Machine Learning Lab Mini Project

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Problem statement

Comparing neuro-evolutionary optimization techniques (Genetic Algorithm) with traditional gradient descent optimization through backpropagation in neural networks

Description

The main aim of the project is to compare the performance of optimization techniques in order to arrive at tuned hyper-parameters of the neural network architecture. This is performed using the neuro-evolutionary method ie. Genetic Algorithm and the traditional neural network Gradient Descent optimization.

Datasets

We propose to evaluate our algorithms on a multitude of datasets, and have currently selected 2 for immediate consideration : the Iris dataset and the CIFAR-10 dataset.

This is perhaps the best known database to be found in the pattern recognition literature. Fisher's paper is a classic in the field and is referenced frequently to this day. (See Duda & Hart, for example.) The data set contains 3 classes of 50 instances each, where each class refers to a type of iris plant. One class is linearly separable from the other 2; the latter are NOT linearly separable from each other.

The CIFAR-10 dataset consists of 60000 32x32 colour images in 10 classes, with 6000 images per class. There are 50000 training images and 10000 test images. The dataset is divided into five training batches and one test batch, each with 10000 images. The test batch contains exactly 1000 randomly-selected images from each class. The training batches contain the remaining images in random order, but some training batches may contain more images from one class than another. Between them, the training batches contain exactly 5000 images from each class.

ML techniques used

1. Deep Artificial Neural Networks
2. Neuroevolution using Genetic Algorithm
3. Gradient descent optimization algorithms - SGD, Adam, Nesterov Momentum
4. Classification

Progress

In the first phase, we've tested both the techniques of optimization on the iris dataset by running the same Neural Network architecture for 100 epochs. The accuracies achieved are as follows

Architecture	Dataset	Training Accuracy (given hyperparameters)	Validation Accuracy (given hyperparameters)
ANN with Gradient Descent Optimization	**iris**	**35.99%**	**23.33%**
ANN with GA optimization	**iris**	**66.67%**	**-**