Impact of Training Environment on Specialized AI Implemented with Reinforcement Learning

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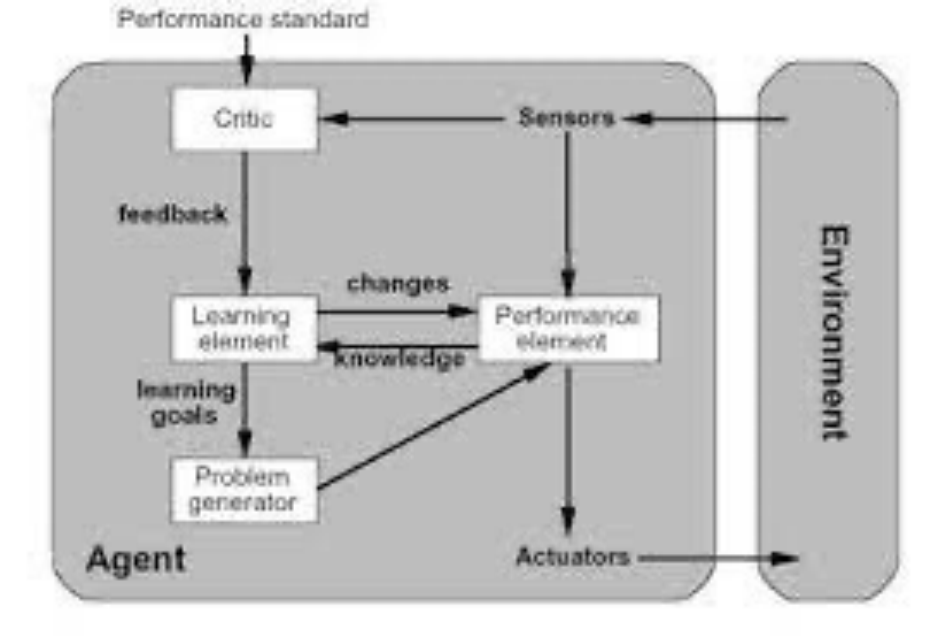
Problem

- Specialized AI can only solve a limited number of problems.
- Specialized AI trained to excel in a specific environment, struggle to repeat success in a freshly encountered scenario.
- The lack of adaptation coupled with the limited problem-solving domain is a situation to be avoided.
- To avoid pitfalls with reinforcement learning, a focus on training environment is important.

Approach



- Create an environment where an agent is given a plethora of opportunities to get a positive reward while also giving opportunities where the agent will get negative feedback for bad actions and settling for lesser goals.
- In theory, the more credible feedback given to the agent during training, the closer the agent is to getting the maximum overall reward in any given scenario.
- To juxtapose a rich training environment, there will be tests performed on an environment that has less chances for a positive and negative feedback. The contrast in environments will help to validate the results from the experiment.

Experiment Environment

- In order to conduct tests on the impact of environment on specialized AI, a testing domain is needed.
- VizDoom is a highly suitable research platform because of the ease in creating custom scenarios and the available information that can be given to any AI system.
- Given custom VizDoom scenarios and a specialized combat agent, tests are conducted to show the impact a training scenario can have on the overall performance of specialized AI.

Custom Scenarios and Performance Measures

Performance Measures

Positive Feedback:

- Large Reward for enemies eliminated.
- Small Reward for damage afflicted to enemies.

Negative Feedback:

- Large negative reward for dying.
- Small negative reward for taking damage.
- Small negative reward for shooting a bullet.
- Small negative reward for living.

Custom Scenarios

Diverse Generalized Scenario:

- Over 20 randomly spawning enemies with different sizes, health pools, movement capabilities, and attack capabilities.
- Large ammo pool to work with.

Standard Basic Scenario:

- Limited amount of low hp, non-hostile enemies.
- Low ammo pool to work with.

Results

- To get results from the experiment the two agent models were put head-to-head in a variety of custom maps ranging in difficulty.
- To note the difficulty judgement was made at my discretion. And the ammo pool given to the agent is made sufficient in order to complete the scenario.

Very Easy – A solo enemy that has a low health pool and can not fight back.

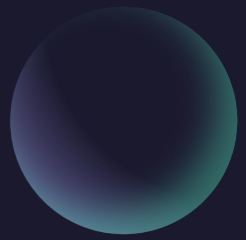
Easy – A solo enemy with a high health pool, that can move at a slow pace.

Medium – Two enemies that can attack the agent.

Hard – Five randomly spawning enemies that surround the agent from all sides. Two of the enemies are hostile.

Extreme – Seven high speed randomly spawning enemies that will surround the agent and be hostile towards it.

Map Images



Result Chart

Conclusion

- The research done using the VizDoom combat agent shows the importance that a testing environment can have on an agent that uses reinforcement learning.
- The impact that this kind of research can have, is that more importance can placed on an agent's training environment when evaluating the performance of AI systems. Helping to aid in the development of AI systems in the future.

Thank You

Any Questions?