

Abstract

Neural networks are incredibly powerful tools for a variety of different situations. However, their development can be difficult, time-consuming, and expensive. To address this, the field of Neural Architecture Search (NAS) seeks to provide automated algorithms to produce optimal network designs. However, recent criticism has been levied towards these algorithms regarding their performance compared to a purely random search strategy. Additionally, these algorithms themselves require a significant amount of configuration, limiting their ability to ease the costs of network design. To examine these criticisms BonsaiNet is presented, a NAS algorithm that operates over a significantly broadened search space that is a superset to those used by other leading NAS algorithms. This broadened search space lowers the average quality of random networks in the space, while preserving high-quality networks to be potentially discovered by NAS. Indeed, BonsaiNet still produces networks competitive with the state-of-the-art, indicating that random search is only competitive with NAS in over-constrained search spaces. Furthermore, BonsaiNet employs a *large-cell* design pattern which eliminates the need to specify the count or types of each individual cell in the model, thus significantly reducing the necessary configuration. To further examine the random search and configuration concerns, SpiderNet is presented, a NAS algorithm that dynamically evolves from a minimal initial state within an infinitely large search space. This transfers the burden of determining network size and macro-level connectivity patterns of the networks from the user to the algorithm, drastically reducing the amount of configuration necessary to provide good results. Indeed, despite the infinite search space and minimal configuration, SpiderNet produces highly competitive models. Furthermore, it consistently produces more time and parameter efficient models than random search, indicating two new dimensions by which NAS can have an advantage over random search. As such, BonsaiNet and SpiderNet demonstrate that random search’s comparable ability to NAS is an illusion produced by both an over-constrained search space and a disregard for time and parameter efficiencies. Additionally, both algorithms provide a strong proof-of-concept towards a minimal-configuration NAS algorithm.