Neural Architecture Search with Reinforcement Learning

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Q1. What is the problem being solved?

- They used a recurrent network to generate the model descriptions of neural networks and train this RNN with reinforcement learning to maximize the expected accuracy of the generated architectures on a validation set.
- Although designing architectures has become easier, it still requires a lot of expert knowledge and takes ample time.

Q2. What is unique about the suggested solution?

- They used a controller to generate architectural hyperparameters of neural networks. To be flexible, the controller is implemented as a reccurrent neural network.
- This paper presents Neural Architecture Search, a gradient-based method for finding good architectures.
- This paper is based on the observations that the structure and connectivity of a neural network can be typically specified by a variable-length string
  - For possible to use a recurrent network - the controller – to generate such string.
  - Training the network specified by the string – the "child network" – on the real data will result in an accuracy on a validation set.
  - Using this accuracy as the reward signal, they can compute the policy gradient to update the controller. As a result, in the next iteration, the controller will give higher probabilities to architenctures that receive high accuracies. (the controller will learn to improve its search over time.)

Q3. How is the idea evaluated?

- Better accuracy and better velocity with CIFAR-10 dataset and Penn Treebank then other human-invented architecthre.
  - CIFAR-10 dataset: model achieves a test error rate of 3.65, which is 0.09 percent better and 1.05x faster than the previous SOTA model that used a similar architectural scheme.
  - Penn Treebank dataset: model can compose a novel reccurent cell that out-performs the widely used LSTM cell, and other SOTA model baselines. their cell achieves a test set perplexity of 62.4 on the Penn Treebank, which is 3.6 perplexity better than the previous SOTA model.
  - The cell can also be transferred to the character language modeling task on PTB and achieves a state-of-the-art perplexity of 1.214