**NAS Papers Comparison**

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[go/nas-papers-comparison](http://go/nas-papers-comparison)

**Table-1. NAS for Image Classification**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Paper** | **Publish Date** | **Venue** | **Author** | **Cited By** | **Search Space** | **CNT** | **WS** | **Search Method** | **Meta-controller** | **Nested** | **Cell** | **Proxy** | **MC** | **GPU Days** | **ES** | **ImageNet** | **Latency** | **Code** |
| Neural Architecture search with reinforcement learning | 20170215 | ICLR | Barret Zoph | 547 | Customized | N | N | RL;G | RNN | Y | N | Y | SP |  | S | N | N |  |
| Learning transferable Architecture for scalable image recognition(**NASNet**) | 20180411 | CVPR | Barret Zoph | 340 | NASNet | N | N | RL(PPO);G | RNN | Y | Y | Y | SP | 2000 | S | 82.7 | N | [Github](https://github.com/tensorflow/models/tree/master/research/slim/nets/nasnet) |
| Progressive Neural Architecture Search(**PNASNet**) | 20180726 | ECCV | Chenxi Liu | 115 | NASNet | N | N | SMBO;G | LSTM | Y | Y | Y | SP | 225 | PP | 82.9 | N | [Github](https://github.com/tensorflow/models/tree/master/research/slim/nets/nasnet) |
| **MnasNet**:Platform-Aware Neural Architecture Search for Mobile | 20180731 |  | Mingxing Tan | 30 | Customized | N | N | RL(PPO);G | RNN | Y | Y | Y | SP |  | S | 76.13 | L |  |
| Large-Scale Evolution of Image Classifiers | 20170611 | ICML | Esteban Real | 232 | Customized | N | N | EA;G | DNA | Y | N | Y | SP |  | S | N | N |  |
| Regularized Evolution for Image Classifier Architecture Search(**AmoebaNet**) | 20181026 | ICML | Esteban Real | 107 | NASNet | N | N | EA;G | DNA | Y | Y | Y | SP | 3150 | S | 83.9 | N | [Github](https://github.com/tensorflow/tpu/tree/master/models/official/amoeba_net) |
| Hierarchical Representations for Efficient Architecture Search | 20180222 | ICLR | Hanxiao Liu | 108 | Hierarchical | N | N | EA;G | DNA | Y | Y | Y | SP |  | S | 79.7 | N |  |
| **SMASH**: One-Shot Model Architecture Search through HyperNetworks | 20180224 | ICLR | Andrew Brock | 77 | Memory  Bank | N | N | RS;G | HyperNet | Y | Y | Y | SP |  | WG | N | N | [Github](https://github.com/ajbrock/SMASH) |
| Efficient Neural Architecture Search via Parameter Sharing(**ENAS**) | 20180212 | ICML | Hieu Pham | 113 | NASNet | N | Y | RL;G | LSTM | N | Y | N | SP |  | DE | N | N | [Github](https://github.com/melodyguan/enas) |
| Understanding and Simplifying One-Shot Architecture Search | 20180209 | ICML | Gabriel Bender | 25 | DAG | N | Y | G | N/A | N | Y | N | WS |  | DE | 75.2 | N |  |
| Efficient Architecture Search by Network Transformation(**EAS**) | 20171121 | AAAI | Han Cai | 51 | Chain | N | N | RL;G | Bi-LSTM | Y | N | Y | SP |  | S | N | N | [Github](https://github.com/han-cai/EAS) |
| Path-Level Network Transformation for Efficient Architecture Search(**PathLevel EAS**) | 20180607 | ICML | Han Cai | 15 | Tree | N | N | RL;G | Tree-LSTM | Y | Y | Y | SP |  | S | 74.6 | N | [Github](https://github.com/han-cai/PathLevel-EAS) |
| Neural Architecture Optimization(**NAO**) | 20181031 | NIPS | Renqian Luo | 25 | NASNet | Y | Y | G | NAO | N | Y |  | WS |  | DE | N | N | [Github](https://github.com/renqianluo/NAO) |
| **FBNet**: Hardware-Aware Efficient ConvNet Design via Differentiable Neural Architecture Search | 20181214 | CVPR | Bichen Wu | 10 | Chain | Y | Y | G | N | N | IRB | N | WS | 9 | DE | 74.9 | L | [Github](https://github.com/JunrQ/NAS) |
| Graph Hypernetworks for Neural Architecture Search(**GHN**) | 20190102 | ICLR | Chris Zhang | 4 | DAG | N | N | RS;G | HyperNet | Y | Y | Y | SP | 0.84 | WG | 73.0 | F |  |
| **DARTS**: Differentiable Architecture Search | 20190222 | ICLR | Hanxiao Liu | 71 | NASNet | Y | Y | G | N | N | Y | N | WS | 4 | DE | 73.3 | L | [Github](https://github.com/quark0/darts) |
| **SNAS**: stochastic neural architecture search | 20190112 | ICLR | Sirui Xie | 10 | DAG | Y | Y | G | N | N | Y | N | WS | 1.5 | DE | 72.7 | L | [Github](https://github.com/JunrQ/NAS/tree/master/snas) |
| Searching for A Robust Neural Architecture in Four GPU Hours(**GDAS**) | 20190200 | CVPR | Xuanyi Dong | 0 | NASNet | Y | Y | G | N | N | Y | N | WS | 0.17 | de | 74.0 | N | [Github](https://github.com/D-X-Y/GDAS) |
| **ProxylessNAS**: Direct Neural Architecture Search on Target Task and Hardware | 20190223 | ICLR | Han Cai | 2 | Chain | Y | Y | G | N | N | IRB | N | TP | 8.33 | DE | 75.1 | Y | [Github](https://github.com/mit-han-lab/ProxylessNAS) |
| Efficient Multi-Objective Neural Architecture Search via Lamarckian Evolution | 20190226 | ICLR | Thomas Elsken | 7 | NASNet |  |  | EA;G |  |  | Y |  |  |  |  |  |  |  |
| **sharpDARTS**: Faster and More Accurate Differentiable Architecture Search | 20190323 | arXiv | Andrew Hundt | 0 | DAG | Y | Y | G | N | N | Y | N | WS | 1.8 | DE | 74.9 | Y |  |
| **Single-Path NAS**: Designing Hardware-Efficient ConvNets in less than 4 Hours | 20190405 | arXiv | D. Stamoulis | 0 | Chain | Y | Y | G | N | N | IRB | N | WS | 0.17 | DE | 74.96 | L | [Github](https://github.com/dstamoulis/single-path-nas) |
| Single Path One-Shot Neural Architecture Search with Uniform Sampling | 20190406 | arXiv | Zichao Gui | 0 | Chain | N | Y | RS;EA | N | Y | IRB |  | SP |  | DE | Y | Y |  |
| Exploring Randomly Wired Neural Networks for Image Recognition | 20190408 | arXiv | Saining Xie | 0 | DAG | N | N | GS | N | Y | Y |  | SP |  | S | 81.6 | F |  |
| Progressive Differentiable Architecture Search: Bridging the Depth Gap between Search and Evaluation(**P-DARTS**) | 20190429 | arXiv | Xin Chen | 0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Aging Evolution for ImageClassifier Architecture Search | 20190500 | AAAI | Esteban Real |  | NASNet |  |  | EA;G |  |  | Y |  |  |  |  |  |  |  |
| Searching for MobileNetV3 | 20190506 | arXiv | Andrew Howard |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

**CNT**: continuous, discrete search space is mapped to continuous space **WS**: Weight Sharing, weights are shared between sub networks

**Nested**: Nested optimization or jointly optimization. One approach for NAS is to consider it as a nested optimization problem, where the inner loop is a normal training process that finds the optimal weights for a given architecture a w.r.t. the training loss and the outer loop searches the optimal architecture w.r.t. a validation loss

**Cell**: Cell based, search for cell, Y for Yes, N for No, IRB for Inverted Residual Block from MobileNetV2 **Proxy**: Proxy tasks, sub networks are trained on proxy tasks

**MC**: memory consumption **ES**: Evaluation Strategy **ImageNet**: ImageNet Top-1 accuracy, N means the paper is not tested on ImageNet dataset.

**Latency**: considered Inferrency latency, network FLOPs or not, L means latency, F means FLOPs, N means no

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Search Space** | **Customized** | **NASNet** | **Chain** | **Tree** | **DAG** |
| Explanation | Customized | NASNet | Linear Chain | Tree | DAG |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Search Method** | **GS** | **RS** | **RL** | **EA** | **G** | **MCTS** | **SMBO** | **BO** | **Other** |
| Explanation | Grid Search | Random Search | Reinforcement Learning | Evolutionary Algorithm | Gradient-based | Monte Carlo Tree Search |  | Bayesian optimization | other types |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Evaluation Strategy** | **S** | **WG** | **PP** | **DE** |
| Explanation | Train from scratch then evaluate | Weights generation by HyperNet | performance prediction(surrogate model) | Direct evaluation without training from scratch when jointly optimization |

|  |  |  |  |
| --- | --- | --- | --- |
| **Memory Consumption(M)** | **SP** | **TP** | **WS** |
| Explanation | Single path | Two paths | Whole supernet |

**GS, RS, RL, EA, MCTS, SMBO, BO**: architecture search is treated as a black-box optimization problem over a discrete space, which leads to a large number of architecture evaluations required.

**Table-2. NAS for Object Detection**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Model** | **Paper** | **Publish Date** | **Venue** | **Author** | **Cited By** | **Search Space** | **Continuous** | **Weight Sharing** | **Search Method** | **Cell** | **M** | **ES** | **ImageNet** | **Latency** | **Code** |
|  | Learning Data Augmentation Strategies for Object Detection | 20190626 | arXiv |  |  |  |  |  |  |  |  |  |  |  |  |
|  | NAS-FPN | 20190416 | CVPR |  |  |  |  |  |  |  |  |  |  |  |  |