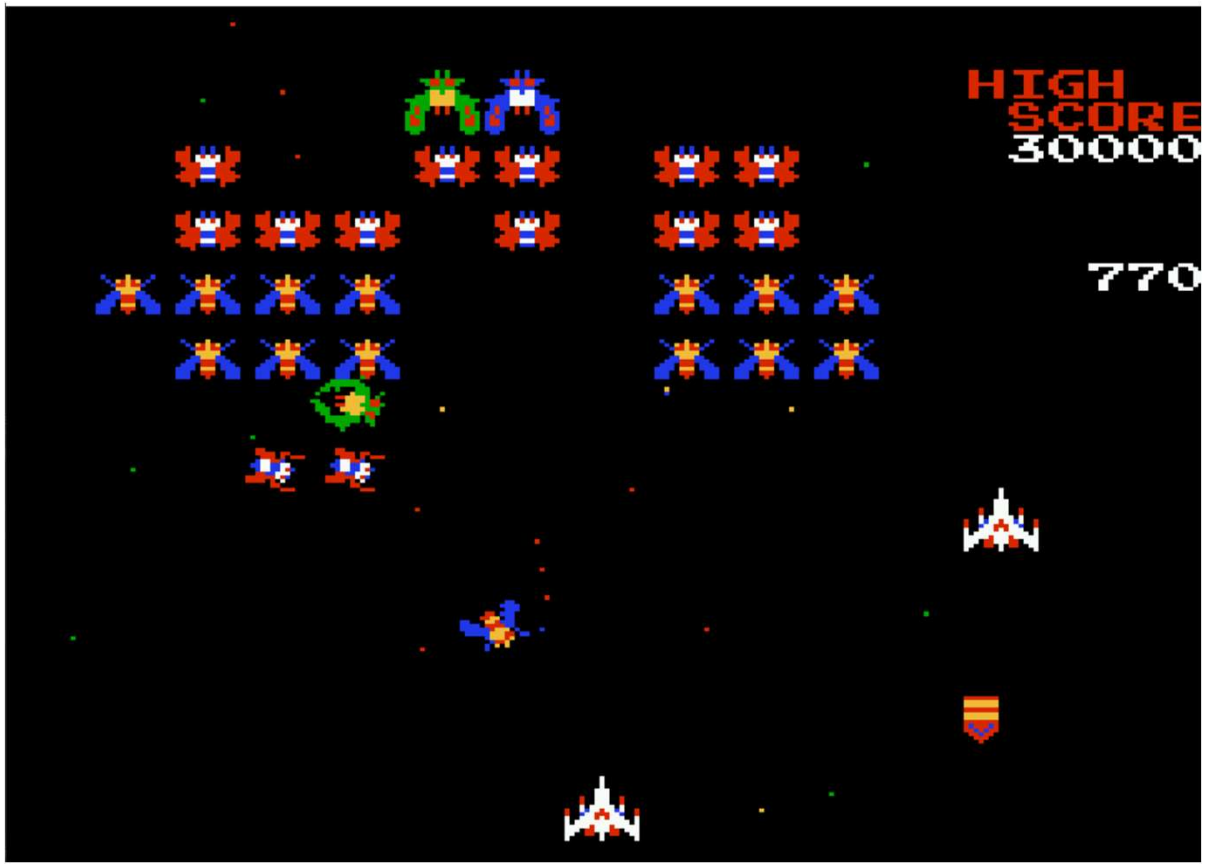
COMPARING SINGLE & DOUBLE DEEP-Q NETWORKS FOR AI LEARNING TO PLAY *GALAGA*

By Braeden Stewart
CS 5640



Picture of the video game *Galaga, The player controls the ship at the bottom*

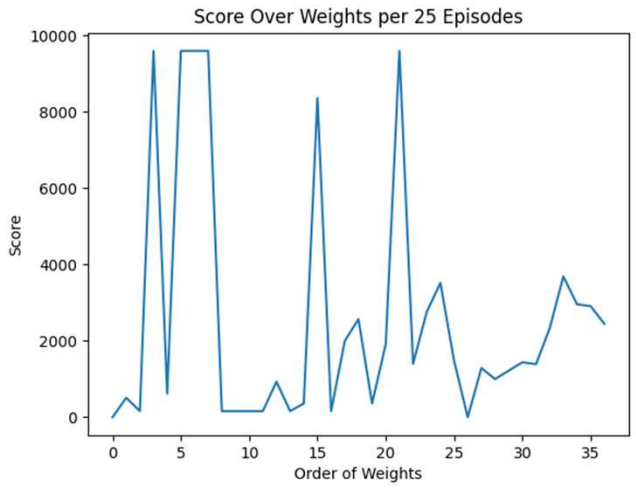
What:

- Comparing Neural Network agents to play, and beat Galaga

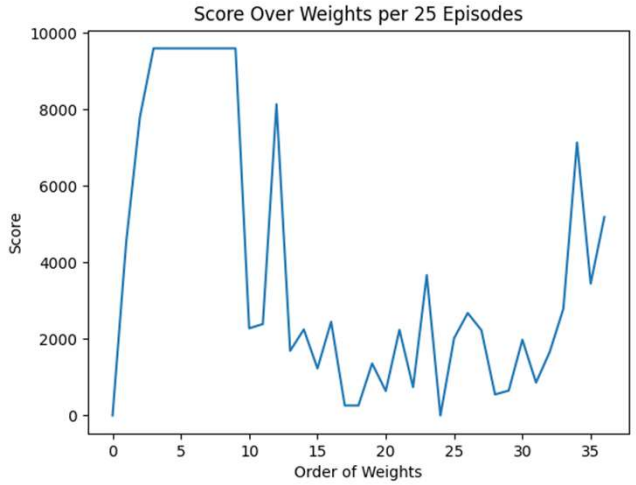
Why:

- Finding a predominant neural network design helps quicken the development of Autonomous Anti-Air emplacements
- Beat my mother's high score

DDQN:



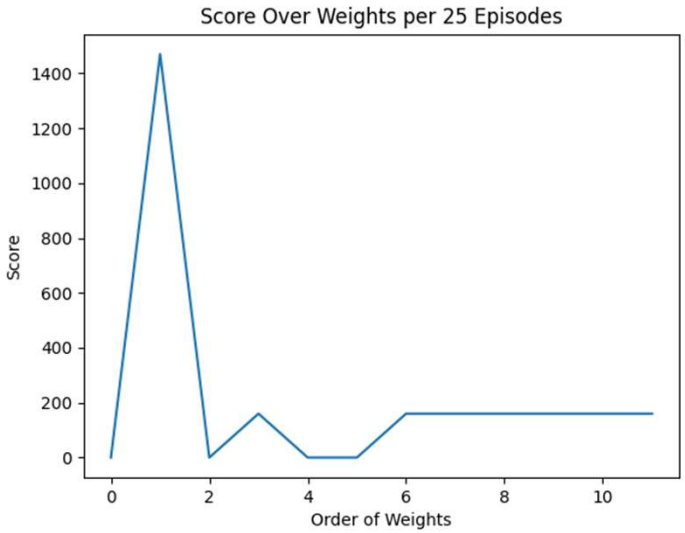
DQN:



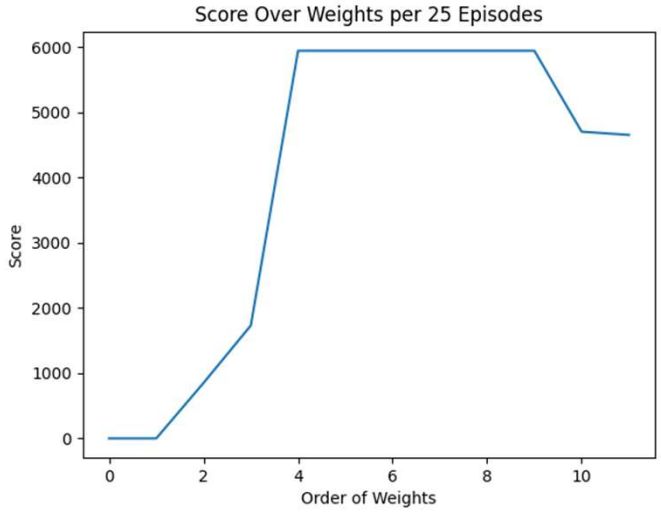
Version 1

- Implemented DDQN & DQN based off similar CNNs
- Set ε_{decay} to subtract itself divided by 50
- Set maximum count of steps per episode to 4000
- Suffered from catastrophic forgetting ~300 episodes
- DQN agent held plateau of high score longer, but did not score higher than DDQN

DDQN:



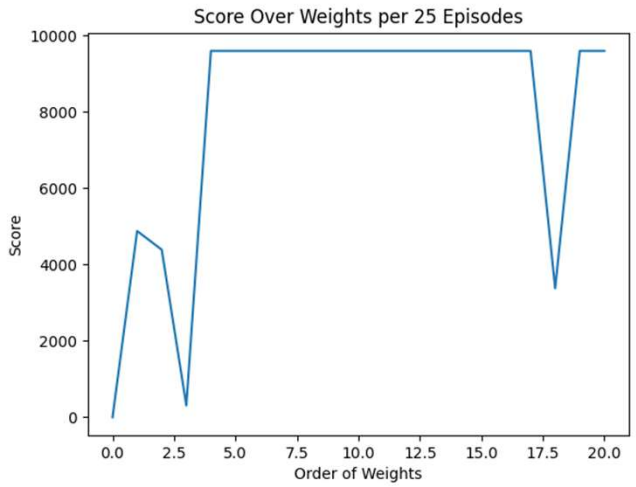
DQN:



Version 2

- Increased exploration time
- Kept maximum count of steps per episode at 4000
- Observed more consistent high scores from DQN agent
- Observed DDQN agent perform abysmally.
- Noticed that both agents were unable to play *Galaga* fully

DDQN:



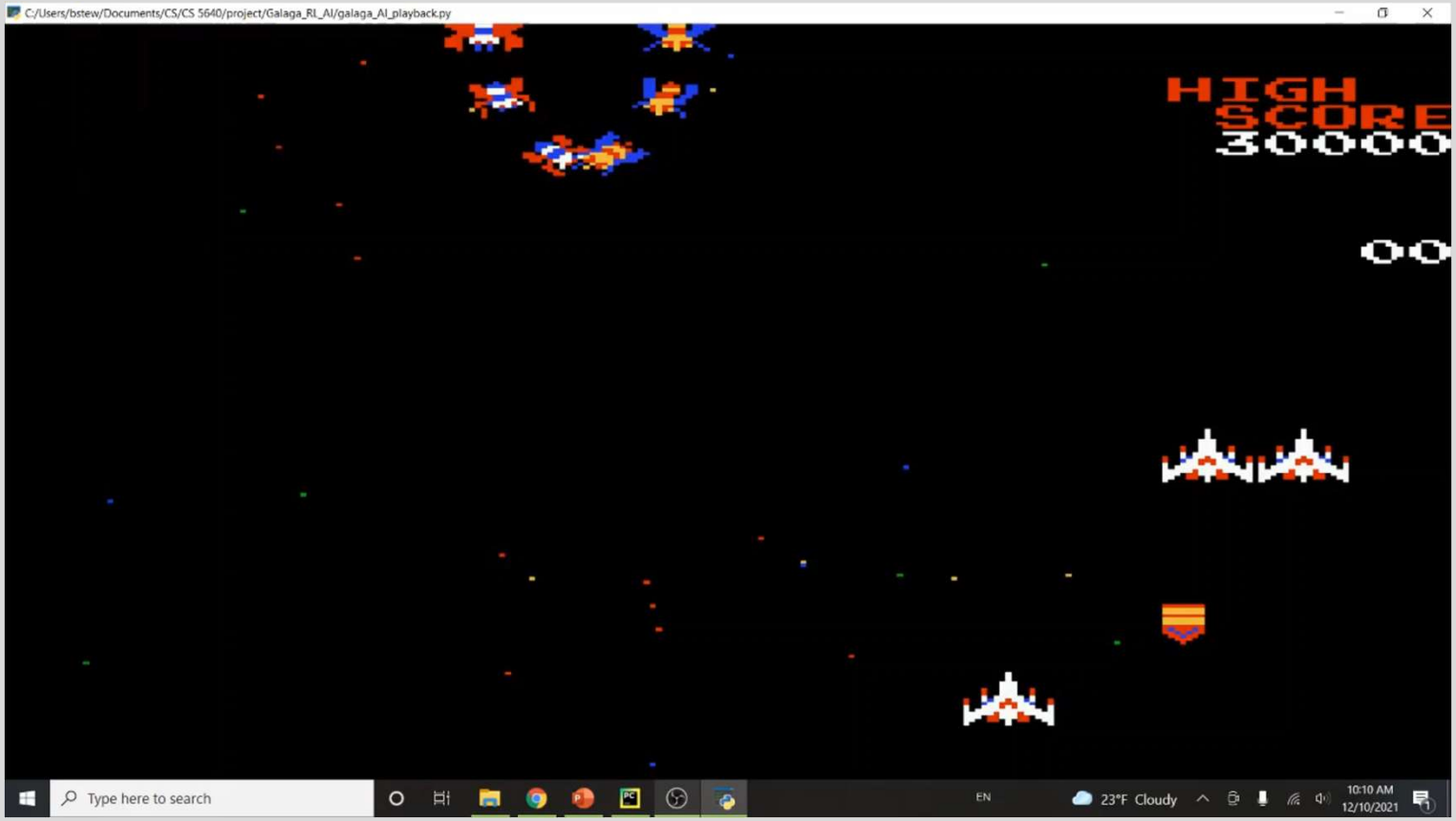
DQN:

Version 3

- Removed hard steps per episode limit
- Added idle-steps per episode limit set to 4000
- Improved DDQN performance with more consistency

Demo of “Lazy” Strategy

Demo of “Coward” Strategy



Summary & Conclusion

- Altered and compared DDQN & DQN agents
- Agents demonstrated a pattern of strategies
- Results of learning were inconclusive
- Neither agent had a decisive advantage over the other
- Mother's score remains safe, for now…