MEF UNIVERSITY

Optimization of Artificial Neural Networks with using Genetic Algorithm

Presented by Ibrahim Onur Serbetci

OUTLINE

MAIN TOPICS

Project Definition

Proposed Method

Experimental Result and Conclusion

References

PROJECT DEFINITION

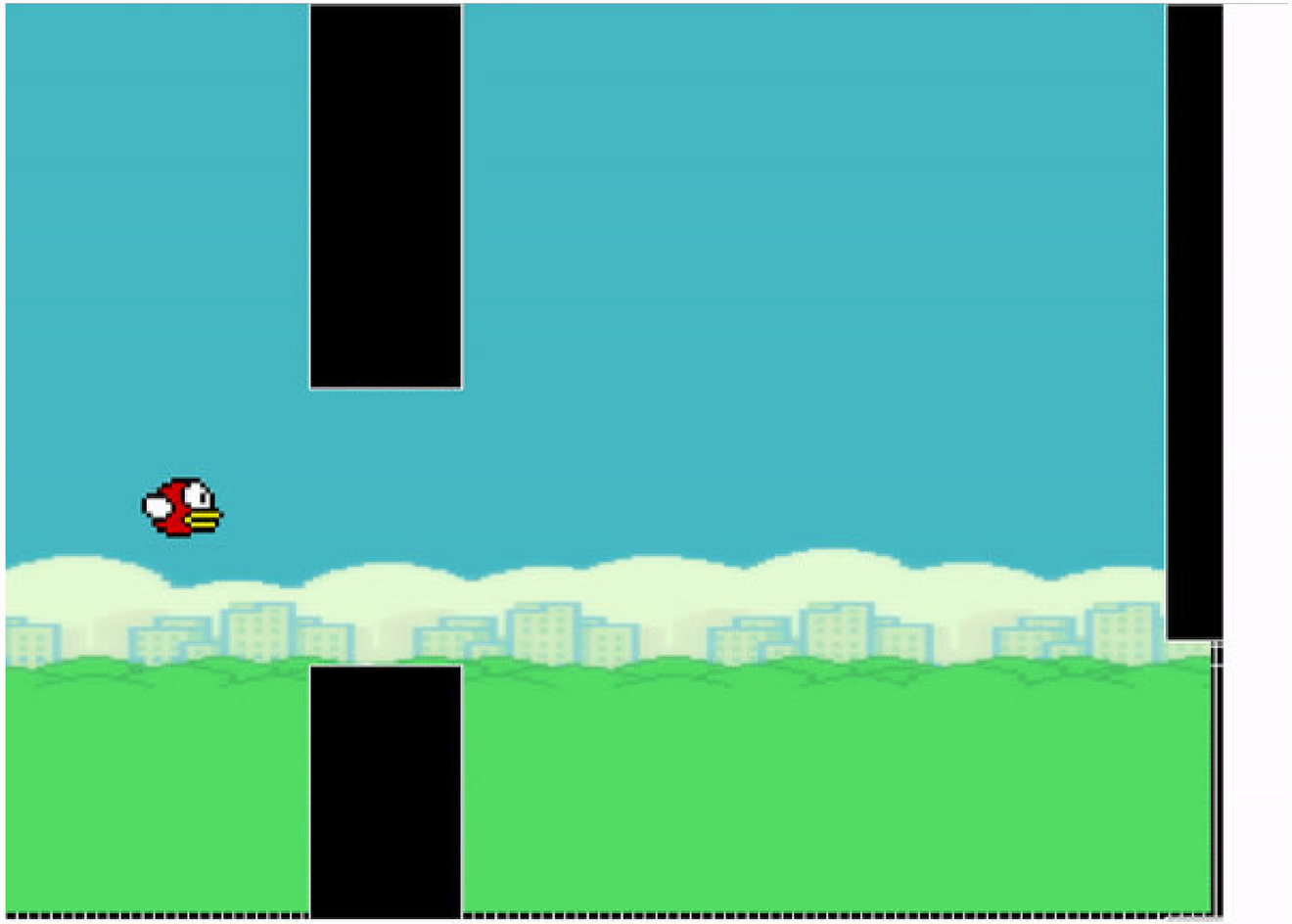
PROJECT AIM

is convert or create automated flappy bird game

PROPOSED METHOD

is optimized neural network algorithm with genetic alorithm

EXAMPLE



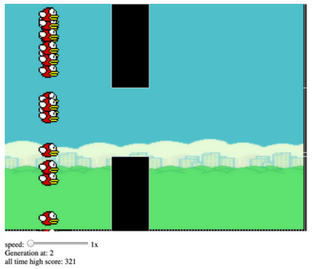
speed: 1x
Generation at: 15
all time high score: 6681

SOLUTION METHOD

GENETIC ALGORITHM AND NEURAL NETWORKS

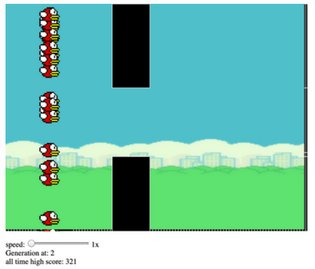
SYSTEM DIAGRAM

GAME STARTS



Random weights

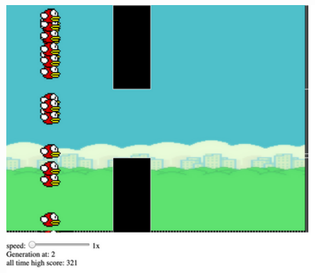
In each frame



Decide whether go up or not

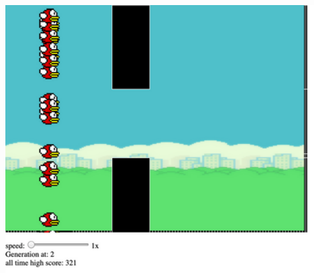
SYSTEM DIAGRAM CONT'D

GAME STARTS



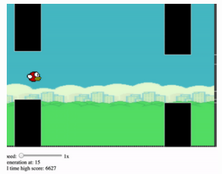
Random weights

If all birds die



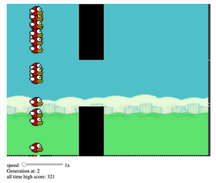
Create New Pop

Inside



Survival of the fittest

Selection of parents



Do a crossover

Pseudo Code

INITIAL POP

Create an
initial population of n
units with random
neural networks

FITNESS

For each unit
calculate
its fitness function to
measure its quality.
Chosse parents with
with prob. weighted
by their fitness values

NEW POP

When all units died,
evaluate the current
population to the
next one by using
crossover

LOOP

Return to Step 2 until
stopping criteria.

FITNESS CALCULATION

- fi is the fitness value of the bird i.
- Si is the score value of the bird i.

$$f_i = \frac{\delta i^2}{\sum_{i=0}^{n} \delta i^2}$$

IMPORTANT HYPER PARAMETERS

GENERATION SIZE

of birds in a generation

CHILD MULTIPLIER

how much rate of the new generation will be from children.

OF HIDDEN LAYERS

is a layer in between input layers and output layers

RESULT

GENETIC ALGORITHM AND NEURAL NETWORKS

EFFECT OF HIDDEN LAYERS

- Parameters settled to;
  Generation size: 500,
  Child multiplier: 0.2

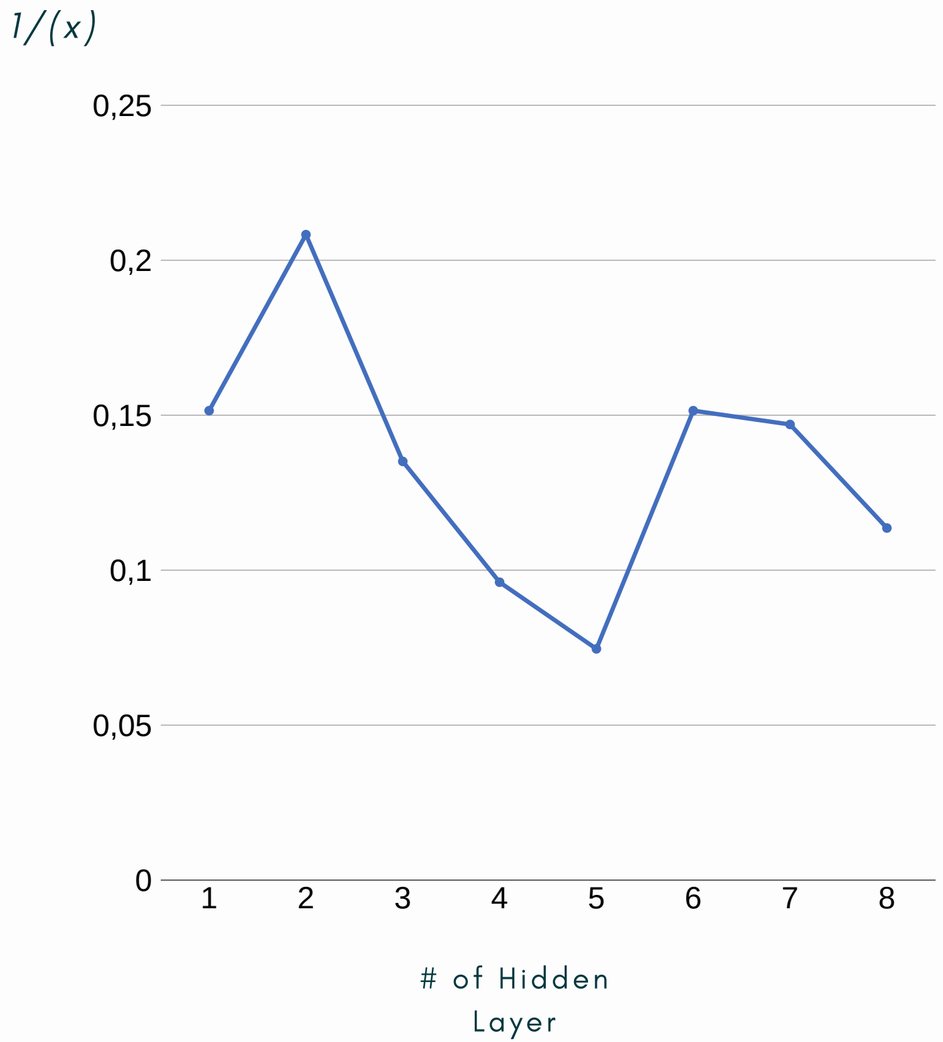
- The values in the table shown in next slide as x. It is generation number need for reaching 10k score

Gen number for 10k score	Run					Stats		
# of Hidden Layer	1	2	3	4	5	Mean	Sd	1/Mean
1	1	11	14	1	6	6,6	5,857	0,152
2	1	5	3	3	12	4,8	4,266	0,208
3	6	12	3	7	9	7,4	3,362	0,135
4	15	8	11	5	13	10,4	3,975	0,096
5	10	14	19	18	6	13,4	5,459	0,075
6	8	4	5	6	10	6,6	2,408	0,152
7	2	5	7	10	10	6,8	3,421	0,147
8	17	3	18	4	2	8,8	7,981	0,114

Figure 1. Generation number need for reach 10k score

EFFECT OF HIDDEN LAYERS CONT'D

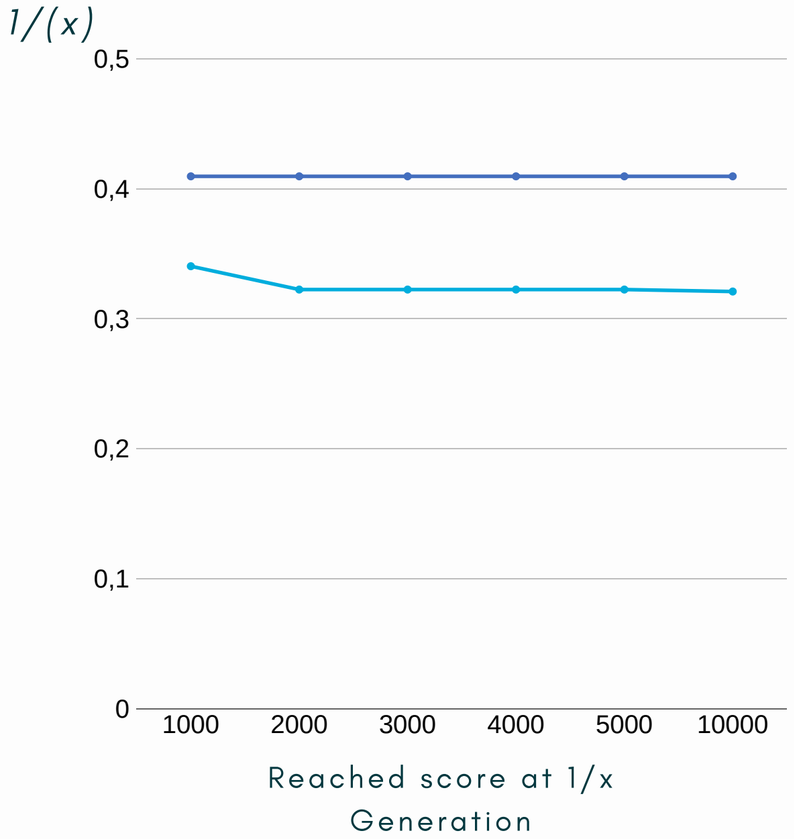
Figure 2. 1/x Generation number need for reach 10k score



PERFORMANCE

- Parameters settled to;
  Generation size: 500,
  Child multiplier: 0.2,
  #of Hidden Layer: 2

Figure 3. 1/x Generation number need for reach x label score



CONCLUSION

GENETIC ALGORITHM AND NEURAL NETWORKS

CHECKLIST

NEURAL NETWORK

Neural network class created. Creates input for Genetic Algorithm.

GENETIC ALGORITHM

Genetic algorithm class created. Working fine. Could be add mutate etc.

NEURO-FLAPPY BIRD

Game created. Machine is playing it. But has some bug about bird hit pipes.

WHAT IS NEXT?

Bugs can be fixed and Genetic Algorithm can be improved more.

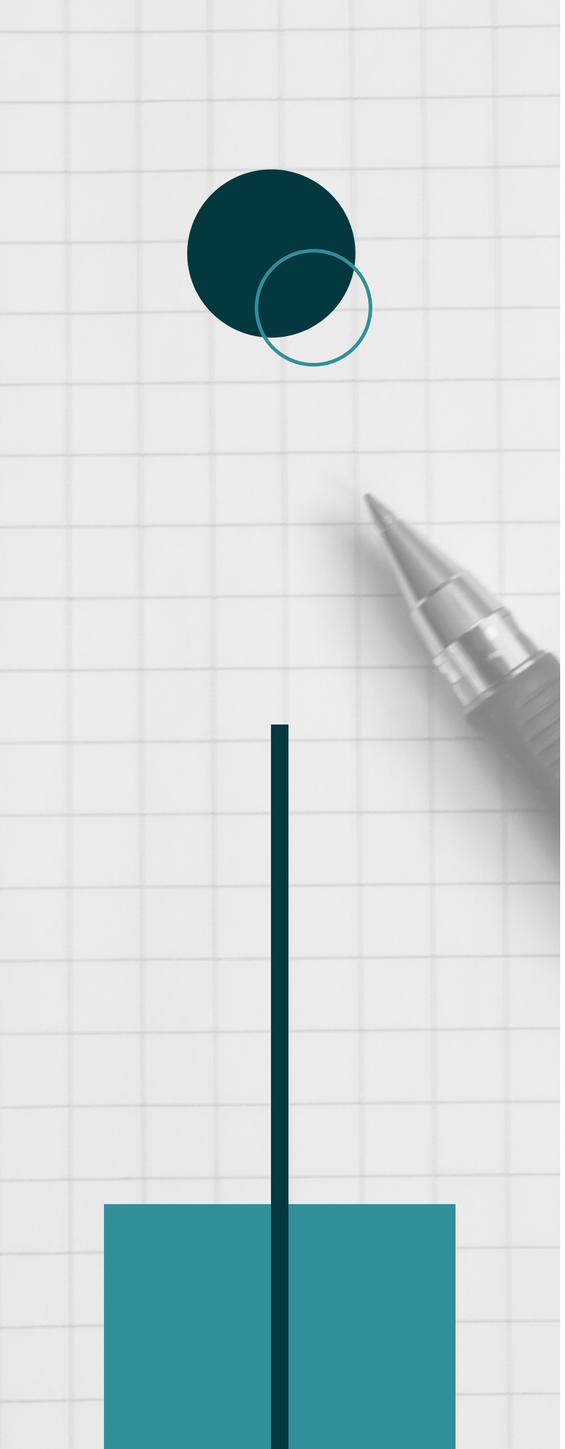
ADDITIONALS

GITHUB REPOSITORY

github.com/iboraham/Introduction-to-Machine-Learnign-Term-Project

ONLINE P5.JS EDITOR

editor.p5js.org/iboraham/present/OOT8c-nLL



REFERENCES

ONLINE VIDEOS

[1]D. Shiffman, Coding Challenge #100.1: Neuroevolution Flappy Bird, 2020. [Online]. Available: https://www.youtube.com/watch?v=c6y21FkaUqw. [Accessed: 27- May- 2020].

BOOKS

[2]D. Shiffman, The nature of the code. [S.l.]: D. Shiffman, 2012.

ARTICLES

[3]A. Gad, "Artificial Neural Networks Optimization using Genetic Algorithm with Python", Medium, 2020. [Online]. Available: https://towardsdatascience.com/artificial-neural-networks-optimization-using-genetic-algorithm-with-python-1fe8ed17733e. [Accessed: 27- May- 2020].

THANK YOU!

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