Noisy Heuristics NAS: A Network Morphism based Neural Architecture Search using Heuristics

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Introduction

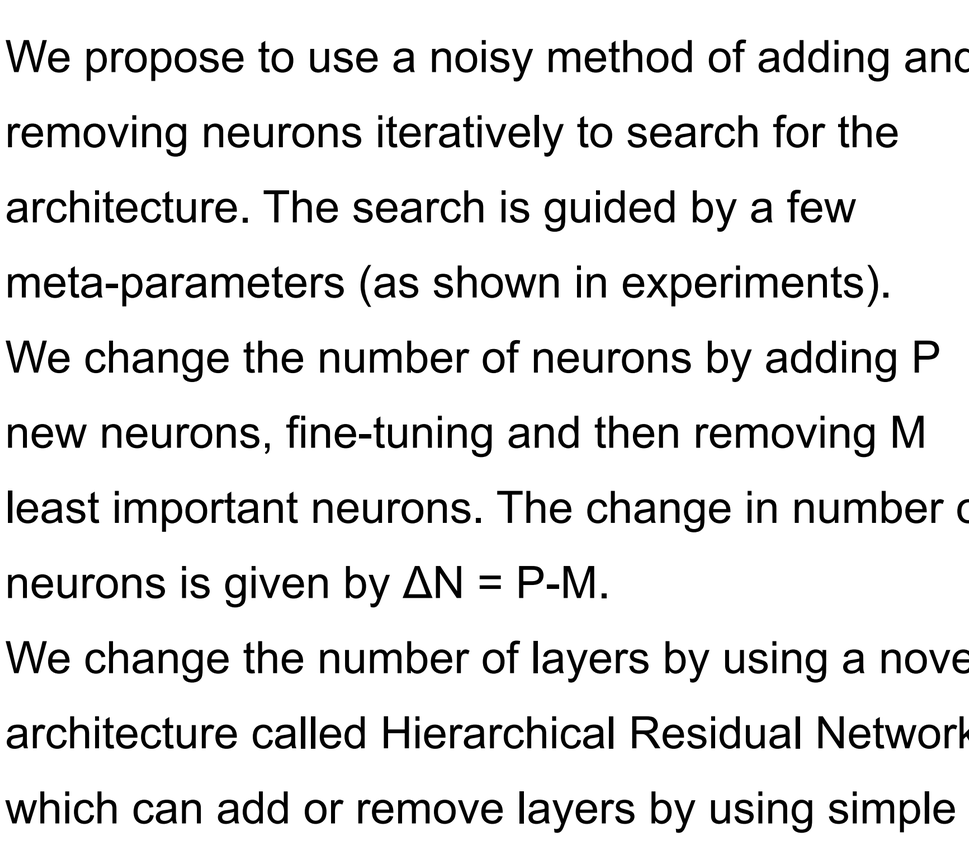
- Network Morphism based NAS is efficient but generally requires Reinforcement Learning or Bayesian Optimization for morphism operations due to a large number of possible choices.
- We search for simple, easy-to-understand and fast heuristic for Network Morphism based NAS.

Motivation

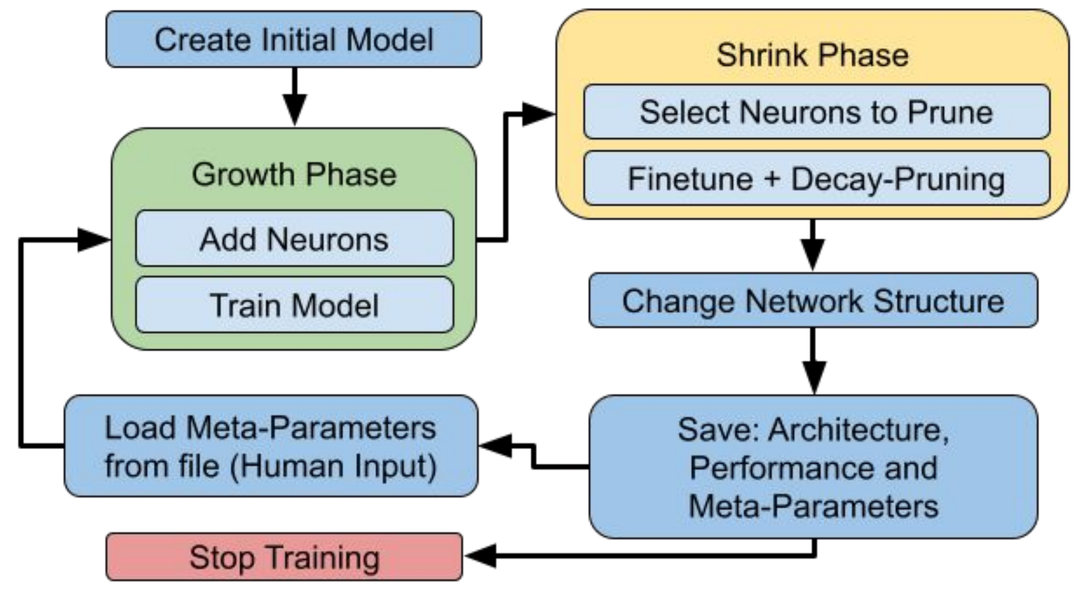
- Dropout, Pruning and Network Morphism suggest that Artificial Neural Networks are robust to small perturbations and additions of neurons.
- Biological Neural Networks suggests that a single model can change the architecture in time by means of neurogenesis, pruning and migration without drastically affecting the overall function.

Our Method

- We propose to use a noisy method of adding and removing neurons iteratively to search for the architecture. The search is guided by a few meta-parameters (as shown in experiments).
- We change the number of neurons by adding P new neurons, fine-tuning and then removing M least important neurons. The change in number of neurons is given by $\Delta N = P-M$.
- We change the number of layers by using a novel architecture called Hierarchical Residual Network which can add or remove layers by using simple heuristics.

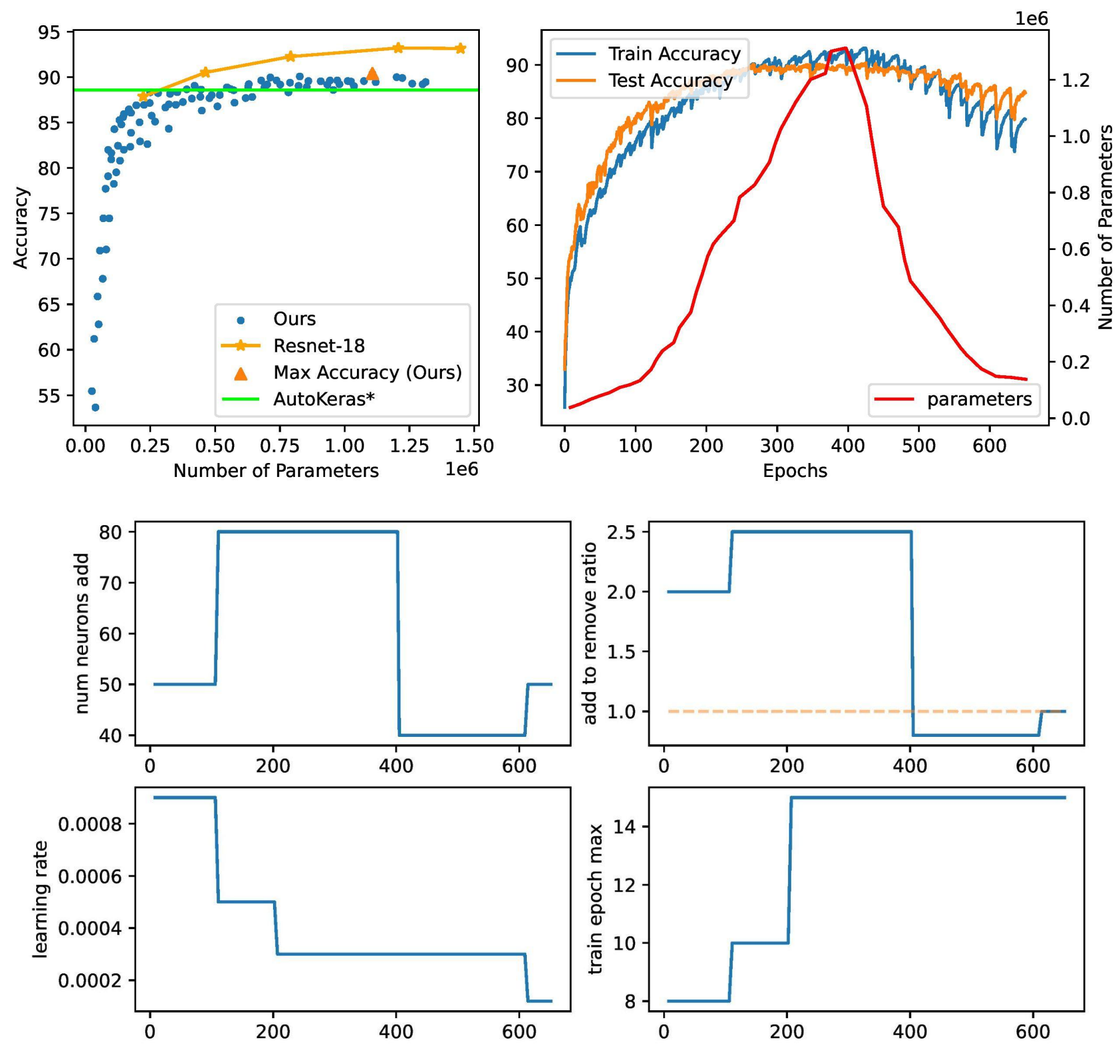


Pipeline:



Experiments

CIFAR-10 (With Expanding and Shrinking Demo)



- While testing for 5 different parameter ResNets, we spend a total of *(200×5=)* 1000 epochs which is higher than we train our method for (≈600).
- Other experiments show that our method can achieve performance similar to highly engineered ResNet-18 with a similar number of parameters on CIFAR-10 and CIFAR-100 datasets.

Conclusion

The experiments show that Neural Network architecture can be searched using simple heuristics and network morphism. Our method finds architecture of varying sizes and can be increased or decreased in capacity to fit the given dataset.