Course Project

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***Abstract*—We applied steepest-ascent hill climbing search algorithm on the pool of Gnome and moved to best accuracy gnome. We defined our goal as accuracy greater then 75 percent and also tried to keep the number of parameter minimum. we defined heuristic equal to accuracy divided by parameter and we update the value of accuracy only when the heuristic value of current gnome string is greater than the heuristic value of previous gnome.**

***Index Terms*—NAS, CNN, Fashion-MNSIT,Genome, Activation Function**

I. Introduction

Create Search algorithm in Neural Architecture Search (NAS) space for the best performing Convolutional Neural Network (CNN) architecture on the fashion-mnist data-set.

II. Neural Architecture Search (NAS)

Neural Architecture Search aims at discovering the best architecture for a neural network for a specific need. NAS essentially takes the process of a human manually tweaking a neural network and learning what works well, and automates this task to discover more complex architectures. This domain represents a set of tools and methods that will test and evaluate a large number of architectures across a search space using a search strategy and select the one that best meets the objectives of a given problem by maximizing a fitness function.

III. Convolutional Neural Network (CNN)

A Convolutional Neural Network (CNN) is a Deep Learning algorithm which can take in an input image, assign importance (learnable weights and biases) to various aspects/objects in the image and be able to differentiate one from the other. The pre-processing required in a CNN is much lower as compared to other classification algorithms. While in primitive methods filters are hand-engineered, with enough training, CNN have the ability to learn these filters/characteristics.The architecture of a CNN is analogous to that of the connectivity pattern of Neurons in the Human Brain and was inspired by the organization of the Visual Cortex. Individual neurons respond to stimuli only in a restricted region of the visual field known as the Receptive Field. A collection of such fields overlap to cover the entire visual area

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IV. Fashion-MNIST Dataset

Fashion-MNIST is a dataset of Zalando's article images—consisting of a training set of 60,000 examples and a test set of 10,000 examples. Each example is a 28x28 grayscale image, associated with a label from 10 classes. Zalando intends Fashion-MNIST to serve as a direct drop-in replacement for the original MNIST dataset for benchmarking machine learning algorithms. It shares the same image size and structure of training and testing splits.

V. Hill Climbing Algorithm

Hill climbing algorithm is a local search algorithm which continuously moves in the direction of increasing elevation/value to find the peak of the mountain or best solution to the problem. It terminates when it reaches a peak value where no neighbor has a higher value. It is also called greedy local search as it only looks to its good immediate neighbor state and not beyond that. A node of hill climbing algorithm has two components which are state and value. Hill Climbing is mostly used when a good heuristic is available. In this algorithm, we don't need to maintain and handle the search tree or graph as it only keeps a single current state.

A. Steepest-Ascent hill climbing used as Search Algorithm

- The steepest-Ascent algorithm is a variation of simple hill climbing algorithm. This algorithm examines all the neighboring nodes of the current state and selects one neighbor node which is closest to the goal state. This algorithm consumes more time as it searches for multiple neighbors.
- Step 1: Evaluate the initial state, if it is goal state then return success and stop, else make current state as initial state.
- Step 2: Loop until a solution is found or the current state does not change.
- Step 3:Let SUCC be a state such that any successor of the current state will be better than it.
- Step 4:For each operator that applies to the current state: (a).Apply the new operator and generate a new state. (b).Evaluate the new state. (c).If it is goal state, then return it and quit, else compare it to the SUCC. (d).If it is better than SUCC, then set new state as SUCC. (e).If

the SUCC is better than the current state, then set current state to SUCC.

- Step 5: Exit.

VI. Result

Gnome string:NC 64 1 relu;RC 32 2 gelu;RC 32 2 gelu;FL gelu;
Best test accuracy: 0.8008000254631042
Return value: (0.8008000254631042, 0.8080833554267883, 140490)