

Projet <DCAS-14> Improving Human-Robot Interactions with Deep Reinforcement Learning

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Supervisors:

Caroline CHANEL

Nicolas DROUGARD

Context

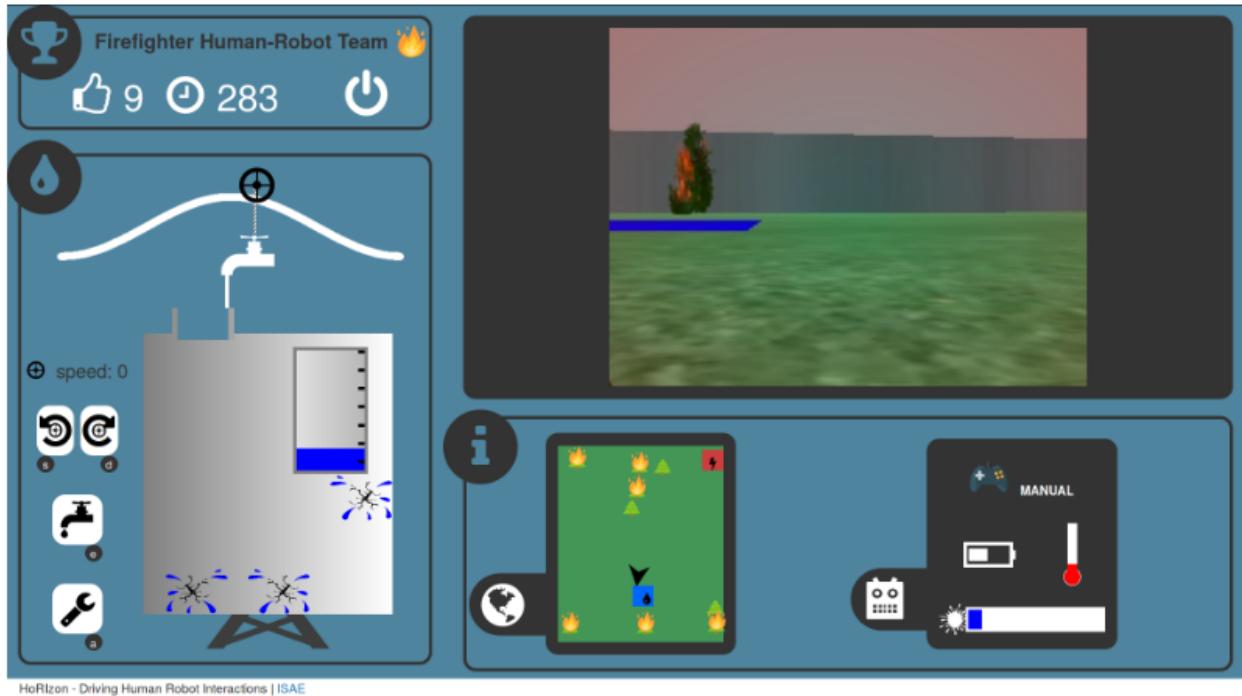
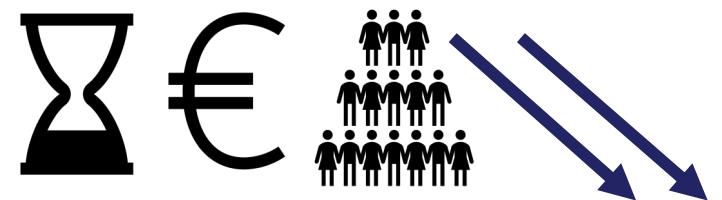
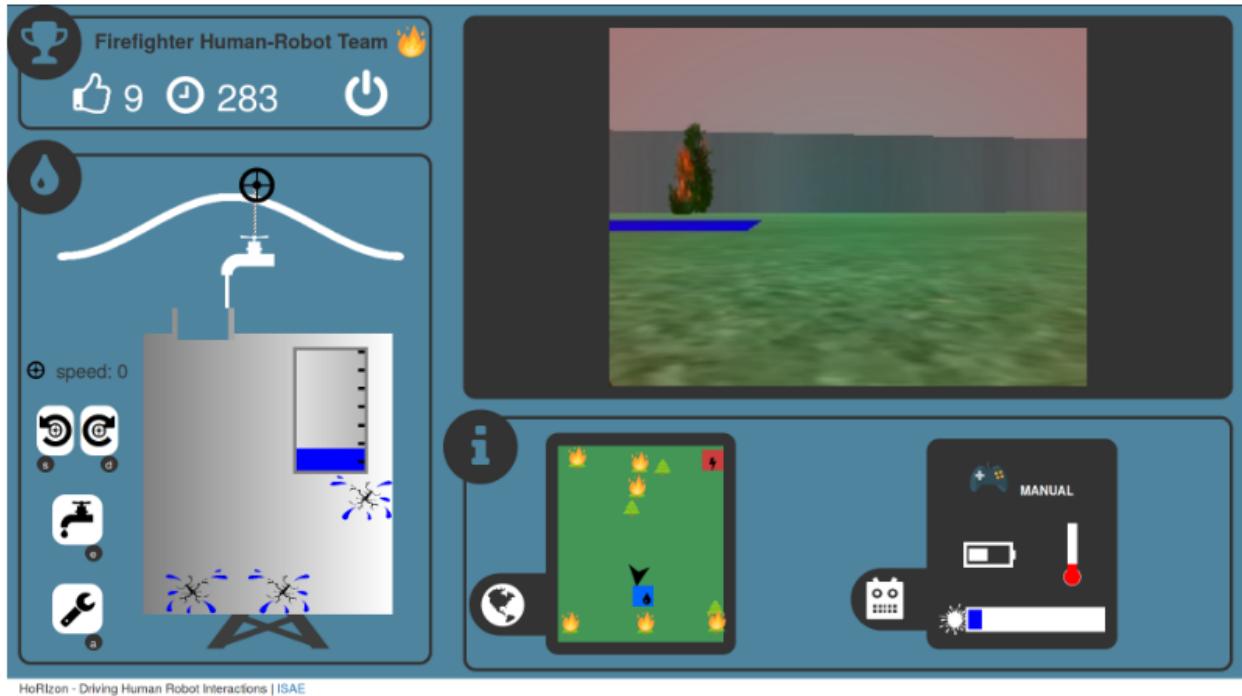


Figure 1 : Screenshot of the Firefighter Robot Game.

To pursue the study of the interaction of human and automated systems a huge amount of data is necessary



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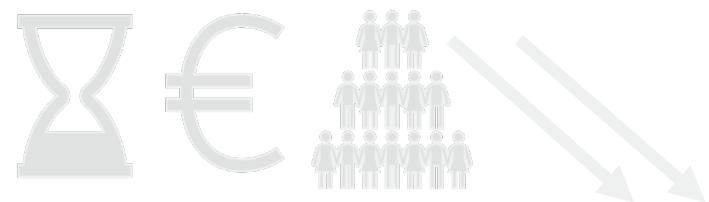


Figure 1 : Screenshot of the Firefighter Robot Game.

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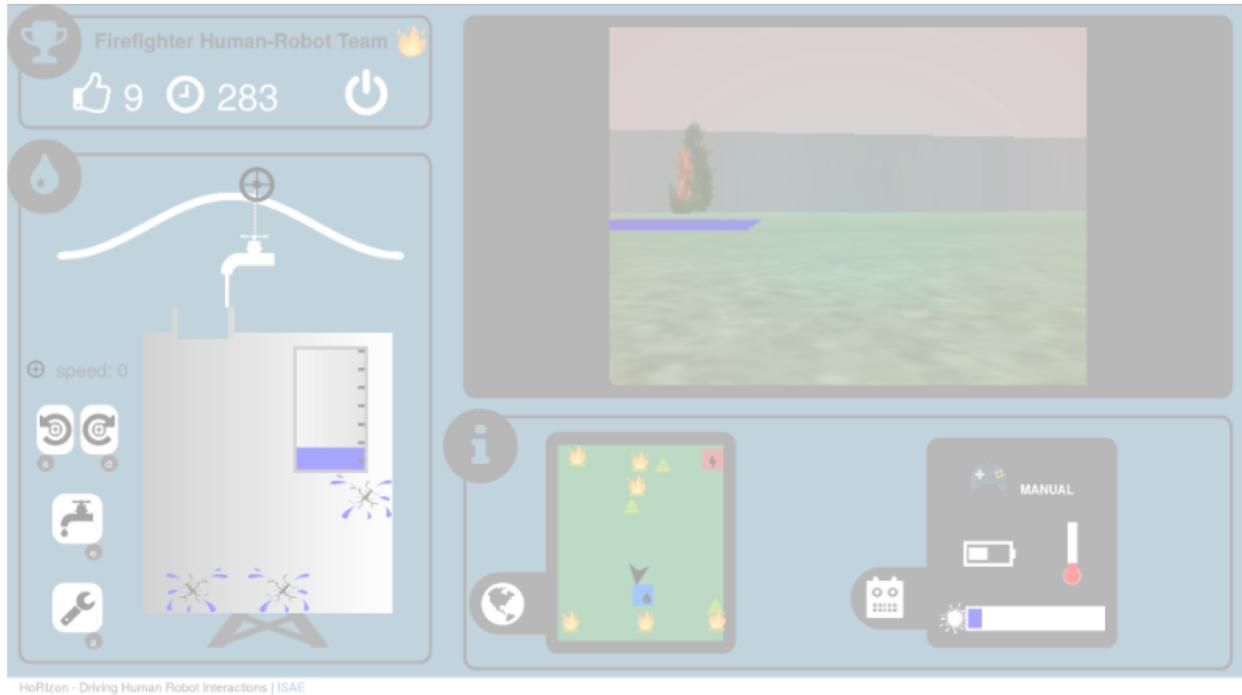
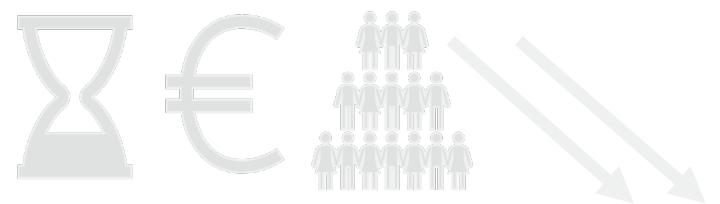


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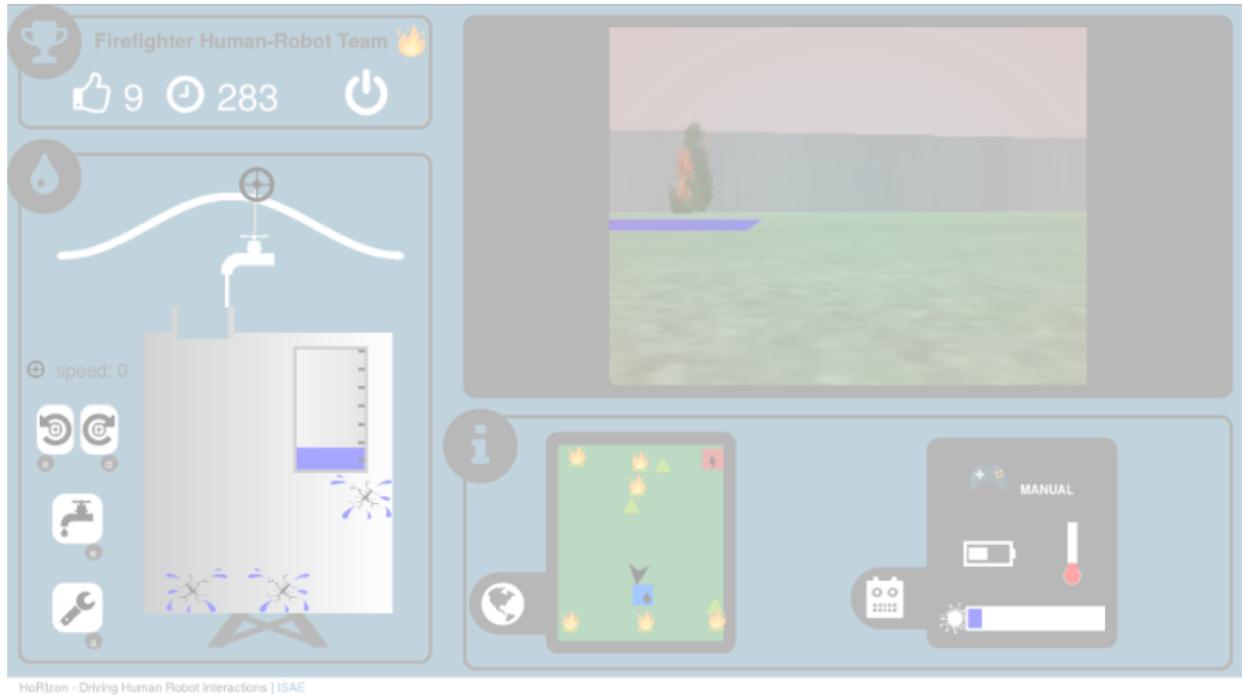
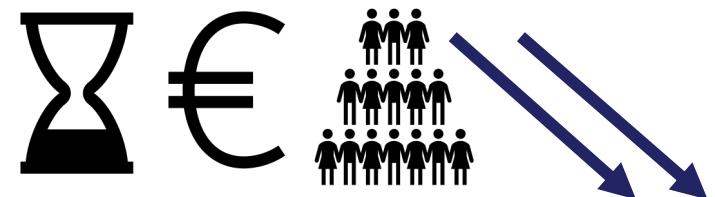


Figure 1 : Screenshot of the Firefighter Robot Game.

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Problem statement

Can recent deep learning algorithms be used to generate artificial results of simulations ?

Problem statement

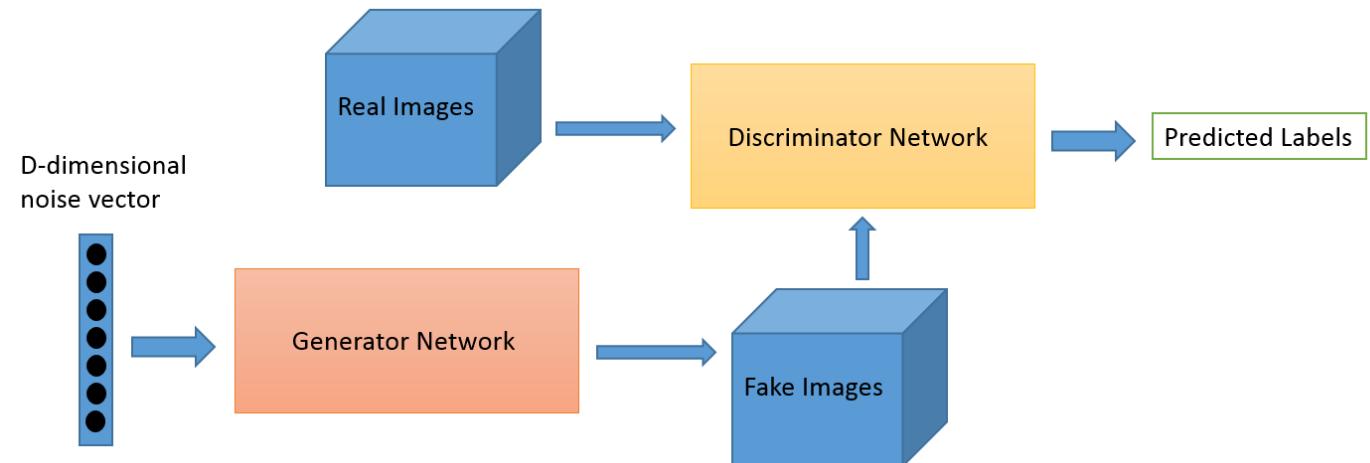
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597	0	-1	0.6691349	-0.00014	-7E-04	0	99	20	50	50	0	front-front-front-front-front-front	-1	-1
596	0	-1	2.5812879	-0.00288	-0.18	0	98	20	50	50	0	right-right-right-right-right-right-right	-1	-1
595	0	-1	2.5823526	-0.00318	-0.735	0	98	20	50	50	0	right-right-right-right-right-right	right	1
594	0	-1	2.5822885	-0.00375	-1.297	0	97	20	50	50	0	right-right-right	-1	-1
593	0	-1	2.5824723	-0.00446	-1.839	0	97	20	50	50	0	right-front-front	right	1
592	0	-1	2.0289695	-0.78416	-2.189	0	96	20	50	50	0	front-front-front-front-front-front	-1	-1

Problem statement

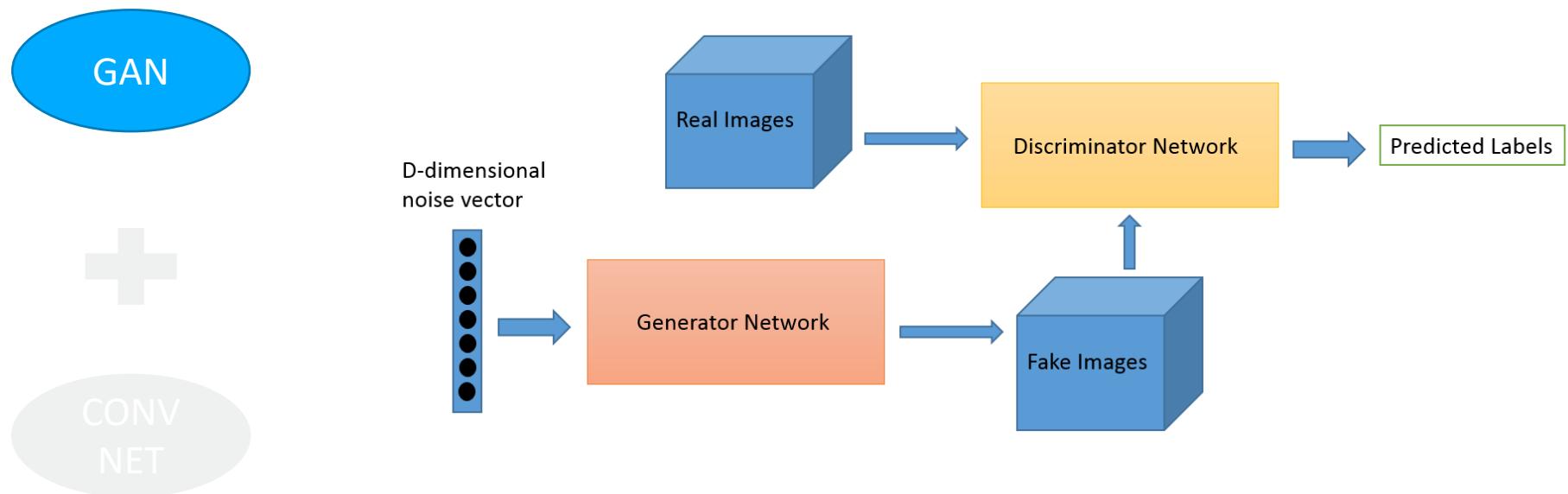
remaining_time	robot_mode	alarm	robot_x	robot_y	robot_theta	forest_state	battery_level	temperature	water_rob ot_tank	water_ground_tank	leaks_state	keys	clicks		shortcuts
597	0	-1	0.6691349	-0.00014	-7E-04	0	99	20	50	50	0	front-front-front-front-front-front	-1	-1	-1
596	0	-1	2.5812879	-0.00288	-0.18	0	98	20	50	50	0	right-right-right-right-right-right-right	-1	-1	-1
595	0	-1	2.5823526	-0.00318	-0.735	0	98	20	50	50	0	right-right-right-right-right-right	right	1	1
594	0	-1	2.5822885	-0.00375	-1.297	0	97	20	50	50	0	right-right-right	-1	-1	-1
593	0	-1	2.5824723	-0.00446	-1.839	0	97	20	50	50	0	right-right-right	right	1	1
592	0	-1	2.0289695	-0.78416	-2.189	0	96	20	50	50	0	front-front-front-front-front-front	-1	-1	-1

	keys	clicks
0	front-front-front-front-front-front	-1
0	right-right-right-right-right-right-right	-1
0	right-right-right-right-right-right	right
0	right-right-right	-1
	right-front-front	right
	front-front-front-front-front	

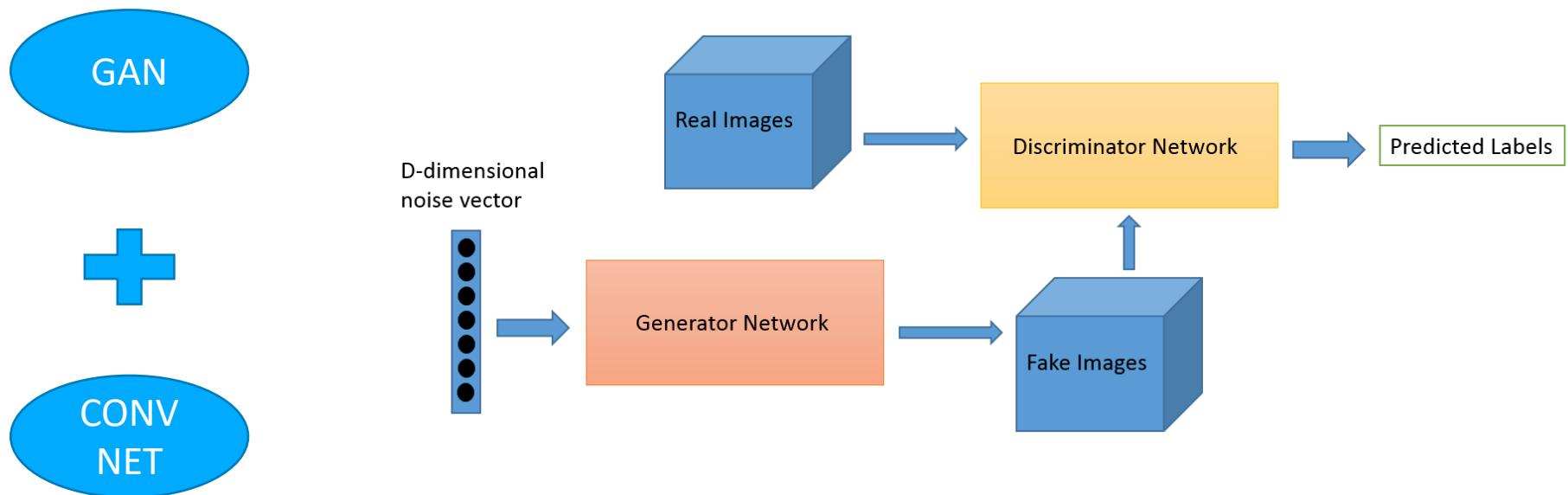
State-of-the-art



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Phase 1: DATA TREATMENT

1. Treat the data

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1. Treat the data
2. Divide the dataset : movements of the robot

Phase 1: DATA TREATMENT

1. Treat the data
2. Divide the dataset :movements of the robot
3. Simplify

Phase 1: DATA TREATMENT

remaining	robot_mo	alarm	robot_x	robot_y	robot_the tree 1	tree 2	tree 3	tree 4	tree 5	tree 6	tree 7	tree 8	tree 9	battery_leak	temperature	water_rock	water_gravel	leak 1	leak 2	leak 3	leak 4	leak 5	leak 6	leak 7	leak 8	leak 9	
1.173149	1.027952	-0.13649	0.09389	-0.42948	0.60836	-0.9629	-0.98709	-1.27702	-0.9837	-0.96342	-1.18356	-1.23262	-1.04124	-1.43546	1.099829	-0.2824	2.13598	-0.65943	-0.60725	-0.61552	1.639036	-0.60614	-0.61118	-0.63021	-0.63035	1.633724	-0.63267
1.167069	1.027952	-0.13649	0.214847	-0.30244	0.610297	-0.9629	-0.98709	-1.27702	-0.9837	-0.96342	-1.18356	-1.23262	-1.04124	-1.43546	1.099829	-0.2824	2.13598	-0.69397	-0.60725	-0.61552	1.639036	-0.60614	-0.61118	-0.63021	-0.63035	1.633724	-0.63267
1.160989	1.027952	-0.13649	0.335553	-0.17525	0.610695	-0.9629	-0.98709	-1.27702	-0.9837	-0.96342	-1.18356	-1.23262	-1.04124	-1.43546	1.064279	-0.2824	2.13598	-0.7285	-0.60725	-0.61552	1.639036	-0.60614	-0.61118	-0.63021	-0.63035	1.633724	-0.63267
1.154909	1.027952	-0.13649	0.455816	-0.04793	0.611627	-0.9629	-0.98709	-1.27702	-0.9837	-0.96342	-1.18356	-1.23262	-1.04124	-1.43546	1.064279	-0.2824	2.13598	-0.76303	-0.60725	-0.61552	1.639036	-0.60614	-0.61118	-0.63021	-0.63035	1.633724	-0.63267
1.148829	1.027952	-0.13649	0.576163	0.079432	0.611125	-0.9629	-0.98709	-1.27702	-0.9837	-0.96342	-1.18356	-1.23262	-1.04124	-1.43546	1.028729	-0.2824	2.13598	-0.79757	-0.60725	-0.61552	1.639036	-0.60614	-0.61118	-0.63021	-0.63035	1.633724	-0.63267
1.142749	1.027952	-0.13649	0.696629	0.206752	0.609843	-0.9629	-0.98709	-1.27702	-0.9837	-0.96342	-1.18356	-1.23262	-1.04124	-1.43546	1.028729	-0.2824	2.13598	-0.8321	-0.60725	-0.61552	1.639036	-0.60614	-0.61118	-0.63021	-0.63035	1.633724	-0.63267
1.136669	1.027952	-0.13649	0.817452	0.33389	0.610177	-0.9629	-0.98709	-1.27702	-0.9837	-0.96342	-1.18356	-1.23262	-1.04124	-1.43546	0.993179	-0.2824	2.13598	-0.85973	-0.60725	-0.61552	1.639036	-0.60614	-0.61118	-0.63021	-0.63035	1.633724	-0.63267
1.130589	1.027952	-0.13649	0.937489	0.461336	0.613336	-0.9629	-0.98709	-1.27702	-0.9837	-0.96342	-1.18356	-1.23262	-1.04124	-1.43546	0.993179	-0.2824	2.13598	-0.85973	-0.60725	-0.61552	1.639036	-0.60614	-0.61118	-0.63021	-0.63035	1.633724	-0.63267
1.124509	1.027952	-0.13649	1.056491	0.589291	0.615863	-0.9629	-0.98709	-1.27702	-0.9837	-0.96342	-1.18356	-1.23262	-1.04124	-1.43546	0.957629	-0.2824	2.13598	-0.85973	-0.60725	-0.61552	1.639036	-0.60614	-0.61118	-0.63021	-0.63035	1.633724	-0.63267
1.118429	1.027952	-0.13649	1.173993	0.717878	0.622917	-0.9629	-0.98709	-1.27702	-0.9837	-0.96342	-1.18356	-1.23262	-1.04124	-1.43546	0.957629	-0.2824	2.13598	-0.85973	-0.60725	-0.61552	1.639036	-0.60614	-0.61118	-0.63021	-0.63035	1.633724	-0.63267

Phase 1: DATA TREATMENT

remaining	robot_mo	alarm	robot_x	robot_y	robot_theta	tree 1	tree 2	tree 3	tree 4	tree 5	tree 6	tree 7	tree 8	tree 9	battery_level	temperature	water_rot	water_grc	leak 1	leak 2	leak 3	leak 4	leak 5	leak 6	leak 7	leak 8	leak 9	leak 10
1.173149	1.027952	-0.13649	0.09389	-0.42948	0.60836	-0.9629	-0.98709	-1.27702	-0.9837	-0.96342	-1.18356	-1.23262	-1.04124	-1.43546	1.099829	-0.2824	2.13598	-0.65943	-0.60725	-0.61552	1.639036	-0.60614	-0.61118	-0.63021	-0.63035	1.633724	-0.63267	
1.167069	1.027952	-0.13649	0.214847	-0.30244	0.610297	-0.9629	-0.98709	-1.27702	-0.9837	-0.96342	-1.18356	-1.23262	-1.04124	-1.43546	1.099829	-0.2824	2.13598	-0.69397	-0.60725	-0.61552	1.639036	-0.60614	-0.61118	-0.63021	-0.63035	1.633724	-0.63267	
1.160989	1.027952	-0.13649	0.335553	-0.17525	0.610695	-0.9629	-0.98709	-1.27702	-0.9837	-0.96342	-1.18356	-1.23262	-1.04124	-1.43546	1.064279	-0.2824	2.13598	-0.7285	-0.60725	-0.61552	1.639036	-0.60614	-0.61118	-0.63021	-0.63035	1.633724	-0.63267	
1.154909	1.027952	-0.13649	0.455816	-0.04793	0.611627	-0.9629	-0.98709	-1.27702	-0.9837	-0.96342	-1.18356	-1.23262	-1.04124	-1.43546	1.064279	-0.2824	2.13598	-0.76303	-0.60725	-0.61552	1.639036	-0.60614	-0.61118	-0.63021	-0.63035	1.633724	-0.63267	
1.148829	1.027952	-0.13649	0.576163	0.079432	0.611125	-0.9629	-0.98709	-1.27702	-0.9837	-0.96342	-1.18356	-1.23262	-1.04124	-1.43546	1.028729	-0.2824	2.13598	-0.79757	-0.60725	-0.61552	1.639036	-0.60614	-0.61118	-0.63021	-0.63035	1.633724	-0.63267	
1.142749	1.027952	-0.13649	0.696629	0.206752	0.609843	-0.9629	-0.98709	-1.27702	-0.9837	-0.96342	-1.18356	-1.23262	-1.04124	-1.43546	1.028729	-0.2824	2.13598	-0.8321	-0.60725	-0.61552	1.639036	-0.60614	-0.61118	-0.63021	-0.63035	1.633724	-0.63267	
1.136669	1.027952	-0.13649	0.817452	0.33389	0.610177	-0.9629	-0.98709	-1.27702	-0.9837	-0.96342	-1.18356	-1.23262	-1.04124	-1.43546	0.993179	-0.2824	2.13598	-0.86755	-0.60725	-0.61552	1.639036	-0.60614	-0.61118	-0.63021	-0.63035	1.633724	-0.63267	
1.130589	1.027952	-0.13649	0.937489	0.461336	0.613336	-0.9629	-0.98709	-1.27702	-0.9837	-0.96342	-1.18356	-1.23262	-1.04124	-1.43546	0.993179	-0.2824	2.13598	-0.8921	-0.60725	-0.61552	1.639036	-0.60614	-0.61118	-0.63021	-0.63035	1.633724	-0.63267	
1.124509	1.027952	-0.13649	1.056491	0.589291	0.615863	-0.9629	-0.98709	-1.27702	-0.9837	-0.96342	-1.18356	-1.23262	-1.04124	-1.43546	0.993179	-0.2824	2.13598	-0.91655	-0.60725	-0.61552	1.639036	-0.60614	-0.61118	-0.63021	-0.63035	1.633724	-0.63267	
1.118429	1.027952	-0.13649	1.173993	0.717878	0.622917	-0.9629	-0.98709	-1.27702	-0.9837	-0.96342	-1.18356	-1.23262	-1.04124	-1.43546	0.993179	-0.2824	2.13598	-0.94112	-0.60725	-0.61552	1.639036	-0.60614	-0.61118	-0.63021	-0.63035	1.633724	-0.63267	

	robot_x	robot_y	robot_theta	tree 1
36489508	0.093889835	-0.429483176	0.608360198	-0.962
36489508	0.214846741	-0.302443195	0.610297039	-0.962
36489508	0.335552833	-0.175254051	0.610694718	-0.962
36489508	0.455816383	-0.047932325	0.611627252	-0.962
36489508	0.576163337	0.079432271	0.611124644	-0.962
36489508	0.696629082	0.206752165	0.609843256	-0.962
36489508	0.817451892	0.333890407	0.610176946	-0.962
36489508	0.937489047	0.461336389	0.613336005	-0.962
36489508	1.056490645	0.589290936	0.615863299	-0.962
36489508	1.173992711	0.717878266	0.622917368	-0.962

Phase 1: DATA TREATMENT

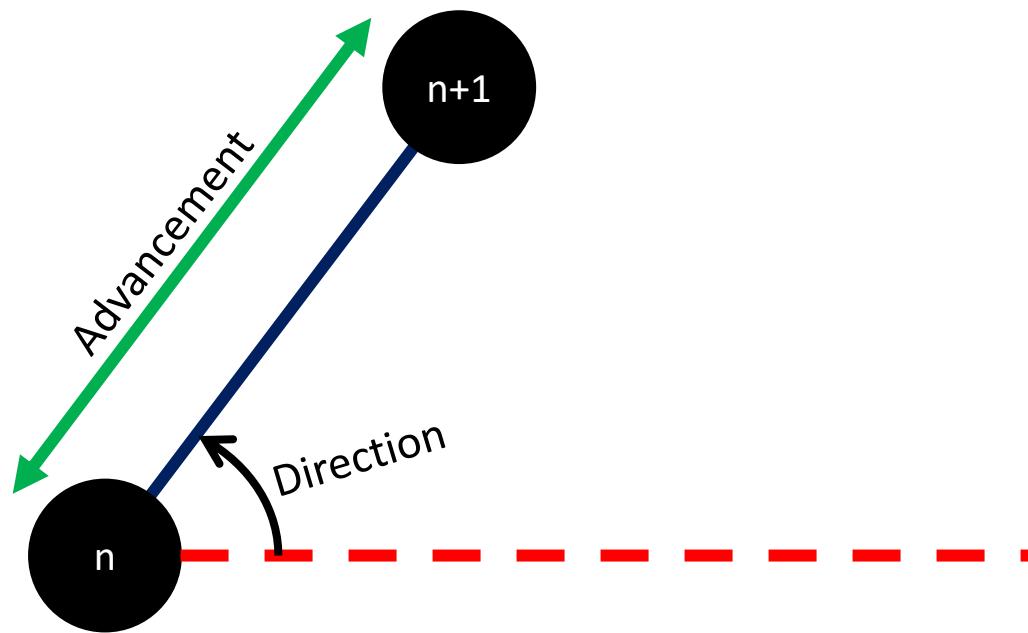
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remaining	robot_mo	alarm	robot_x	robot_y	robot_theta	tree 1	tree 2	tree 3	tree 4	tree 5	tree 6	tree 7	tree 8	tree 9	battery_leak	temperature	water_rot	water_grc	leak 1	leak 2	leak 3	leak 4	leak 5	leak 6	leak 7	leak 8	leak 9	leak 10
1.173149	1.027952	-0.13649	0.09389	-0.42948	0.60836	-0.9629	-0.98709	-1.27702	-0.9837	-0.96342	-1.18356	-1.23262	-1.04124	-1.43546	1.099829	-0.2824	2.13598	-0.65943	-0.60725	-0.61552	1.639036	-0.60614	-0.61118	-0.63021	-0.63035	1.633724	-0.63267	
1.167069	1.027952	-0.13649	0.214847	-0.30244	0.610297	-0.9629	-0.98709	-1.27702	-0.9837	-0.96342	-1.18356	-1.23262	-1.04124	-1.43546	1.099829	-0.2824	2.13598	-0.69397	-0.60725	-0.61552	1.639036	-0.60614	-0.61118	-0.63021	-0.63035	1.633724	-0.63267	
1.160989	1.027952	-0.13649	0.335553	-0.17525	0.610695	-0.9629	-0.98709	-1.27702	-0.9837	-0.96342	-1.18356	-1.23262	-1.04124	-1.43546	1.064279	-0.2824	2.13598	-0.7285	-0.60725	-0.61552	1.639036	-0.60614	-0.61118	-0.63021	-0.63035	1.633724	-0.63267	
1.154909	1.027952	-0.13649	0.455816	-0.04793	0.611627	-0.9629	-0.98709	-1.27702	-0.9837	-0.96342	-1.18356	-1.23262	-1.04124	-1.43546	1.064279	-0.2824	2.13598	-0.76303	-0.60725	-0.61552	1.639036	-0.60614	-0.61118	-0.63021	-0.63035	1.633724	-0.63267	
1.148829	1.027952	-0.13649	0.576163	0.079432	0.611125	-0.9629	-0.98709	-1.27702	-0.9837	-0.96342	-1.18356	-1.23262	-1.04124	-1.43546	1.028729	-0.2824	2.13598	-0.79757	-0.60725	-0.61552	1.639036	-0.60614	-0.61118	-0.63021	-0.63035	1.633724	-0.63267	
1.142749	1.027952	-0.13649	0.696629	0.206752	0.609843	-0.9629	-0.98709	-1.27702	-0.9837	-0.96342	-1.18356	-1.23262	-1.04124	-1.43546	1.028729	-0.2824	2.13598	-0.8321	-0.60725	-0.61552	1.639036	-0.60614	-0.61118	-0.63021	-0.63035	1.633724	-0.63267	
1.136669	1.027952	-0.13649	0.817452	0.33389	0.610177	-0.9629	-0.98709	-1.27702	-0.9837	-0.96342	-1.18356	-1.23262	-1.04124	-1.43546	0.993179	-0.2824	2.13598	-0.85973	-0.60725	-0.61552	1.639036	-0.60614	-0.61118	-0.63021	-0.63035	1.633724	-0.63267	
1.130589	1.027952	-0.13649	0.937489	0.461336	0.613336	-0.9629	-0.98709	-1.27702	-0.9837	-0.96342	-1.18356	-1.23262	-1.04124	-1.43546	0.993179	-0.2824	2.13598	-0.85973	-0.60725	-0.61552	1.639036	-0.60614	-0.61118	-0.63021	-0.63035	1.633724	-0.63267	
1.124509	1.027952	-0.13649	1.056491	0.589291	0.615863	-0.9629	-0.98709	-1.27702	-0.9837	-0.96342	-1.18356	-1.23262	-1.04124	-1.43546	0.957629	-0.2824	2.13598	-0.85973	-0.60725	-0.61552	1.639036	-0.60614	-0.61118	-0.63021	-0.63035	1.633724	-0.63267	
1.118429	1.027952	-0.13649	1.173993	0.717878	0.622917	-0.9629	-0.98709	-1.27702	-0.9837	-0.96342	-1.18356	-1.23262	-1.04124	-1.43546	0.957629	-0.2824	2.13598	-0.85973	-0.60725	-0.61552	1.639036	-0.60614	-0.61118	-0.63021	-0.63035	1.633724	-0.63267	

	robot_x	robot_y	robot_theta	tree 1
9508	0.093889835	-0.429483176	0.608360198	-0.962
489508	0.214846741	-0.302443195	0.610297039	-0.962
6489508	0.335552833	-0.175254051	0.610694718	-0.962
36489508	0.455816383	-0.047932325	0.611627252	-0.962
36489508	0.576163337	0.079432271	0.611124644	-0.962
36489508	0.696629082	0.206752165	0.609843256	-0.962
6489508	0.817451892	0.333890407	0.610176946	-0.962
189508	0.937489047	0.461336389	0.613336005	-0.962
508	1.056490645	0.589290936	0.615863299	-0.962
	1.173992711	0.717878266	0.622917368	

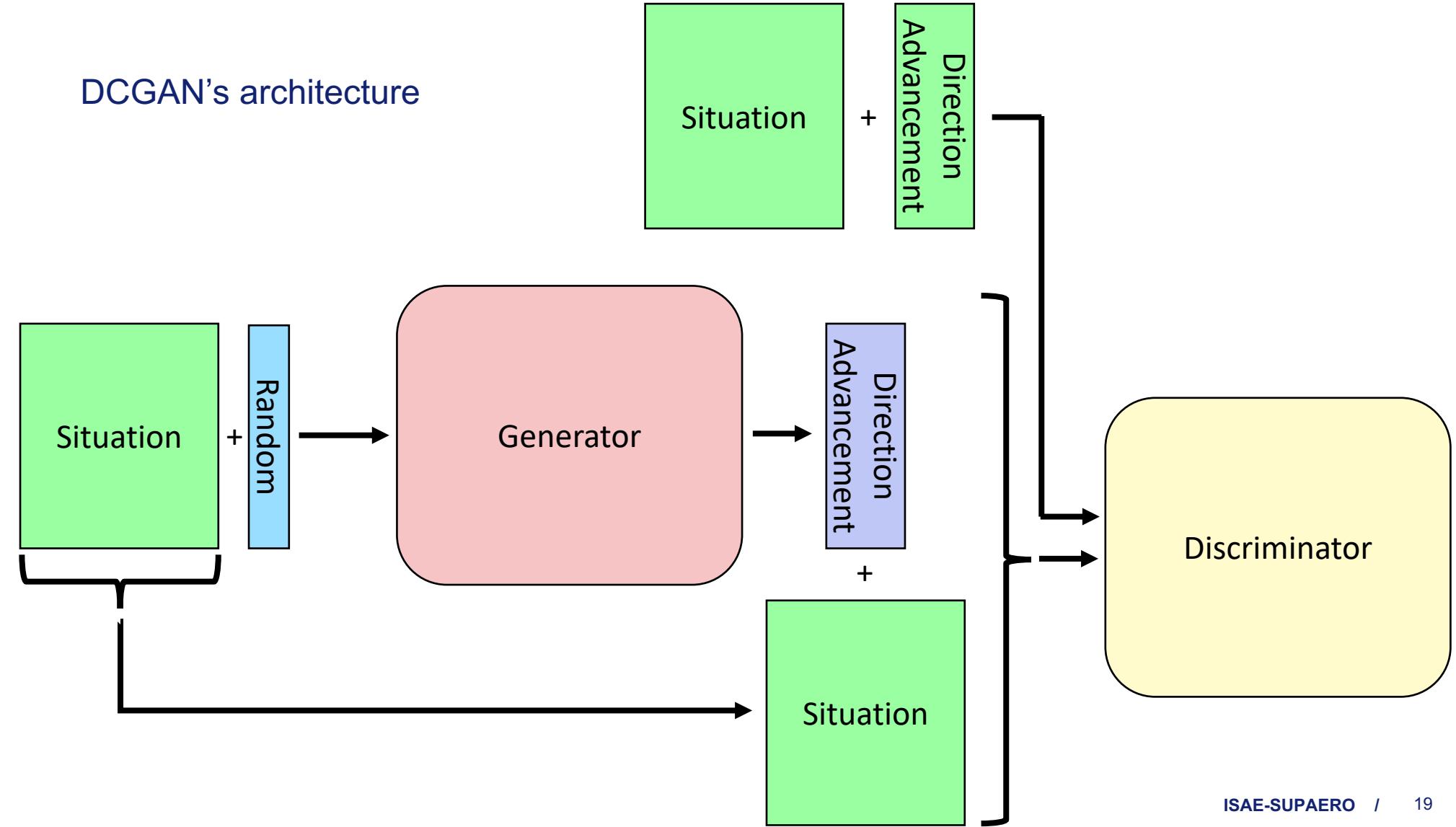
1st approach

Generate user's input



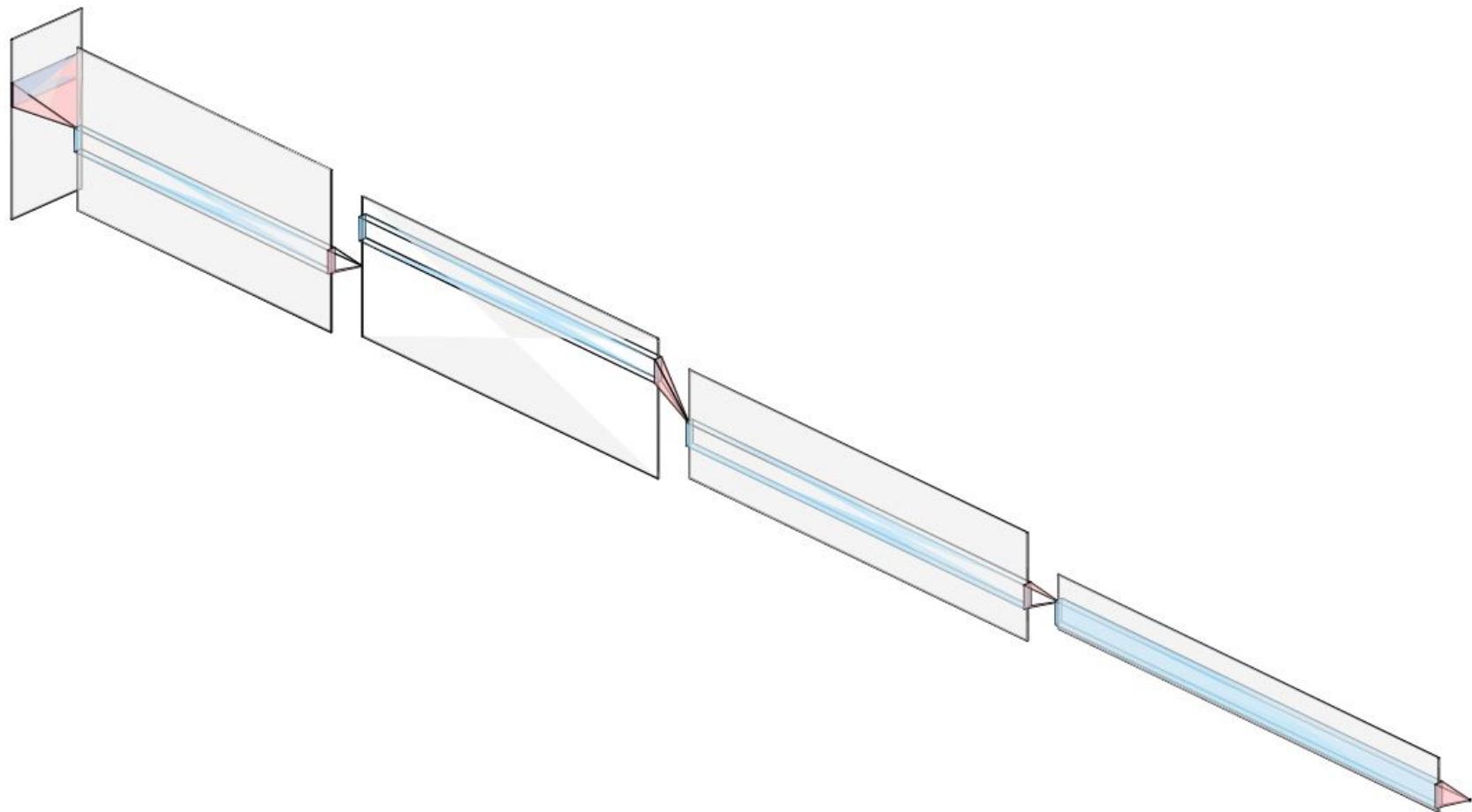
1st approach

DCGAN's architecture



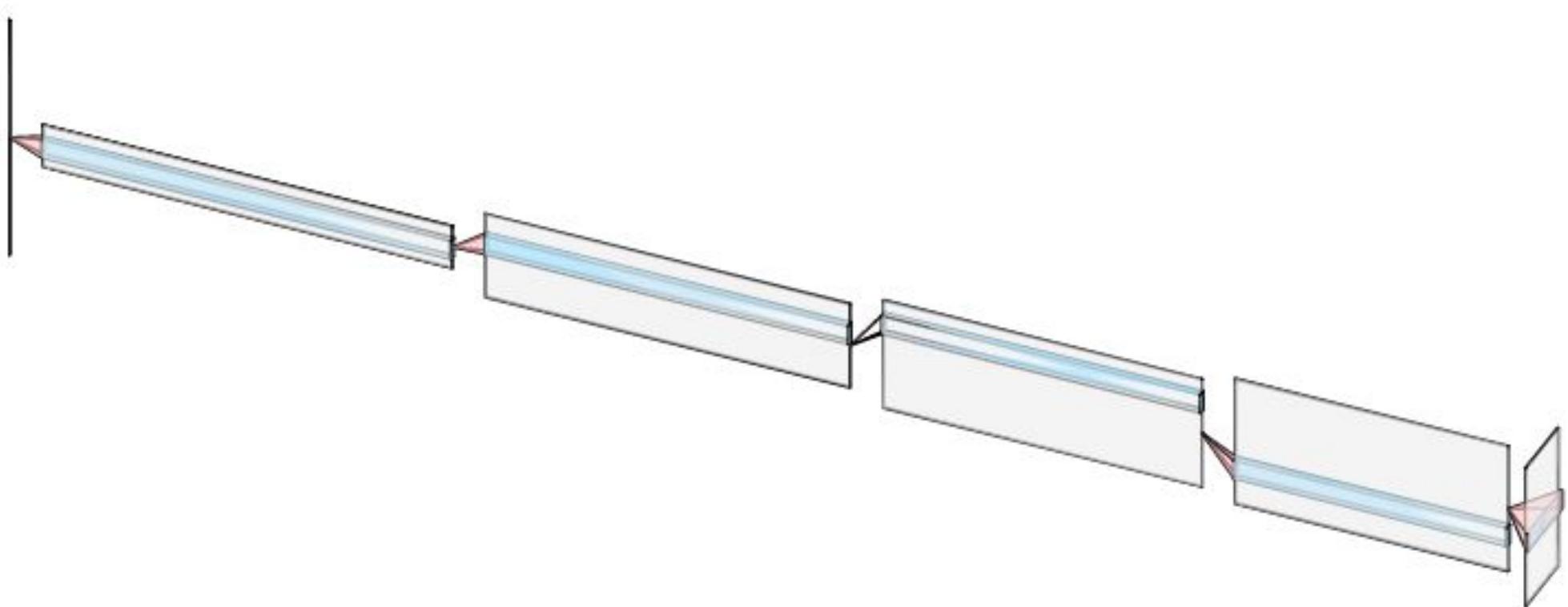
Phase 2: IMPLEMENTATION

Discriminator's architecture



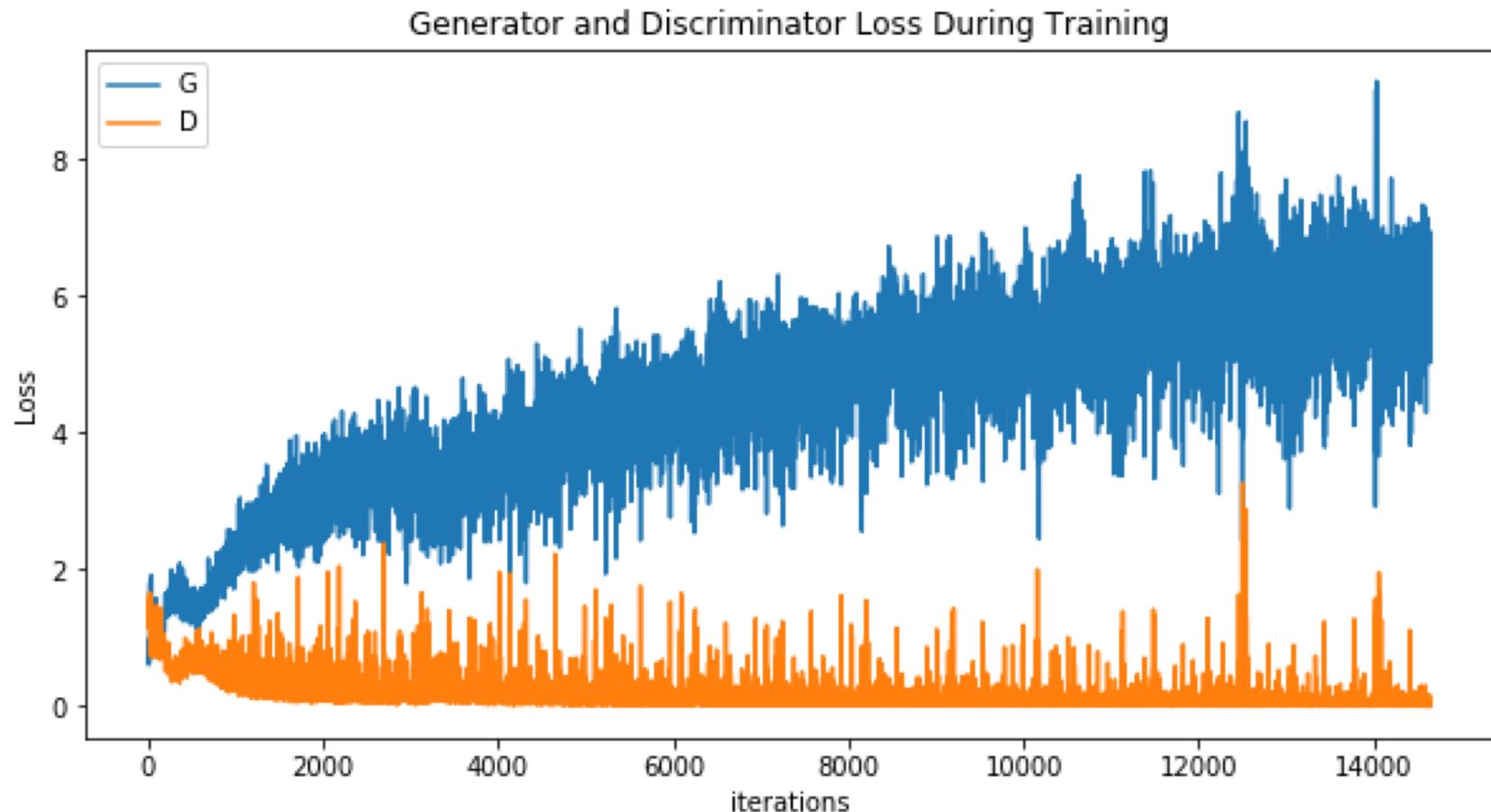
Phase 2: IMPLEMENTATION

Generator's architecture



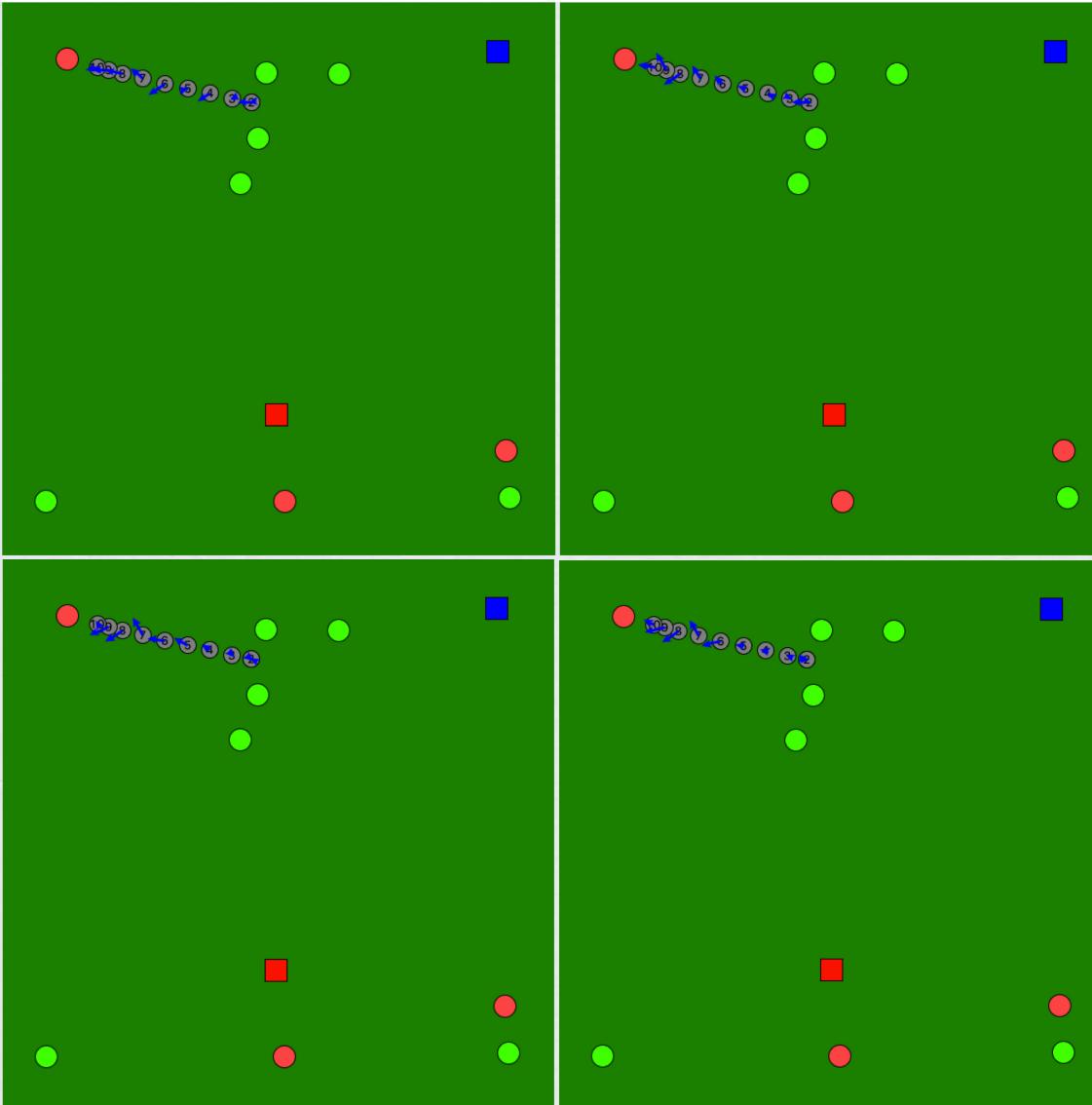
Phase 3: VALIDATION

Convergence



Phase 3: VALIDATION

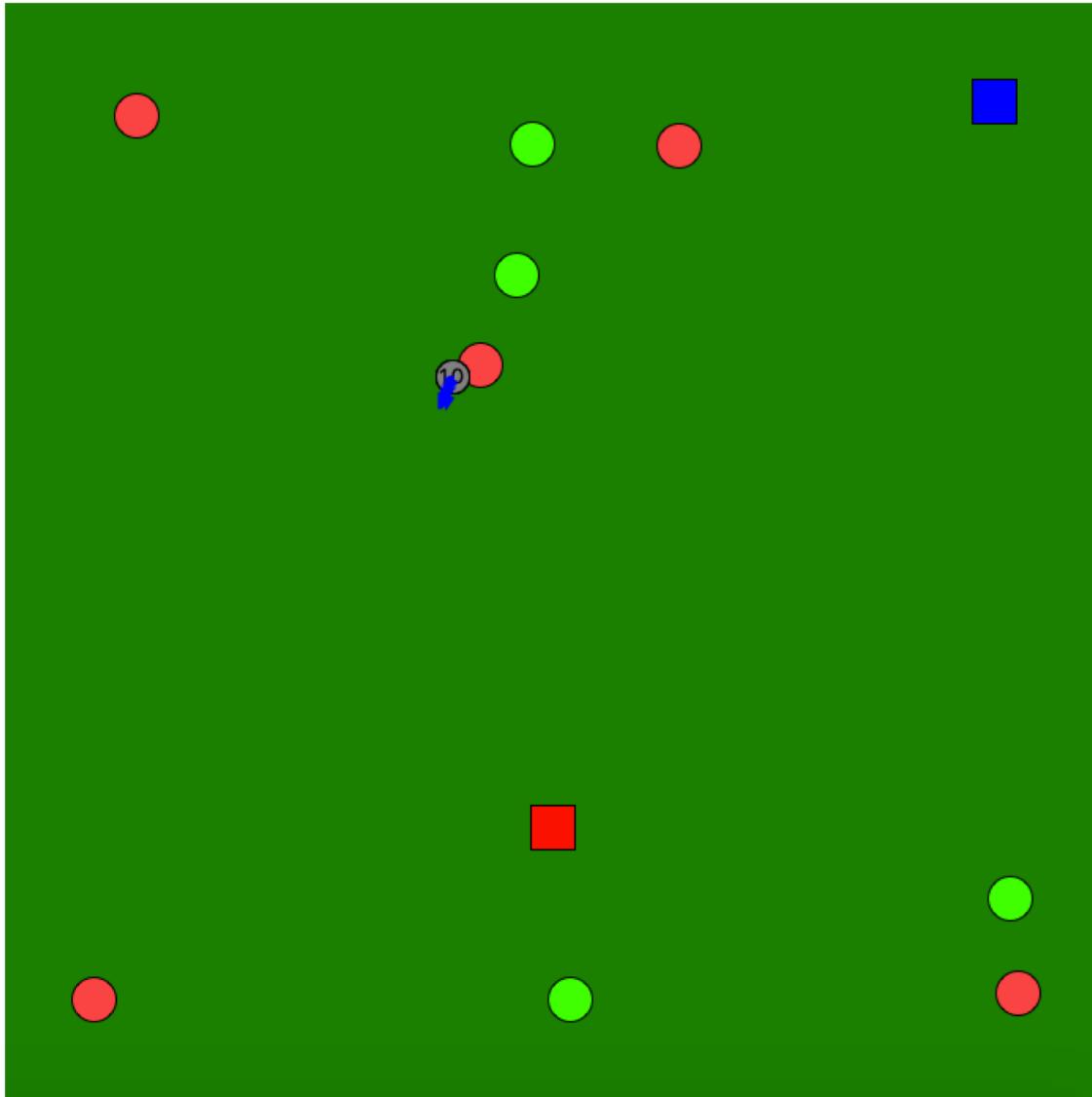
Visual validation



Evolution of the results throughout the epochs

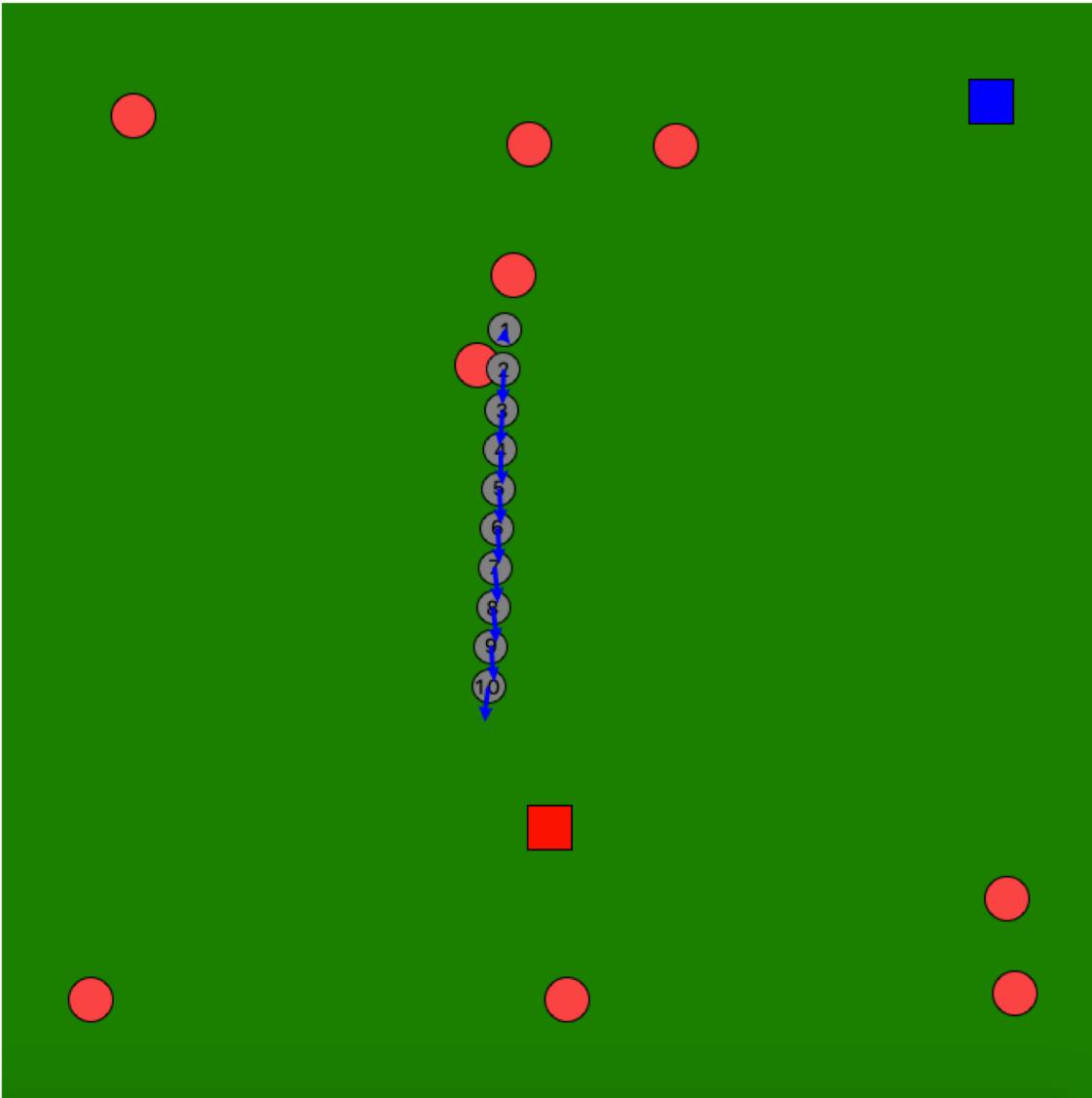
Phase 3: VALIDATION

Visual validation

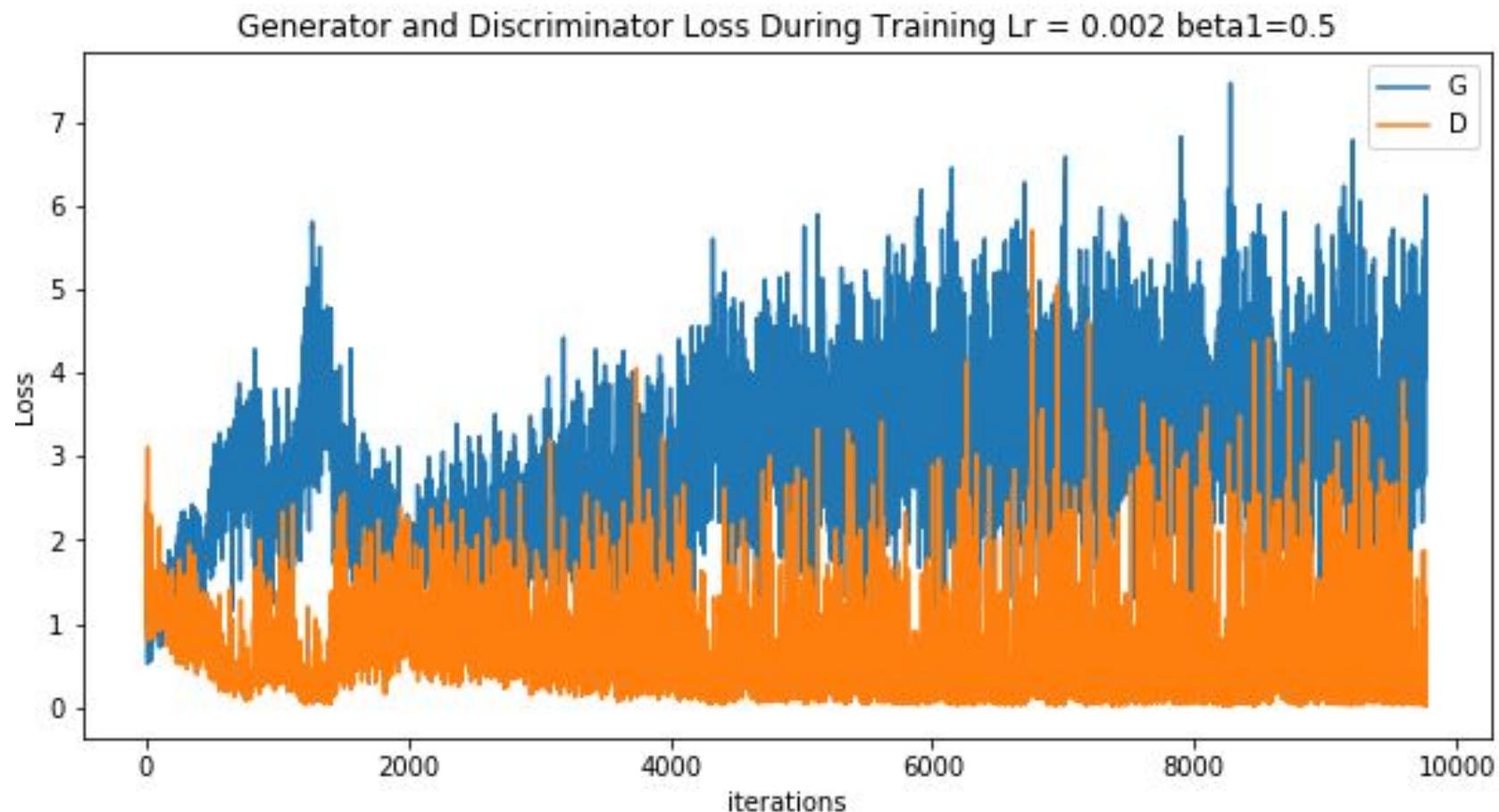


Phase 3: VALIDATION

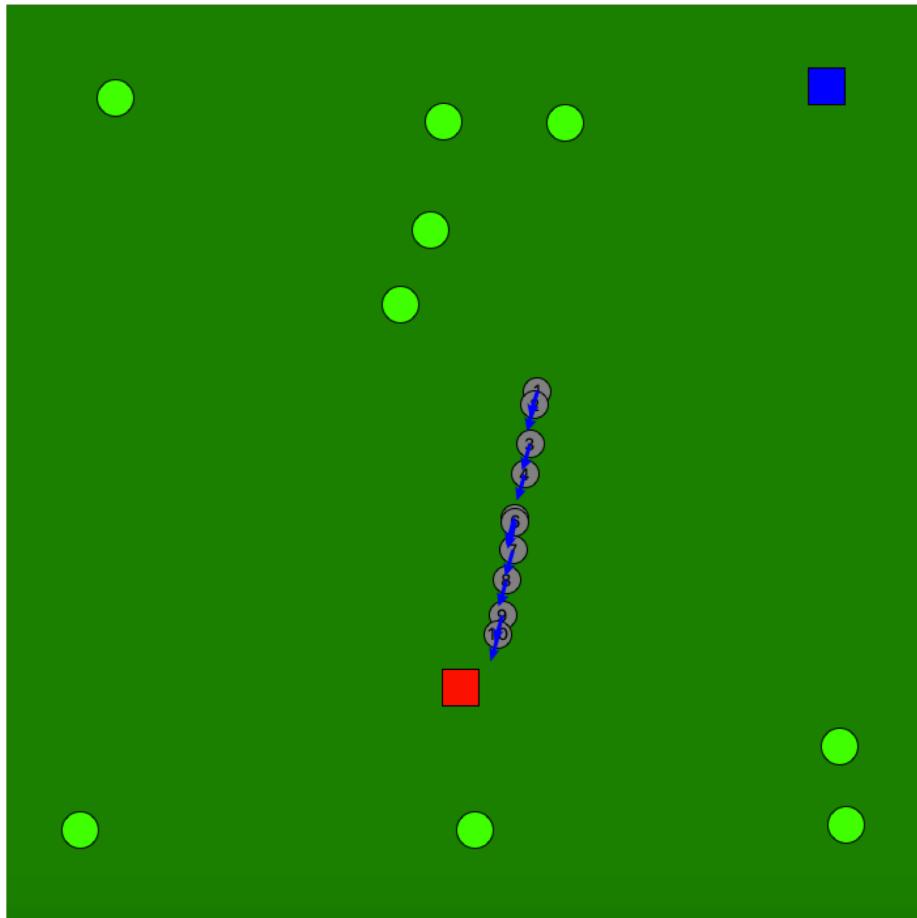
Visual validation



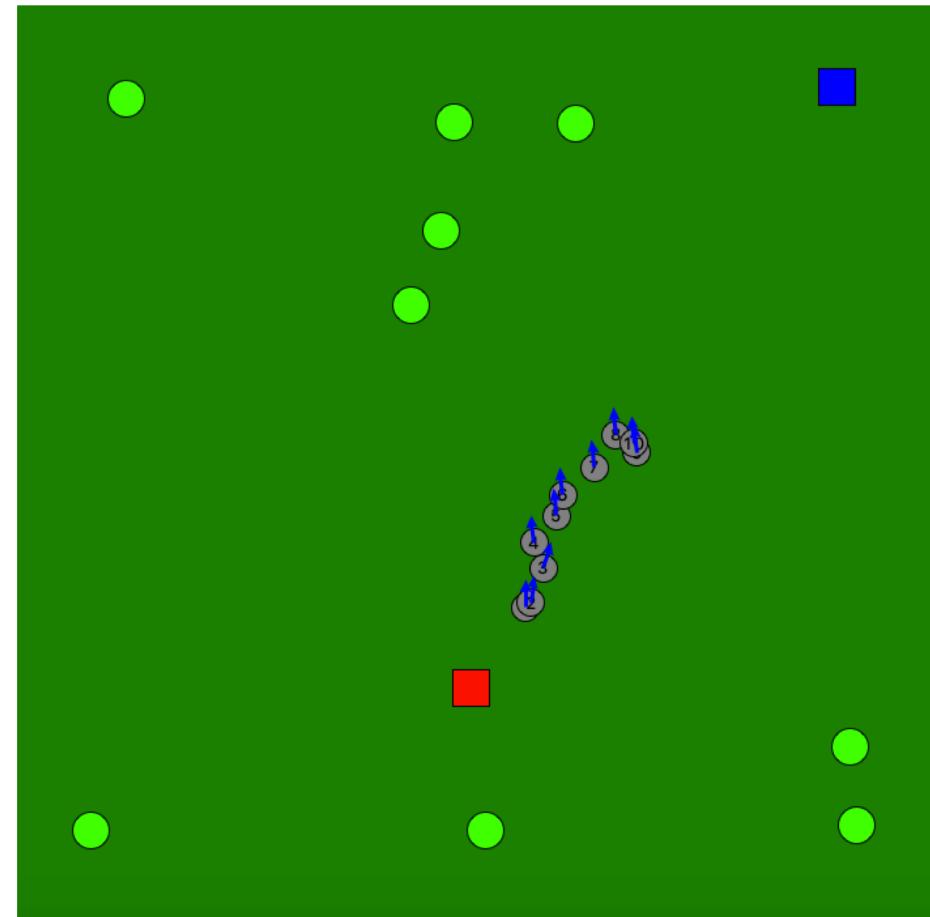
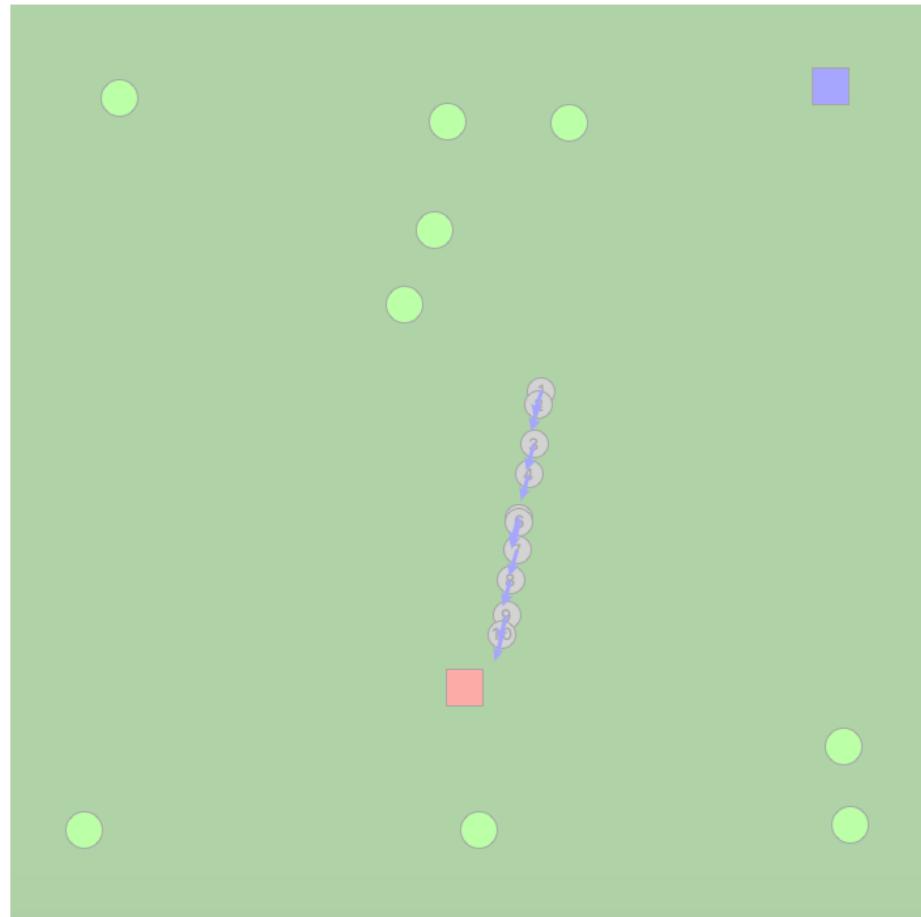
Results



Results



Results



Many thanks!
Questions?

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