



# Training an Image Classifier with the Genetic Algorithm to Differentiate Between Roses and Irises

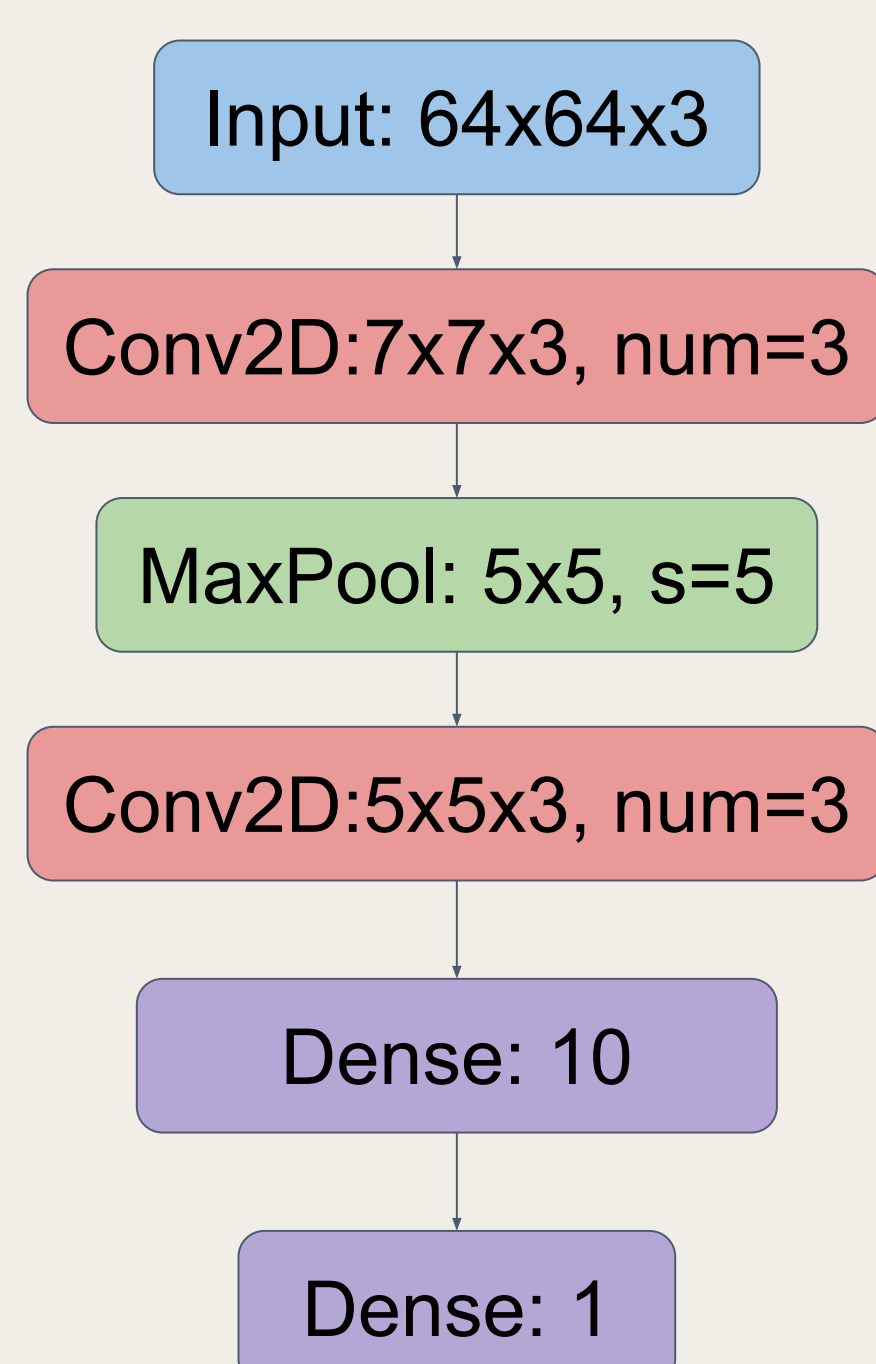
Rob Bray

## Introduction

- Genetic algorithms have been used to evolve image classifiers in the past, such as a semantic classifier using color data.<sup>1</sup>
- Goal: examine the efficacy training a convolutional neural network with the genetic algorithm for classifying two different flowers, an iris and a rose.
- Parameters examined: mutation probability, crossover probability, parent selection strategy, tournament size, and number of parents selected from.

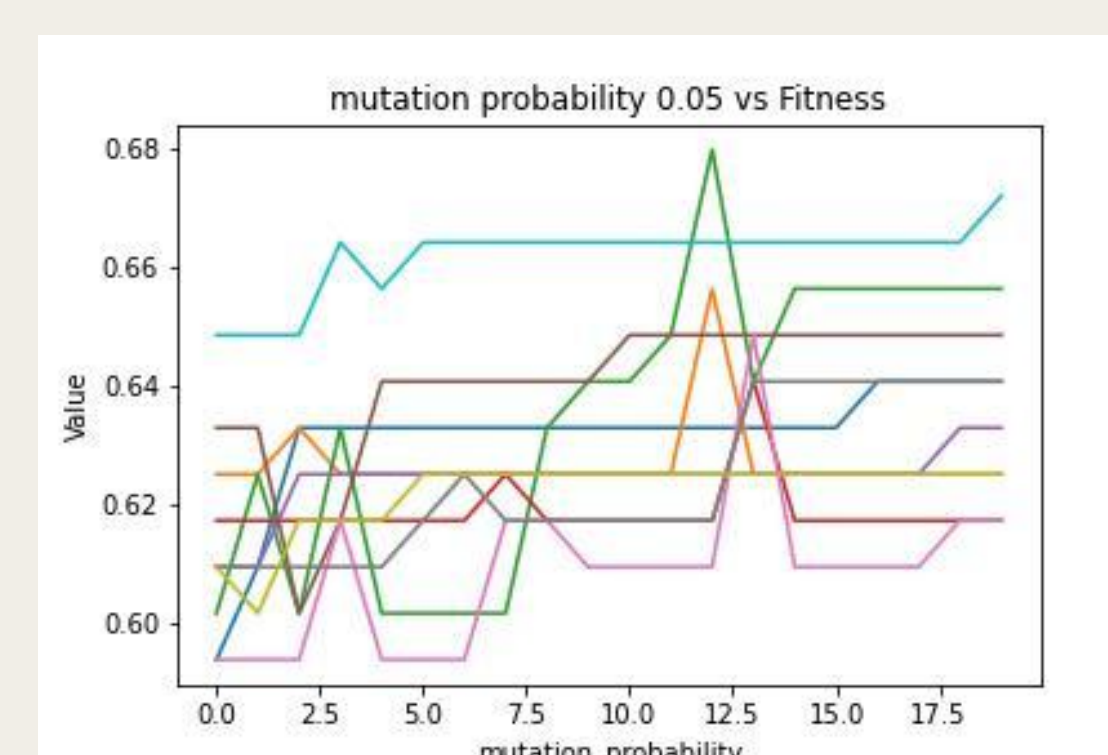
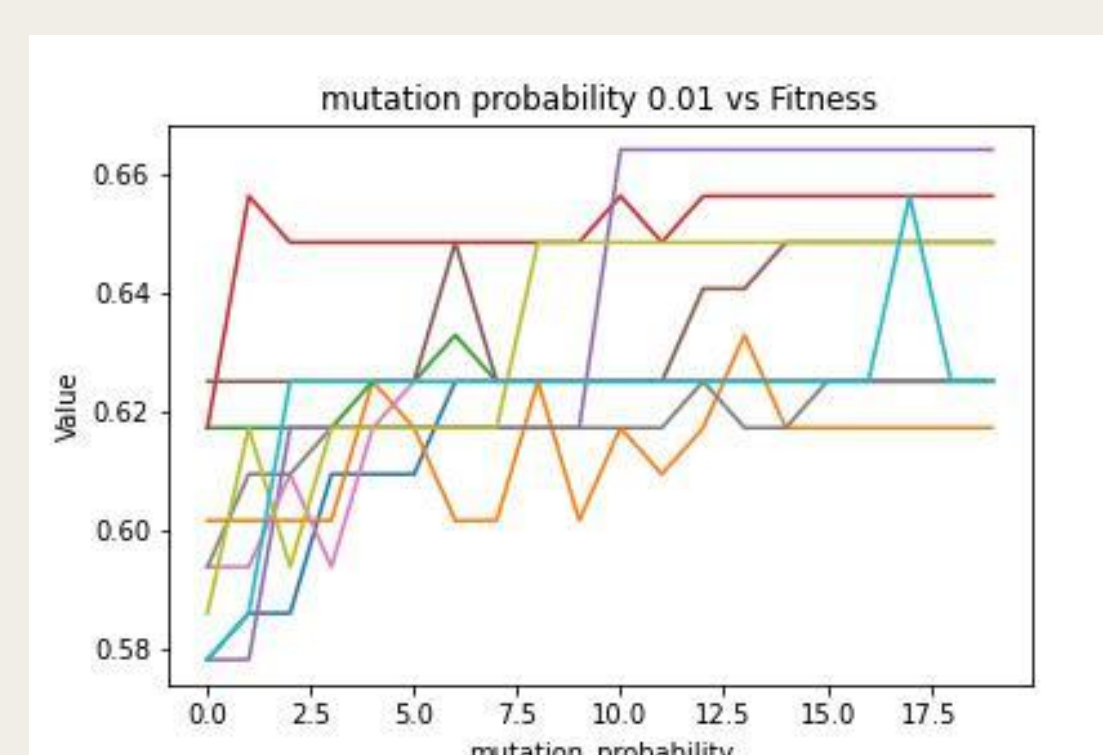
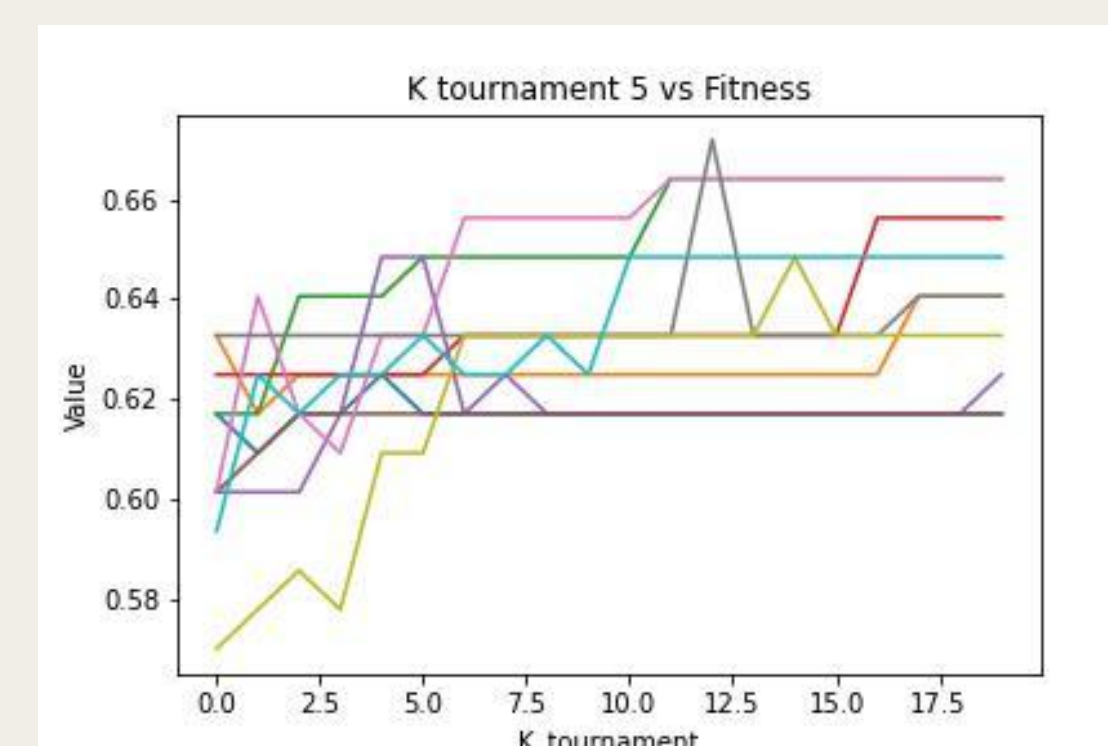
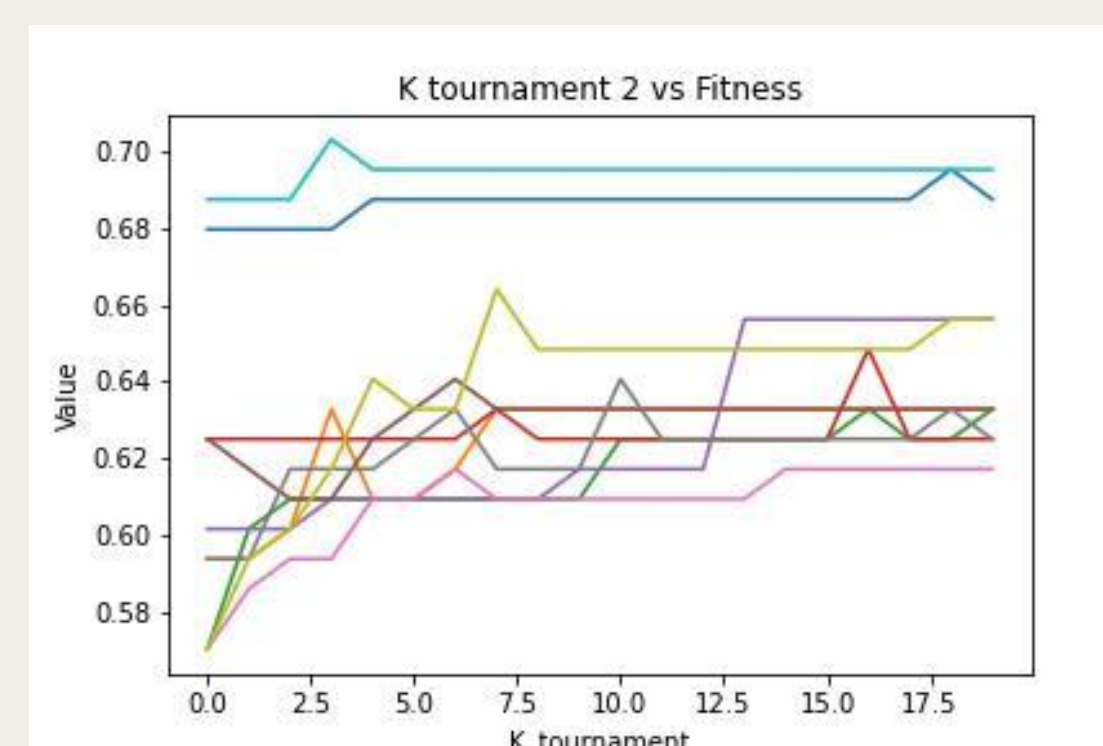
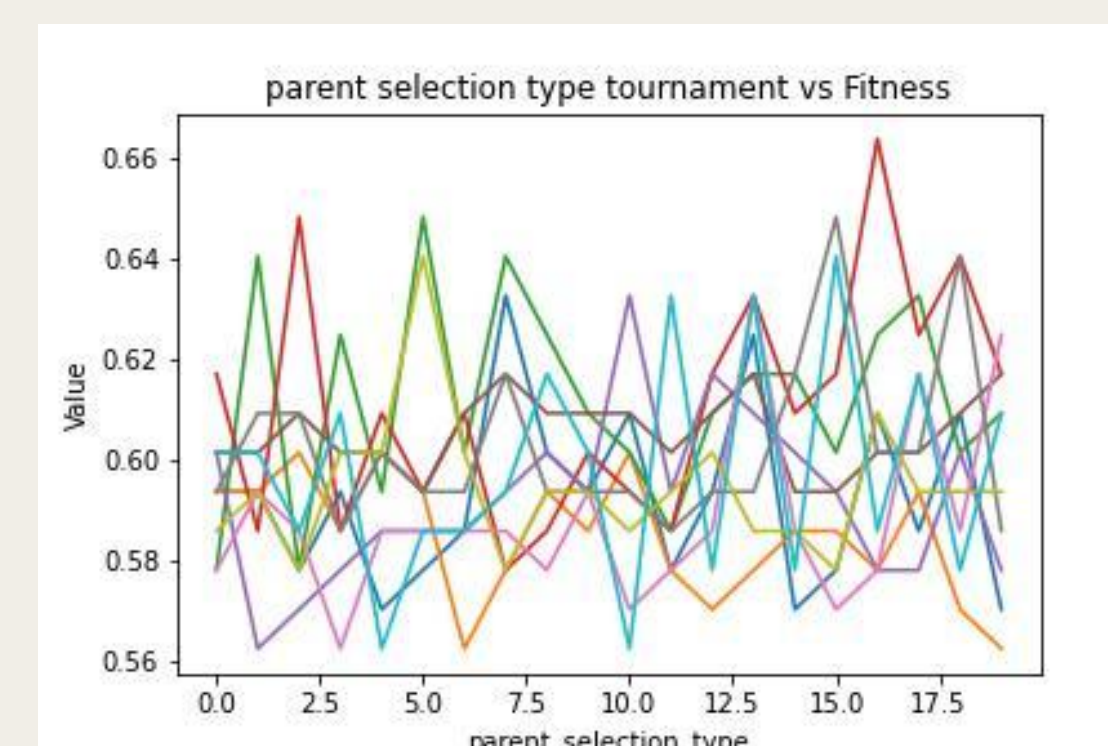
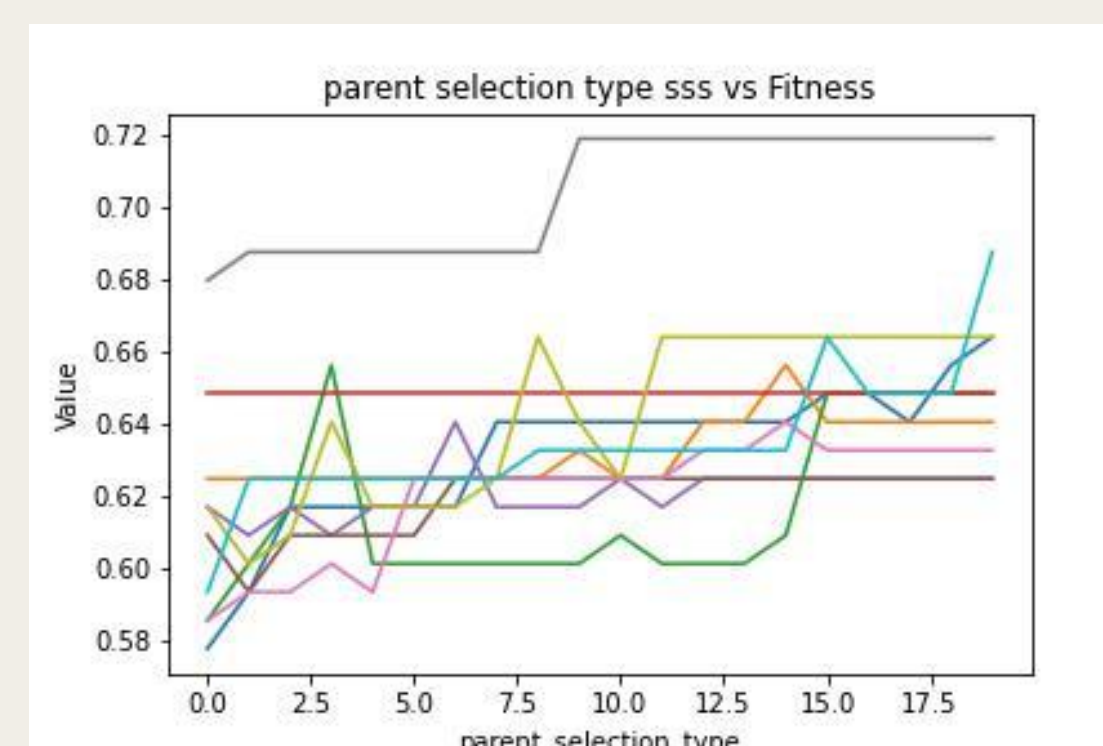
## Methodology

- 2055 flower images<sup>2</sup>
  - 1055 Iris
  - 1000 Rose
  - Size: 64x64x3
- PyGAD framework for training Keras model
  - Batch Size: 128
  - Number of Solutions: 50
  - Number of Generations: 20
  - Each generation trained on one batch
  - Each run, select a hyperparameter to change
  - Fitness: accuracy of predictions
- **CNN structure:**



## Results

- Training accuracies reached around 65-72%
- Testing accuracies stayed around 50%
- Backpropagation Training Accuracy: 72%
- Best-Performing Hyperparameters:
  - Parent Selection: steady-state
  - Tournament K: 5
  - Mutation Probability: 0.01
  - Number of Parents Selected From: Inconclusive
  - Crossover Probability: 0.3



## Conclusion

- Training accuracies reached comparable levels to backpropagation.
- Testing accuracy is low. The model is likely overfitting to training data because of how small it is.
- For future work, a larger model would be able to generalize and perform better on testing data. This was not done because of compute time and resources.

