# ResNetsに対する新たな正則化手法ShakeDropの提案

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## Contributions

- We propose a new powerful regularization method, **ShakeDrop**, for improvements of ResNets architectures and achieved **state-of-the-art results** on image classification datasets, CIFAR-10/100 (as of Mar. 2018)
- We confirmed **ShakeDrop** stabilizes learning strongly disturbed by **multiplying even a negative factor** by regarding **StochasticDepth [1] mechanism as a probabilistic switch of two network architectures**

| Regularization methods | 2-Branch ResNets | | | 3-Branch ResNets |
|---|---|---|---|---|
| | ResNet | WideResnet | PyramidNet | ResNeXt |
| StochasticDepth [1] | 😐 | 😐 | 😐 | 😐 |
| Shake-Shake [2] | - | - | - | ☺ |
| **ShakeDrop (ours)** | ☺ | ☺ | ☺ | ☺ |

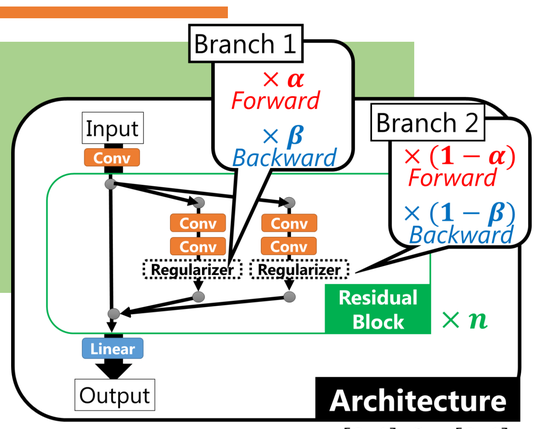
**Comparison of Regularization methods**

## Architectures

### ➢ Shake-Shake [2]

For 3-Branch ResNets

High accuracy



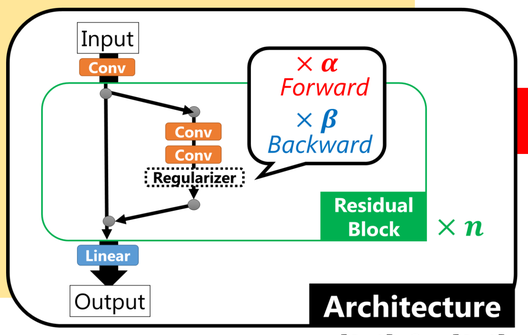

$\alpha \in [0,1], \beta \in [0,1]$

### ➢ 1-branch Shake

(intermediate method)

For any-Branch ResNets

Low accuracy



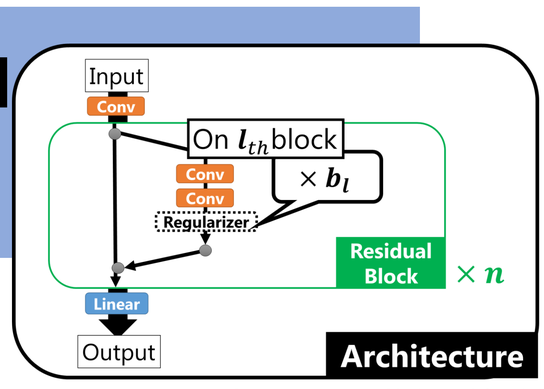

$\alpha \in [0,1], \beta \in [0,1]$

### ➢ StochasticDepth [1]

For any-Branch ResNets

Low accuracy

**Stabilize**



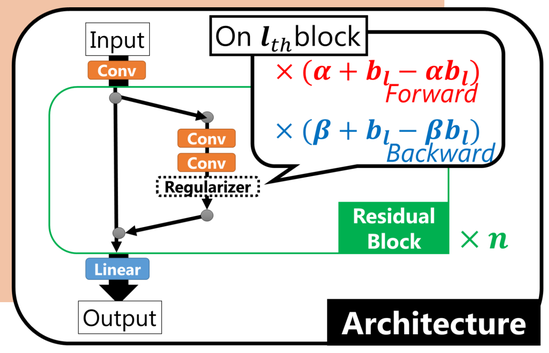

$b_l = Bernoulli(1 - l/2n)$

### ➢ ShakeDrop

**(proposed method)**

For any-Branch ResNets

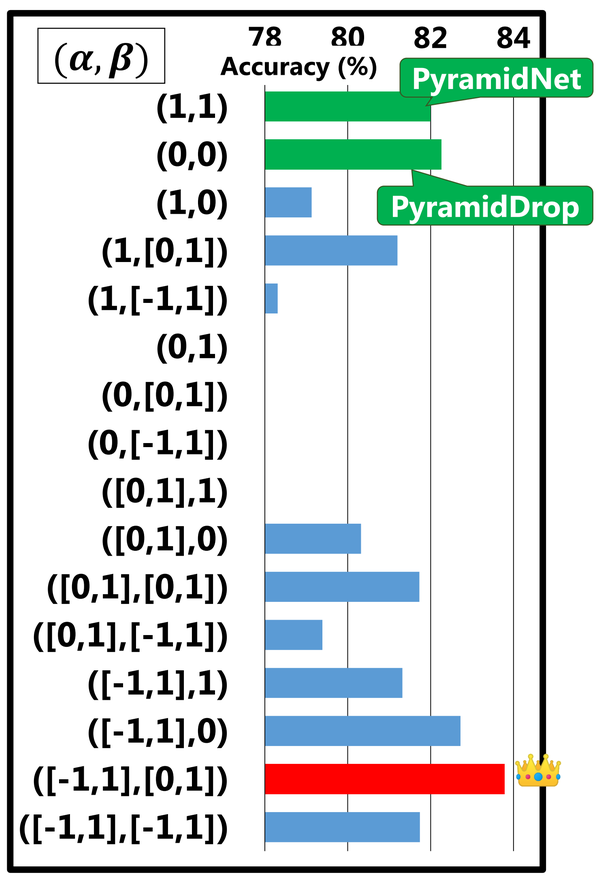
High accuracy




$\alpha \in [-1,1], \beta \in [0,1], b_l = Bernoulli(1 - l/2n)$

## Experiments (image classification)

### ① Parameter Search




**Best Parameters:**

$\alpha \in [-1,1], \beta \in [0,1]$

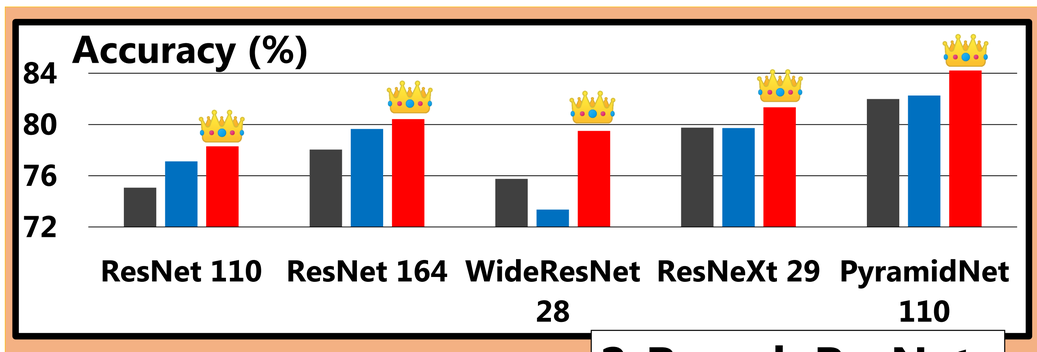
### ② Comparison with Baseline Methods

**Best Parameters:**

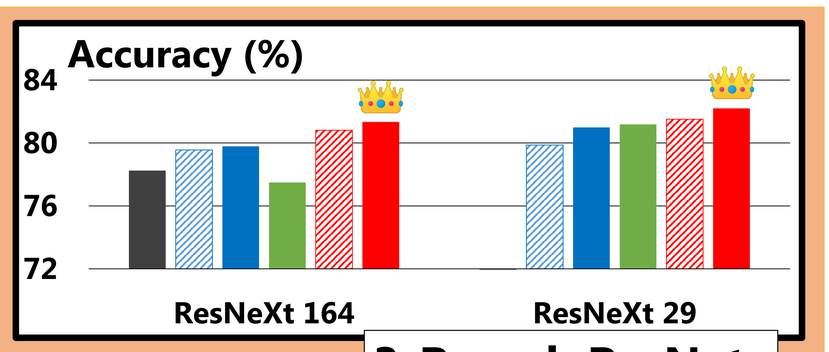
$\alpha \in [-1,1], \beta \in [0,1]$

Vanilla
StochasticDepth [1]
ShakeDrop (ours)

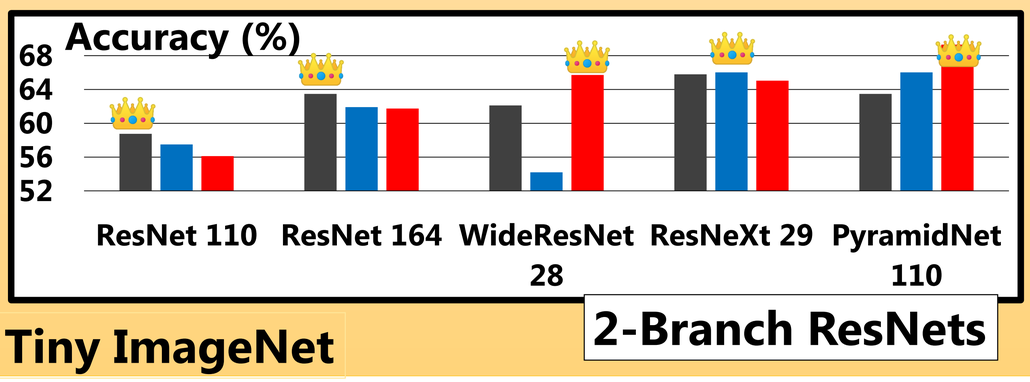
Vanilla
StochasticDepth-A [1]
StochasticDepth-B [1]
Shake-Shake [2]
ShakeDrop-A (ours)
ShakeDrop-B (ours)



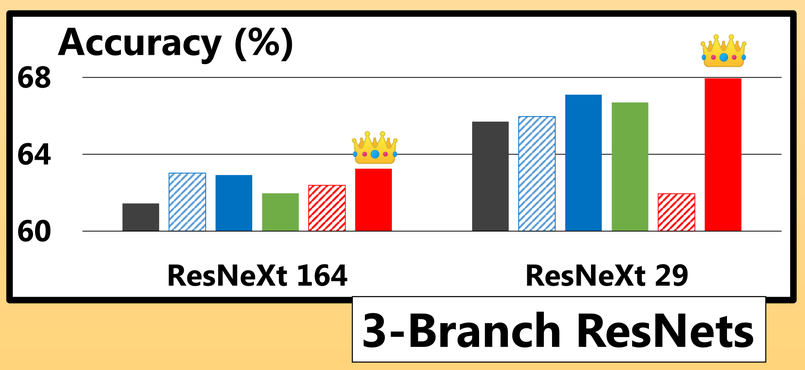

**CIFAR-100** **2-Branch ResNets**




**3-Branch ResNets**




**Tiny ImageNet** **2-Branch ResNets**




**3-Branch ResNets**

*[1] Gao Huang, Yu Sun, Zhuang Liu, Daniel Sedra and Kilian Weinberger, "Deep Networks with Stochastic Depth," NIPS2016*
*[2] Xavier Gastaldi, "Shake-Shake Regularization of 3-branch Residual Networks," ICLR2017 workshop*