robotics lab
Intelligent Embodied Agents

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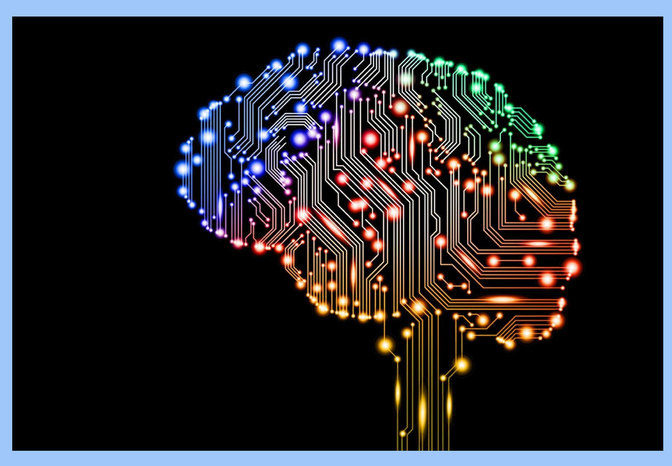
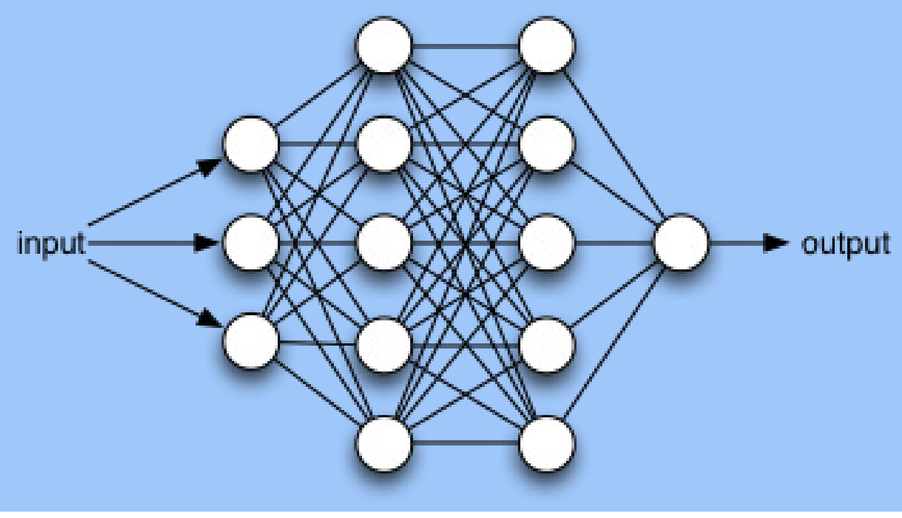
Evolving a Learning Agent using Neuroevolution in the FightingICE Game Framework

Motivation

- Artificial intelligence is the study of emulating intelligence in machines. [1]
- One fundamental attribute of intelligence is the ability to learn.
- The field of machine-learning aims to imitate this ability in machines. [2]

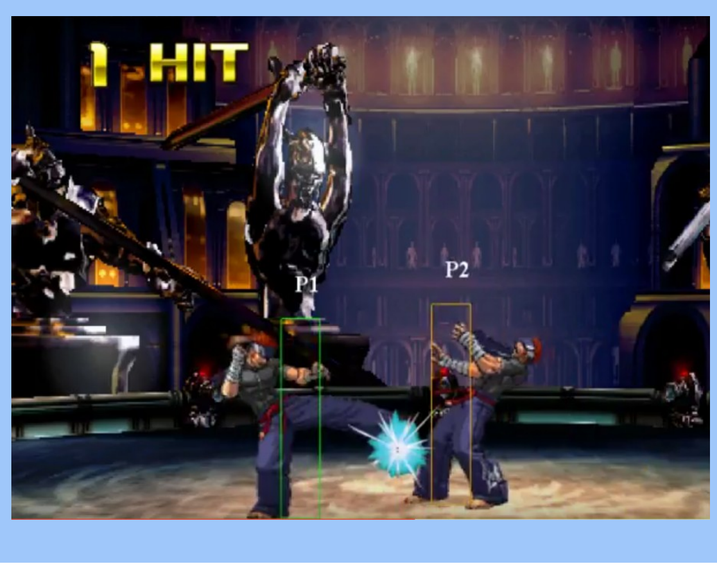


- Dissertation aims to implement the machine-learning method neuroevolution: evolutionary algorithms evolving an artificial neural network.
- Agent implemented in the FightingICE framework.
- Can the agent be evolved to a competitive level?
- Will the introduction of an incremental learning environment benefit evolution rate?



FightingICE

- 2-dimensional fighting video game.
- Java based game framework organised and maintained by Ritsumeikan University, Japan. [3]
- Two characters fight in an arena similar to popular games such as Tekken and Street Fighter.



Design

- Prototype 1 : Agent controlled by artificial neural network perceiving and acting in environment.
- Prototype 2 : Neuroevolution machine-learning method acting on weights of neural network.
- Prototype 3 : Implement incremental learning environment.

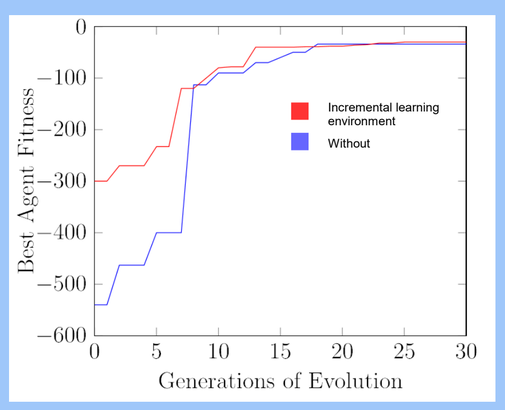
```
public void eval(int[] results) {
    int fitness;
    fitness = results[0] + results[1] + results[2];
    System.out.println("Fitness:" + fitness);
    try {
        /* Append to fitness file */
        FileWriter fw = new FileWriter(new File(EXPERIMENT_NAME +
            "/generation" + generation + ".txt"), true);
        fw.write(Integer.toString(fitness) + "\n");
        fw.close();
        ...
```

https://github.com/robbiejdunn/FightingICENeuroevolution
https://youtu.be/EIxX_CfB4Q0

Results

- Evaluate data from agent's evolution to determine effectiveness of evolution and incremental learning environment.
- Evaluate performance versus human opponent.

Agent Difficulty	Round 1 Result	Round 2 Result	Round 3 Result	Average Performance
Easy	-160	-234	-215	-169
Moderate	147	-26	37	52
Difficult	168	145	250	187



- Learning agent implemented neuroevolution successfully.
- Agent was evolved to point of being competitive versus a human opponent.
- Incremental learning environment benefits rate of agent evolution.

[1] Barto, S. (1998). Reinforcement Learning: An Introduction.
[2] Michalski, R. (1983). Machine Learning: An Artificial Intelligence Approach.
[3] FightingICE website - http://www.ice.ci.ritsumei.ac.jp/~ftgaic/index-2.html

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