_2 | 0 | second constant (used by hand-crafted gas/brake controller) $c_2 = 100$ |
| LR1 | 0 | difference between left and right front facing track sensors $(S_8 - S_{10})$ |
| S_9 | 0 | front facing sensor |
| v_x | 0 | velocity of car |
| abs | 1 | absolute value of argument |
| + | 2 | sum of both arguments |
| - | 2 | difference of both arguments |
| * | 2 | product of both arguments |
| / | 2 | protected division |