

# Neural Architecture Optimization

M1 松岡祐貴

# Neural Architecture Optimization

- × **どんなもの？**
  - × Network Architecture Search
    - × Cell Block
- × **手法のキモ**
  - × 連続表現にネットワーク構築をマッピング
- × **有効性の証明**
  - × CIFAR-10でError rate:2.11%
  - × PTBでPerplexity:56.0

# Neural Architecture Optimization

## × 従来

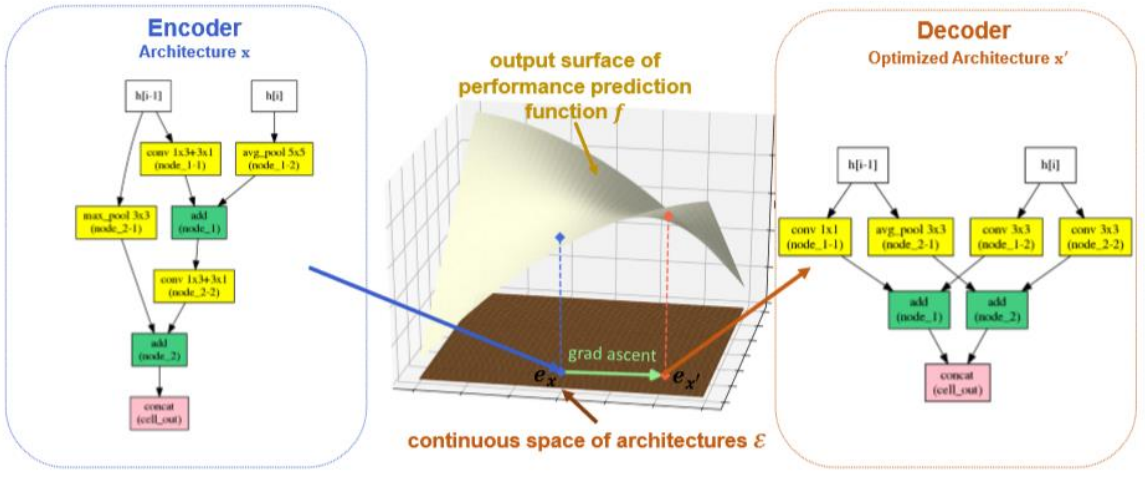
- × RL・EAで探索
  - × 離散空間を探索するため非効率的

## × NAO

- × エンコーダでアーキテクチャを連続空間にマッピング
  - × コントローラ:LSTM(中間層数:1)
  - × a.k.a embedding?で連続表現にマッピング
- × デコーダで連続空間からアーキテクチャを復号
  - × 連続空間なら扱いが簡単

# Neural Architecture Optimization

## × Overview



# Neural Architecture Optimization

## × 探索範圍

- × Convolution layer
  - × Identity
  - × 1x1 Conv.
  - × 3x3 Conv.
  - × **1x3 + 3x1 Conv.**
  - × **1x7 + 7x1 Conv.**
  - × 2x2 max pooling
  - × 3x3 max pooling
  - × 5x5 max pooling
  - × 2x2 average pooling
  - × 3x3 average pooling
  - × 5x5 average pooling

# Neural Architecture Optimization

- × 探索範圍
  - × Activation Function
    - × tanh
    - × Relu
    - × Identity
    - × sigmoid

# Neural Architecture Optimization

## × 結果

| Model                     | B | N   | F   | #op | Error(%) | #params | M     | GPU Days |
|---------------------------|---|-----|-----|-----|----------|---------|-------|----------|
| DenseNet-BC [19]          |   | 100 | 40  | /   | 3.46     | 25.6M   | /     | /        |
| ResNeXt-29 [43]           |   |     |     | /   | 3.58     | 68.1M   | /     | /        |
| NASNet-A [47]             | 5 | 6   | 32  | 13  | 3.41     | 3.3M    | 20000 | 2000     |
| NASNet-B [47]             | 5 | 4   | N/A | 13  | 3.73     | 2.6M    | 20000 | 2000     |
| NASNet-C [47]             | 5 | 4   | N/A | 13  | 3.59     | 3.1M    | 20000 | 2000     |
| Hier-EA [27]              | 5 | 2   | 64  | 6   | 3.75     | 15.7M   | 7000  | 300      |
| AmoebaNet-A [38]          | 5 | 6   | 36  | 10  | 3.34     | 3.2M    | 20000 | 3150     |
| AmoebaNet-B [38]          | 5 | 6   | 36  | 19  | 3.37     | 2.8M    | 27000 | 3150     |
| AmoebaNet-B [38]          | 5 | 6   | 80  | 19  | 3.04     | 13.7M   | 27000 | 3150     |
| AmoebaNet-B [38]          | 5 | 6   | 128 | 19  | 2.98     | 34.9M   | 27000 | 3150     |
| AmoebaNet-B + Cutout [38] | 5 | 6   | 128 | 19  | 2.13     | 34.9M   | 27000 | 3150     |
| PNAS [26]                 | 5 | 3   | 48  | 8   | 3.41     | 3.2M    | 1280  | 225      |
| ENAS [36]                 | 5 | 5   | 36  | 5   | 3.54     | 4.6M    | /     | 0.45     |
| Random-WS                 | 5 | 5   | 36  | 5   | 3.92     | 3.9M    | /     | 0.25     |
| DARTS + Cutout [28]       | 5 | 6   | 36  | 7   | 2.83     | 4.6M    | /     | 4        |
| NAONet                    | 5 | 6   | 36  | 11  | 3.18     | 10.6M   | 1000  | 200      |
| NAONet                    | 5 | 6   | 64  | 11  | 2.98     | 28.6M   | 1000  | 200      |
| NAONet + Cutout           | 5 | 6   | 128 | 11  | 2.11     | 128M    | 1000  | 200      |

# Neural Architecture Optimization

## × Best Cell

