

Project Genome

Genetic Algorithm for Deep Learning Optimization



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COM S 402 Fall 2020

Project Description

- Implemented a genetic algorithm to quickly find optimal parameters & hyperparameters for deep learning convolutional neural networks (CNNs) on a given image dataset.
- Deep learning CNNs require extensive manual trial and error with expensive resources to find an optimal parameter set.
- With our solution, Vermeer can get the best Deep Learning CNN model saved with optimal architecture and parameters for their given image dataset.

Client

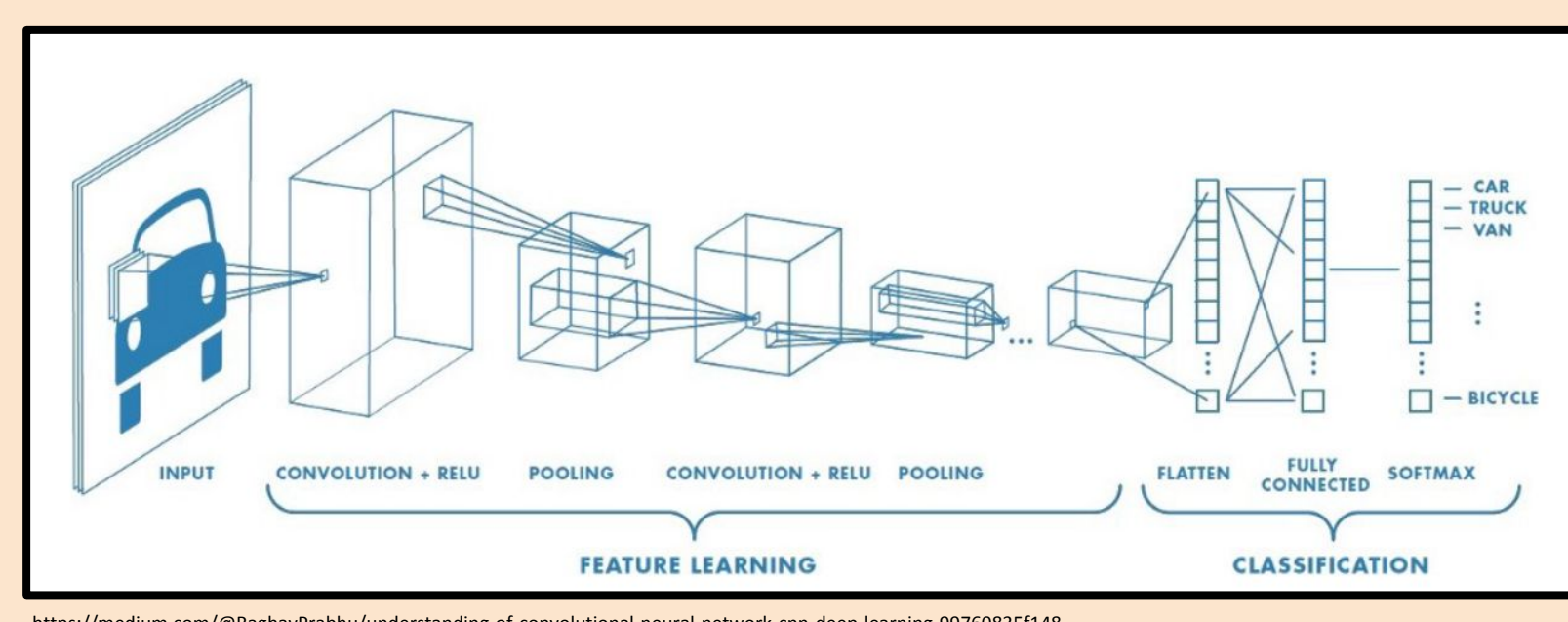
Vermeer Corporation

Project Owner

Dr. Reza Morsali

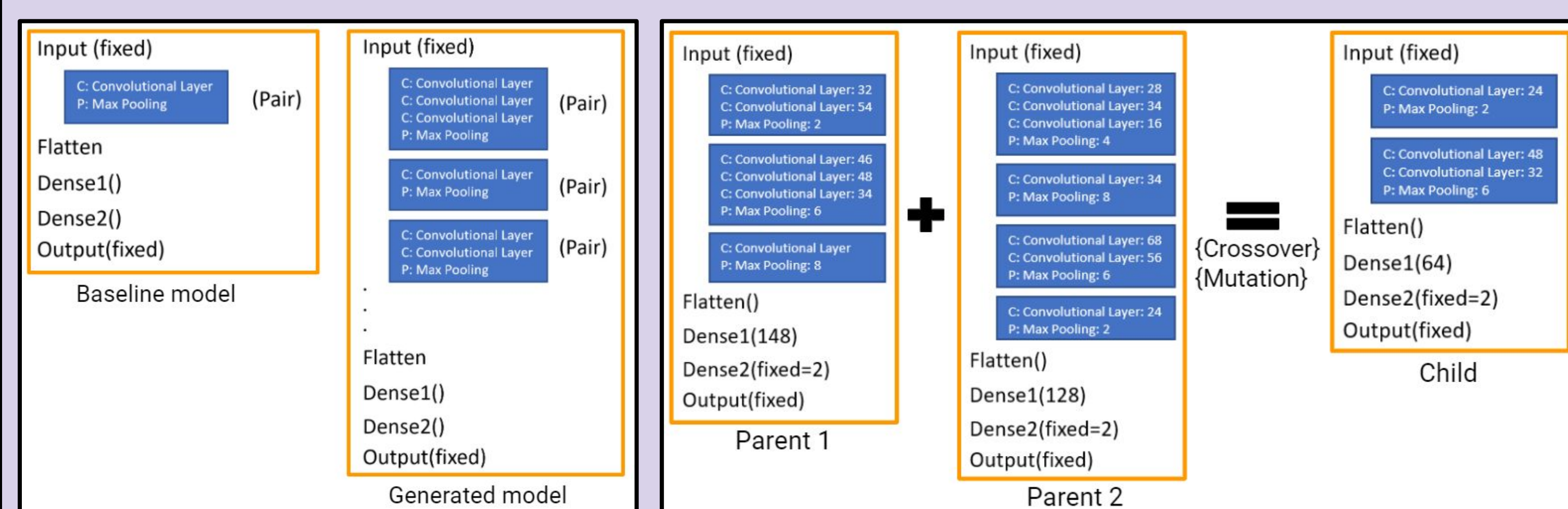
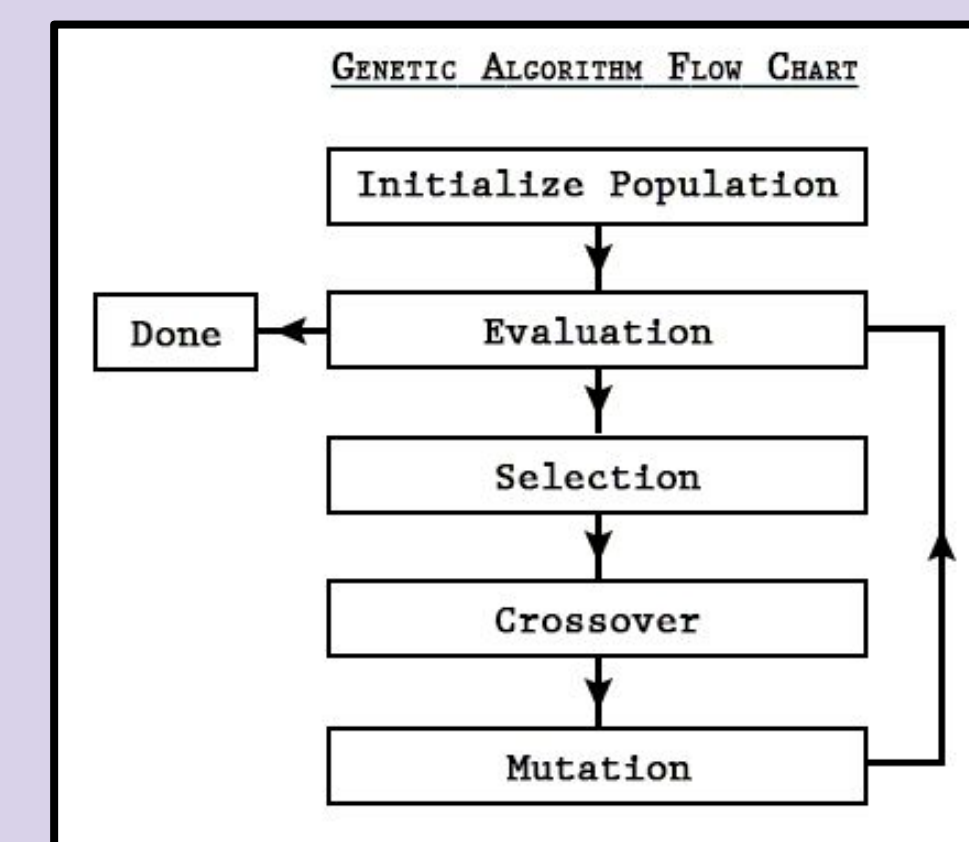
Advisor

Dr. Adisak Sukul



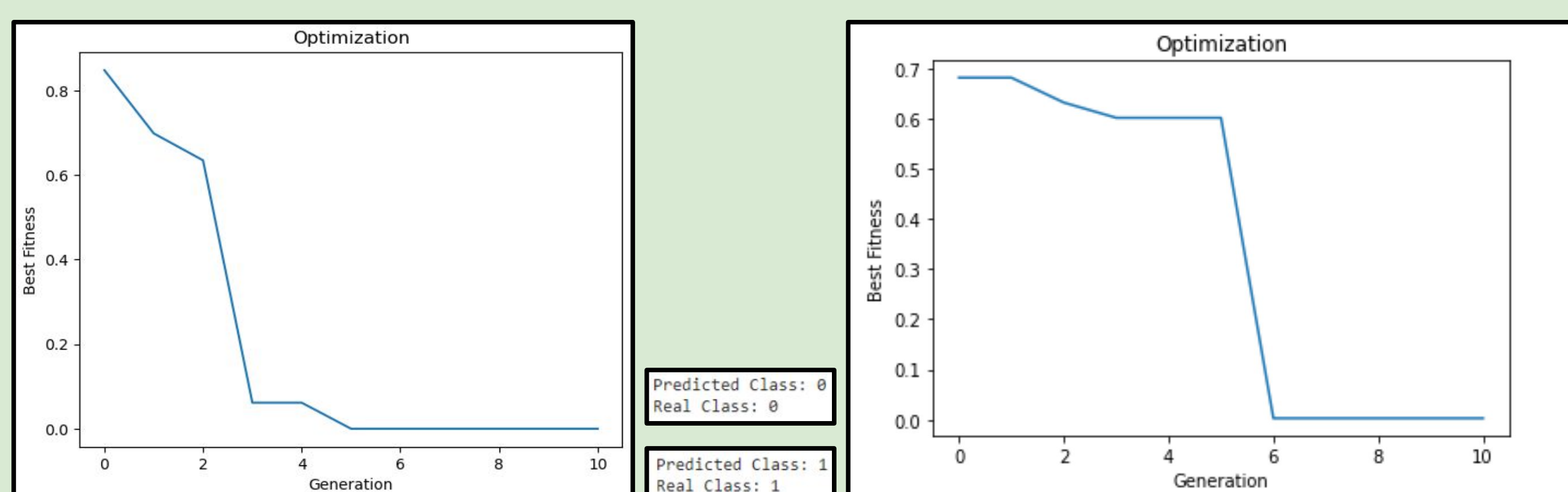
Algorithm

- Implement a Genetic Algorithm
 - Goal = minimize Validation Loss
- Create Fitness Function
 - Integrate with Genetic Algorithm
 - Create baseline CNN model
 - Fitness Criterion = Validation Loss
- Add variables for Genetic Algorithm to optimize
 - Batch Size, Activation Function, Optimizer
 - Layers - Conv2D, Max Pooling, Dense Layers
 - Filter size, Pooling Size, Number of Nodes
 - Number of Pairs & Number of layers in each Pair



Results

- Successfully works on Vermeer Data
 - Validation Loss brought to minimum
 - Converges very well
 - Near 100% accuracy, and 0.0 % loss on test data
- Best Model & Parameters Saved



Future Work

- Add more hyper parameter variables
- Test new / complex Datasets
- Compare results with other Research Algorithms
- Write a paper on the Algorithm

Limitations

- Uses lots of memory
- Needs lots of computation
- Tested algorithm on few datasets

What went right

- Great teamwork
- Quick learning of Genetic Algorithms and Convolutional Neural Networks
- Consistent communication with client
- Quality product produced
- Timely and helpful resources provided by ISU advisor
 - GCP VMs, Coursera, Learning Material

Lessons Learned

- Have a more defined goal earlier
- Work more as a team at times to consolidate work, knowledge, and experience