

# AutoML: Neural Architecture Search (NAS)

## Overview

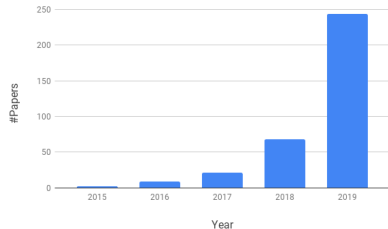
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# Neural Architecture Search (NAS)

- Goal: automatically find neural architectures with strong performance
  - ▶ Optionally, subject to a resource constraint

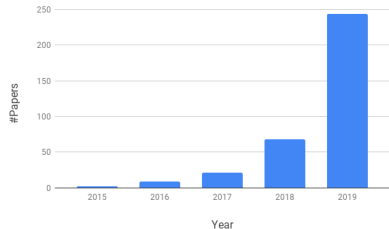
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- A decade-old problem, but main stream since 2017 and now intensely researched
- One of the main problems AutoML is known for



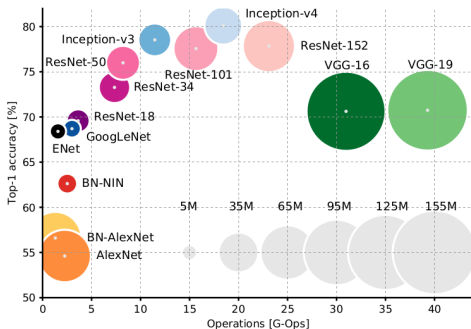
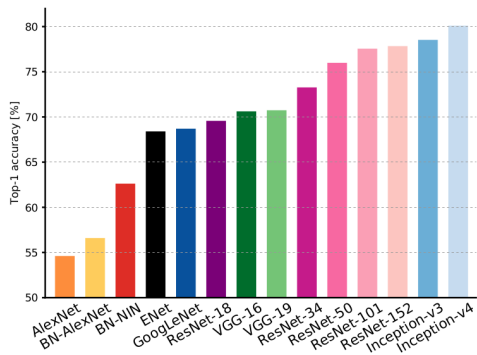
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- Initially extremely expensive
- By now several methods promise low overhead over a single model training



# Motivation for NAS

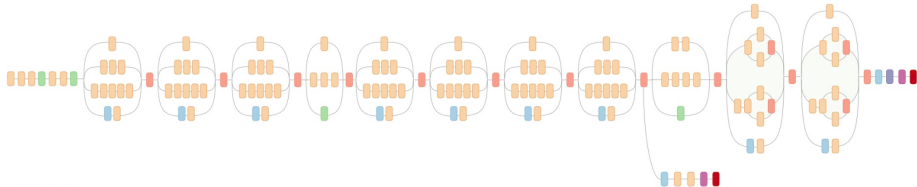
- Performance improvements on various tasks due to novel architectures
- Can we automate this design process, potentially discovering new components/topologies?



[Canziani et al. 2017]

# Motivation for NAS

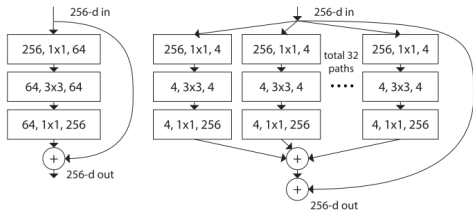
- Manual design of architectures is **time consuming**
- Complex state-of-the-art architectures are a result of **years of trial** and errors by experts



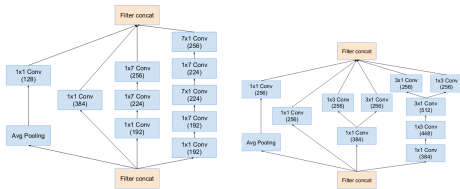
Inception-v3 [Szegedy et al. 2015]

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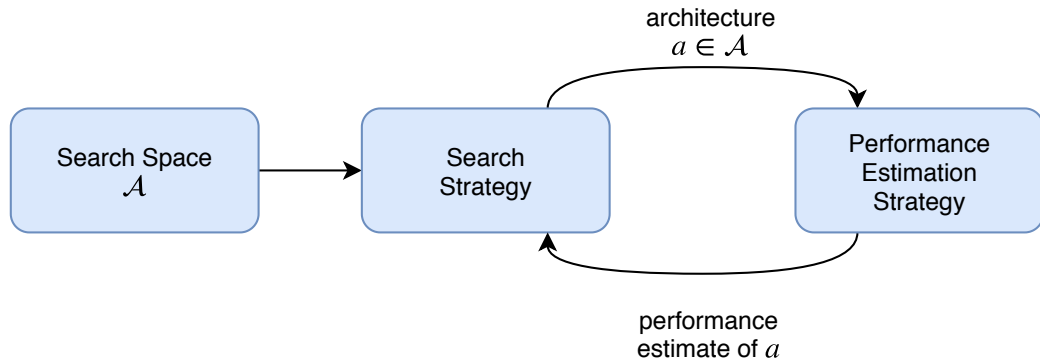
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  - Main pattern: Repeated blocks with same structure (topology)



ResNet/ResNeXt blocks  
[He et al. 2016; Xie et al. 2016]



Inception-v4 blocks [Szegedy et al. 2016]



- **Search Space:** the types of architectures we consider; micro, macro, hierarchical, etc.
- **Search Strategy:** Reinforcement learning, evolutionary strategies, Bayesian optimization, gradient-based, etc.
- **Performance Estimation Strategy:** validation performance, lower fidelity estimates, one-shot model performance, etc.



## Questions to Answer for Yourself / Discuss with Friends

- Repetition:  
List three major components of NAS methods.
- Discussion:  
Is there a problem for which you would like to apply NAS yourself?