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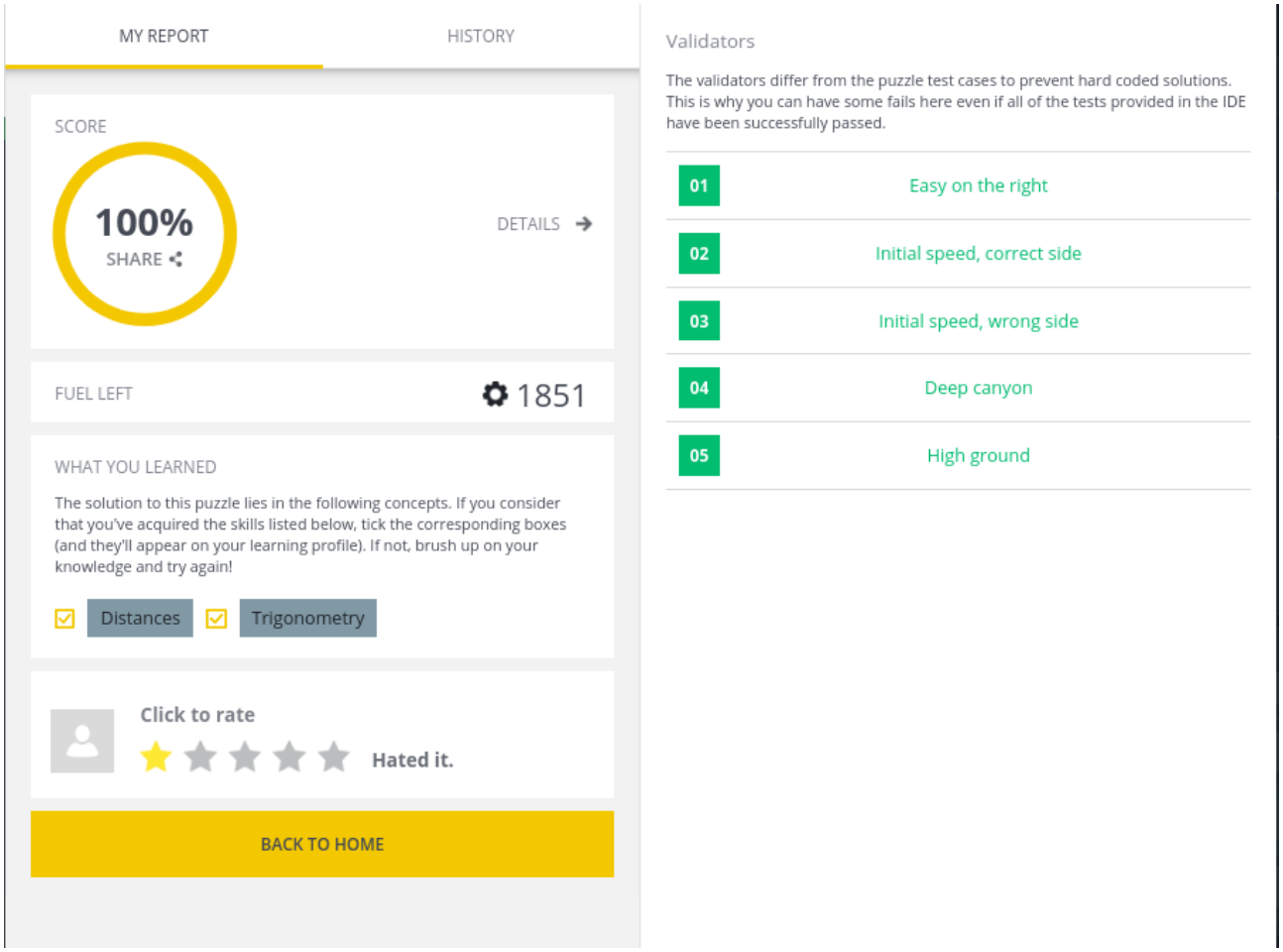
Mars Lander

Simulations for *Easy on the right* test: ~17600



Forward model details

- Action's description contains differences between previous and next thrust power and rotation so it's easier to make crossovers and mutations.

RHEA

The algorithm described below passed all tests.

- Population size: 50,
- Action sequence length: 20,
- New populations for computing each move: 20,

Creating new population

- 6 bests individuals proceed to next population.
- The rest is made up as follows:
    1. 2 parents are selected with roulette wheel.
    2. 2 children are created with 1-point crossover
    3. Every gene of each child can mutate with probability of 1/2L, where L – sequence length

Fitness function

I evaluated only last state of each sequence. There are several features of state that I use to calculate it's value:

- distance to landing zone – should be as small as possible
- vertical and horizontal speed – lander shouldn't fly too fast
- if landing zone is above lander's position, it should fly up.

For each feature I create part of evaluation function:

- For distance it's just `7000 – ds`, where ds – distance to landing zone in straight line (7000 because it's more than maximum possible distance and I want my function to be always >= 0)
- For speed I have 2 functions (1 for vertical speed, 1 for horizontal). They can be described as follows:
    - $f(v) = 1$ if $v <= v_{min}$
    - $f(v) = 0$ if $v >= v_{max}$
    - $f(v) = 1/(v_{min} - v_{max})$ if $v_{min} < v < v_{max}$
- For going up
    - if landing is below lander then f(state) = 1
    - else f(state) = 1 / distance_to_landing

Multiplying these 3 functions gives my fitness function.

Program variations

I tried different approaches for fitness function and evolution but they didn't give satisfying results.

I left some unused evaluation function in my code. I tried, for example

- Evaluate somehow lander rotation – it turned out to be unnecessary
- Calculate ground distance from crash point to landing zone – it was too slow

I also tried crossover from https://www.codingame.com/blog/genetic-algorithm-mars-lander/, and different values of population size, sequence length etc. It didn’t give better results.