

# Research review of the paper: “Playing FPS game with Deep Reinforcement learning”

Ref: <https://arxiv.org/pdf/1609.05521v1.pdf>

**Abstract:** Paper presents the first architecture to tackle 3D environments for an autonomous agent in a first-person shooter game. Typically, deep reinforcement learning methods only utilize visual input for training. Paper presents a method to augment these models to exploit game feature information such as the presence of enemies or items, during the training phase.

**Goal:** Deep reinforcement learning has been useful in mastering human level control policies such as object recognition, robot control. They have also defeated humans in Atari and Go games.

These agents has full knowledge of current state of environment or game. The paper aims to tackle task of playing FPS game in a 3D environment, which is more complicated as it involves navigating map, collecting items, identifying and killing enemies. The agent uses the information on the screen (pixels) and divides the problem in 2 phases:

1. Navigation – exploring map to collect items and find enemy
2. Action – Fight enemy when they are observed.

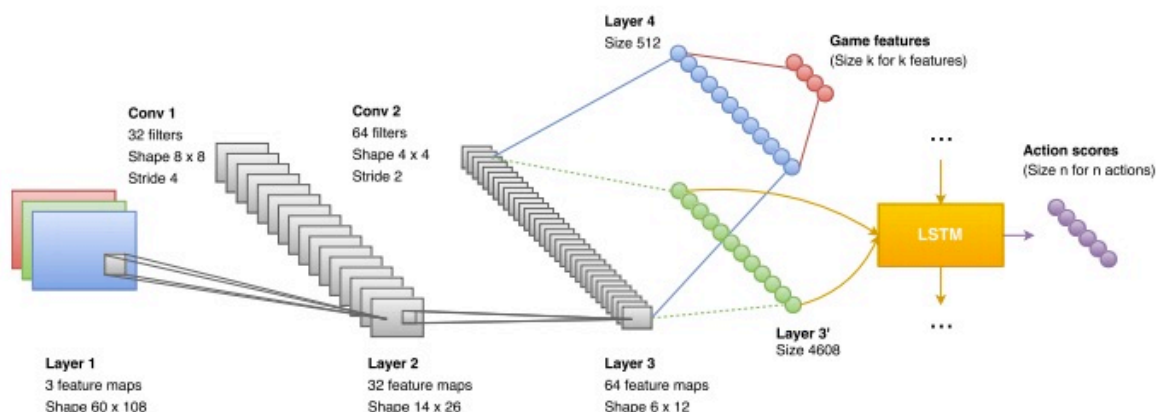


Figure 2: An illustration of the architecture of our model. The input image is given to two convolutional layers. The output of the convolutional layers is split into two streams. The first one (bottom) flattens the output (layer 3') and feeds it to a LSTM, as in the DRQN model. The second one (top) projects it to an extra hidden layer (layer 4), then to a final layer representing each game feature. During the training, the game features and the Q-learning objectives are trained jointly.

## Results:

The proposed model was able to outperform built-in bots and humans and demonstrated generalizability of model to unknown maps.

Evaluation Metric	Single Player		Multiplayer	
	Human	Agent	Human	Agent
Number of objects	5.2	9.2	6.1	10.5
Number of kills	12.6	27.6	5.5	8.0
Number of deaths	8.3	5.0	11.2	6.0
Number of suicides	3.6	2.0	3.2	0.5
K/D Ratio	1.52	5.12	0.49	1.33

Table 1: Comparison of human players with agent. Single player scenario is both humans and the agent playing against bots in separate games. Multiplayer scenario is agent and human playing against each other in the same game.