Jivitesh Sharma et al., Int J Robot Res Appl Autom. 2019
DOI: dx.doi.org/10.18689/IJRA2019.a1.002

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**International Conference on**

ROBOTICS AND AUTOMATION ENGINEERING

**October 23-24, 2019 | Rome, Italy**

# Deep Reinforcement Learning for Fire Evacuation

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We use Deep Reinforcement Learning, specifically Deep Q-network models, for optimal evacuation planning in case of fire emergency. We design our own fire evacuation environment which is a fire simulator in a building model.

The building model is graph based with vertices/nodes representing rooms and edges representing the connections between rooms, i.e. hallways. The only input needed to build the environment is the building structure or blueprint. The environment consists of the graph based building model, the location of the fire, the random fire spread based on a degree function and the reward designed as an exponential decay function, so that the rewards received by the agent keeps on decreasing as time progresses in order to emphasize speed of evacuation. Other than these features, there are bottlenecks in rooms which allows a maximum of 'B' people in a room.

The novelty in the reinforcement learning model is that, that we use DQN agent pretraining using Q-matrices, where the Q-matrices are pretrained on the graph based building model in order to transfer knowledge about the shortest path to the exit nodes.

We compare our model with other state-of-the-art models such as DQN, DDQN, Dueling DQN, PPO, VPG, A2C etc. on the fire evacuation environment. We show that our model is able to outperform all the other state-of-the-art models and achieves near optimal evacuation plan with requiring minimum number of time-steps.

## Biography

Jivitesh Sharma is a PhD Research Fellow at the University of Agder, Norway and part of the Center for Artificial Intelligence Research (CAIR) group. He is doing his research on Deep Neural Networks for Fire emergency systems. His research entails Computer Vision tasks like Image Classification, Instance Segmentation and Object Detection and Deep Reinforcement Learning like Q-learning and Policy Gradients. Apart from his PhD, he is also working with Agder Energi AS, which is a renewable energy production company in Norway, to optimize hydropower generation using meta-heuristic methods and genetic algorithms.

## Notes: