Wireless Team

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Problem Statement & Solution

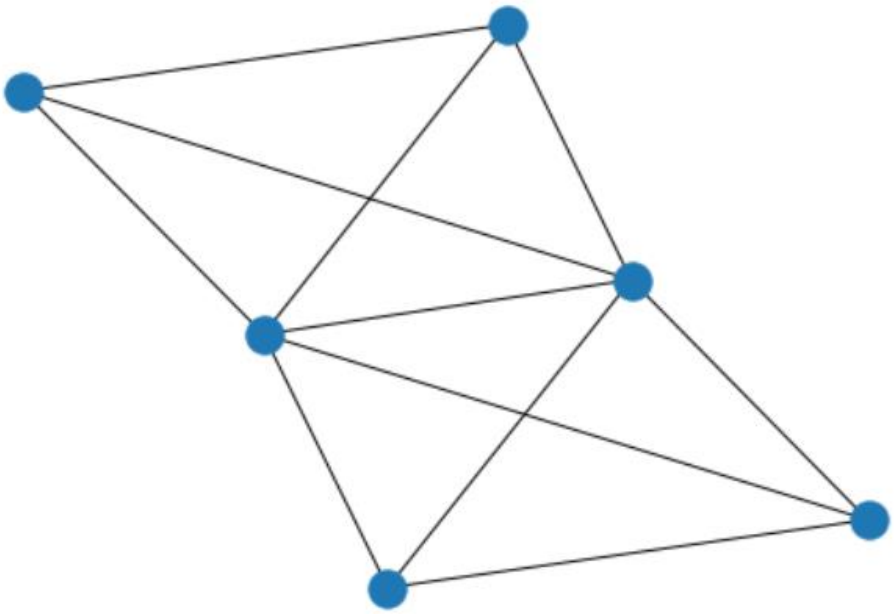
Problem Statement

- Wireless transmission in a network with two collision domain and defect node

Solution

- DRL agent should learn to transmit packet by avoiding collision and any defect node

Current Network



State, Action and Reward

State:

State vector includes

1. Destination of a packet at each node (Random destination selected)

2. Defect node status

MultiDiscrete ([7, 7, 7, 7, 7, 7, 2, 2, 2, 2, 2, 2])

Ex : [3, 4, 5, 0, 1, 3, 0, 0, 1, 0, 0, 0]

State, Action and Reward

Action:

Next hop and transmit/wait status for each node

MultiDiscrete ([6, 6, 6, 6, 6, 6, 2, 2, 2, 2, 2, 2]

Ex: [2, 3, 1, 4, 5, 2, 0, 1, 1, 0, 0, 1]

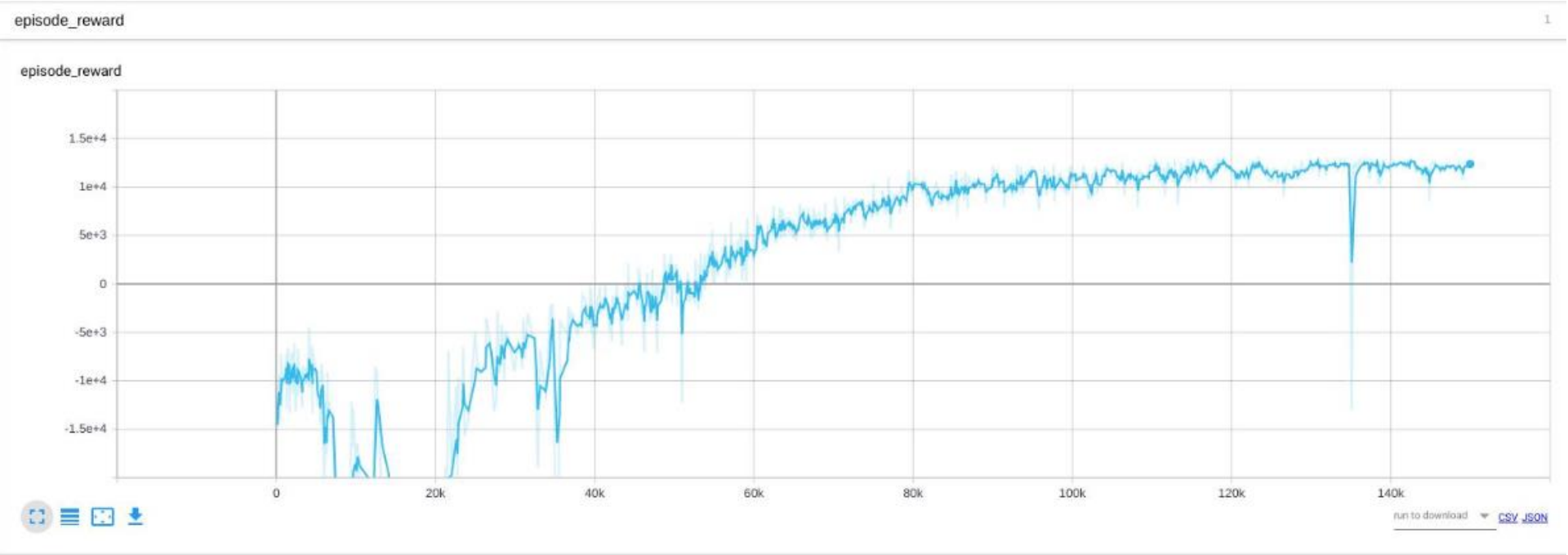
State, Action and Reward

Reward:

- Next hop not in same domain = -100
- Next hop is defect node = -100
- Packet collision = -100
- Successful transmission = -10
- Transmit action on node with no packets = -100

- Packet reached destination = +1000

Graph – Episode Reward



Challenges

- Large Action Space

Action Space: MultiDiscrete ([6, 6, 6, 6, 6, 6, 2, 2, 2, 2, 2, 2])
Action space size: 432

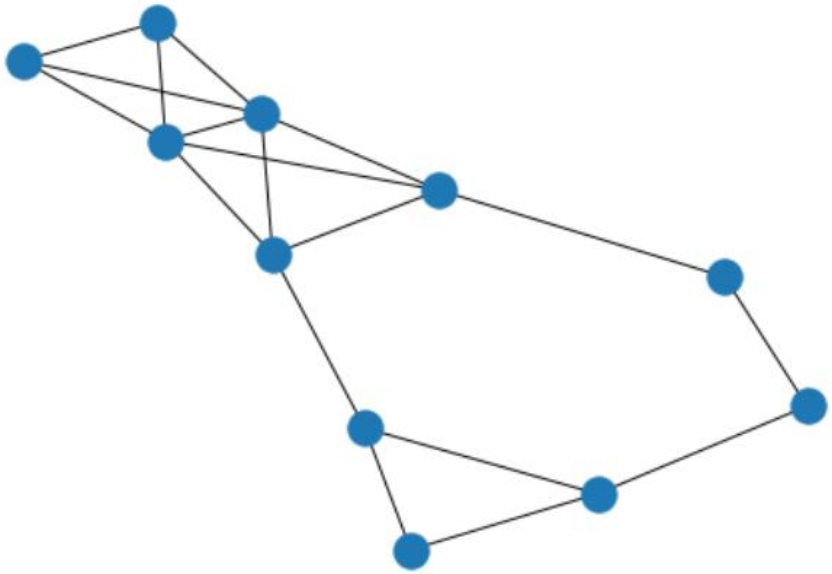
- Reward stabilization around 80k timesteps

Challenges

- Action space size for huge network

MultiDiscrete ([11, 11, 11, 11, 11, 11, 11, 11, 11, 11, 11, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2]

Size = 2662



Changes

Modified action space

For each node: Total Nodes + 1

MultiDiscrete ([7, 7, 7, 7, 7, 7])

Size = 42

Ex: [2, 6, 5, 3, 5, 6]

Where 6 indicates wait action for node 1 and 5

Next Steps

- Modifications on action space
- Train agent with large network with multiple collision domain
- Dynamic defect nodes in the network
- Hyper-parameter optimization

THANK YOU!

Collision and Transmission Scenarios

- **Collision**
  - At a time multiple nodes in same collision domain shouldn't transfer
  - Hidden terminal problem

- **Transmission**
  - One node at a time in one collision domain
  - While intermediate node transmitting, no other node should transmit
  - Simultaneously, nodes in independent collision domain can transfer (except to intermediate node)