Siamese Network & AutoAug

Paper review

YU MO, 2022/07/11

Siamese Network

Architecture & Loss Function

Siamese Network

Contributions

- Proposed the effective **Siamese Architecture** for classification/verification on large number of categories with only small train samples(Face recognization/ Fingerprint recognization).

- Proposed a discriminative loss function which does not need to estimate the probability distribution of data.

Siamese Network

Architecture

- **Shared** weights Convolutional Network. (Identical Network, one network)

- Ew is the defined similarity metrics called scalar energy function in the **energy-based models**(EBM).

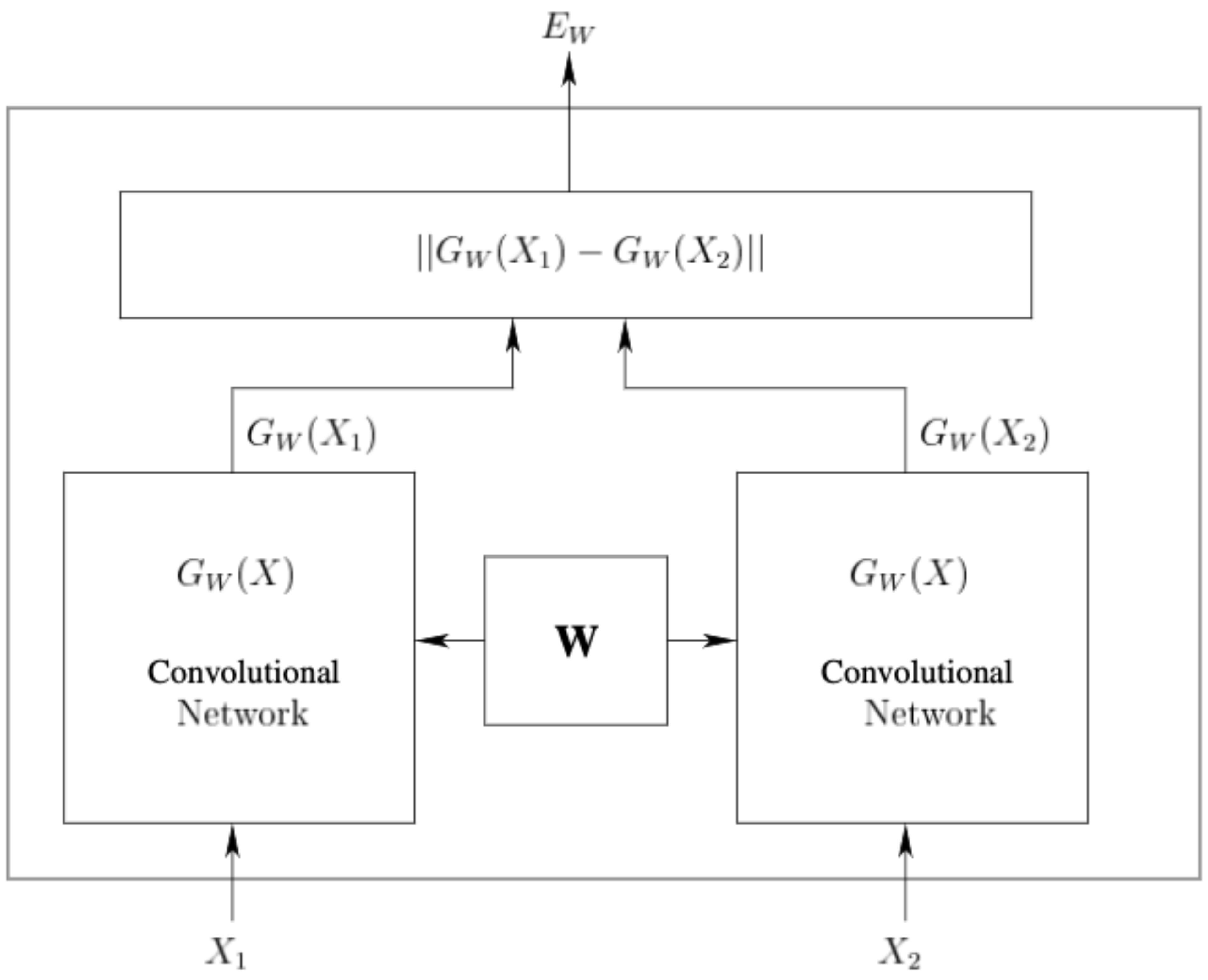


Figure 1. Siamese Architecture.

Siamese Network

Contrastive Loss Function in Training

- Energy function **Ew** should satisfy that energy of impostor pair should be large/ increase and the energy of genuine pair should be small/decrease.

- Remaining part is to prove how to derive the Loss Function to meet the requirement.

$$E_W(X_1, X_2) = ||G_W(X_1) - G_W(X_2)||$$

Energy Function

$$\downarrow$$

$$\mathcal{L}(W) = \sum \mathcal{L}(W, (Y, X_1, X_2)^i)$$
$$\mathcal{L}(W, (Y, X_1, X_2)^i) = (1 - Y_i)\mathcal{L}_G(E_W(X_1, X_2)^i) + Y_i\mathcal{L}_I(E_W(X_1, X_2)^i)$$

Loss Function design

$$\downarrow$$

$$\mathcal{L}(W, Y, X_1, X_2) = (1 - Y)\frac{2}{Q}(E_W)^2 + Y \cdot 2Qe^{-\frac{2.77}{Q}E_W}$$

Simplified Loss Function

Siamese Network

Results

- False accept(FA, 认伪(率))
- False reject(FR, 拒真(率))
- 3 datasets in total, trained in 2 datasets and verified on 3 datasets.

	AT&T		AR/Purdue	
	Val	Test	Val	Test
Number of Subjects	35	5	96	40
Images/Subject	10	10	26	26
Images/Model	–	5	–	13
No. Genuine Images	500	500	750	500
No. Impostor Images	500	4500	750	4500

	False Accept		
	10%	7.5%	5%
AT&T (Test)	0.00	1.00	1.00
AT&T (Validation)	0.00	0.00	0.25
AR (Test)	11	14.6	19
AR (Validation)	0.53	0.53	0.80

Table 1. Above: Details of the validation and test sets for the two datasets. Below: False reject percentage for different false accept percentages.

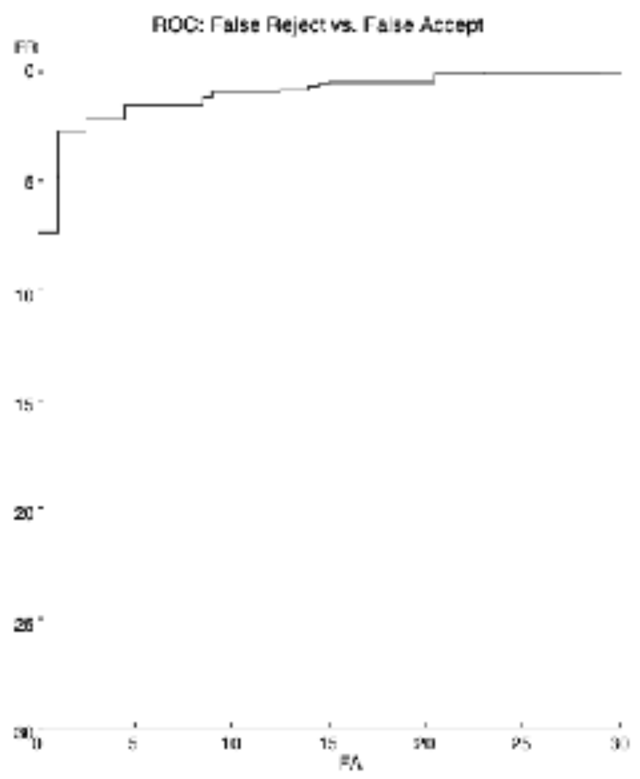


Figure 6. AT&T dataset: percent false reject vs. false accept.

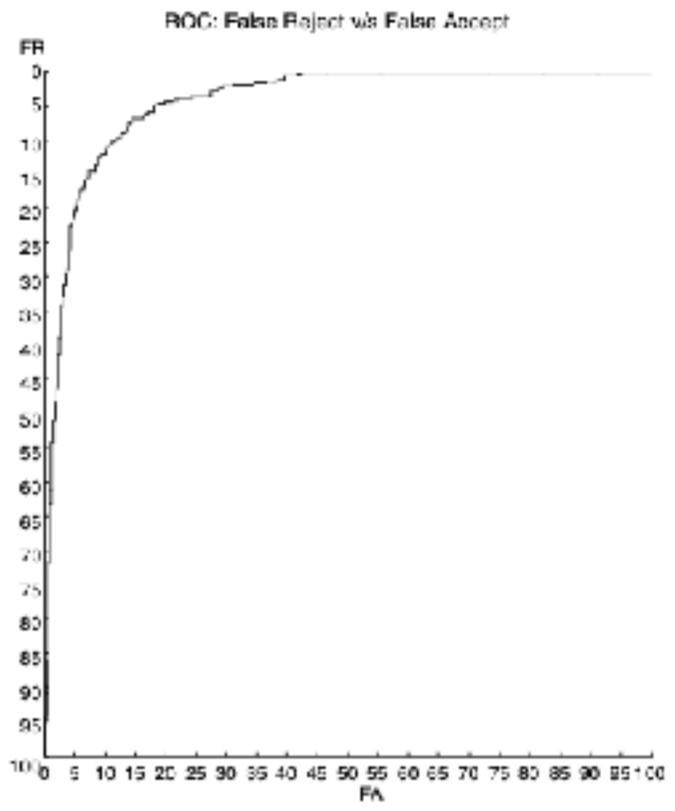


Figure 7. AR/Purdue dataset: percent false reject vs. false accept.

Siamese Network

Differences with Self-Supervised Learning

- Output is different. SSL is the trained network while SN is the label.
- SN is still need labels when training.
- The idea of loss function design is different.
- SSL maybe regarded as a special type of SN. Essentially, they are the same.

AutoAugment

Google Brain

AutoAugment: Learning Augmentation Strategies from Data

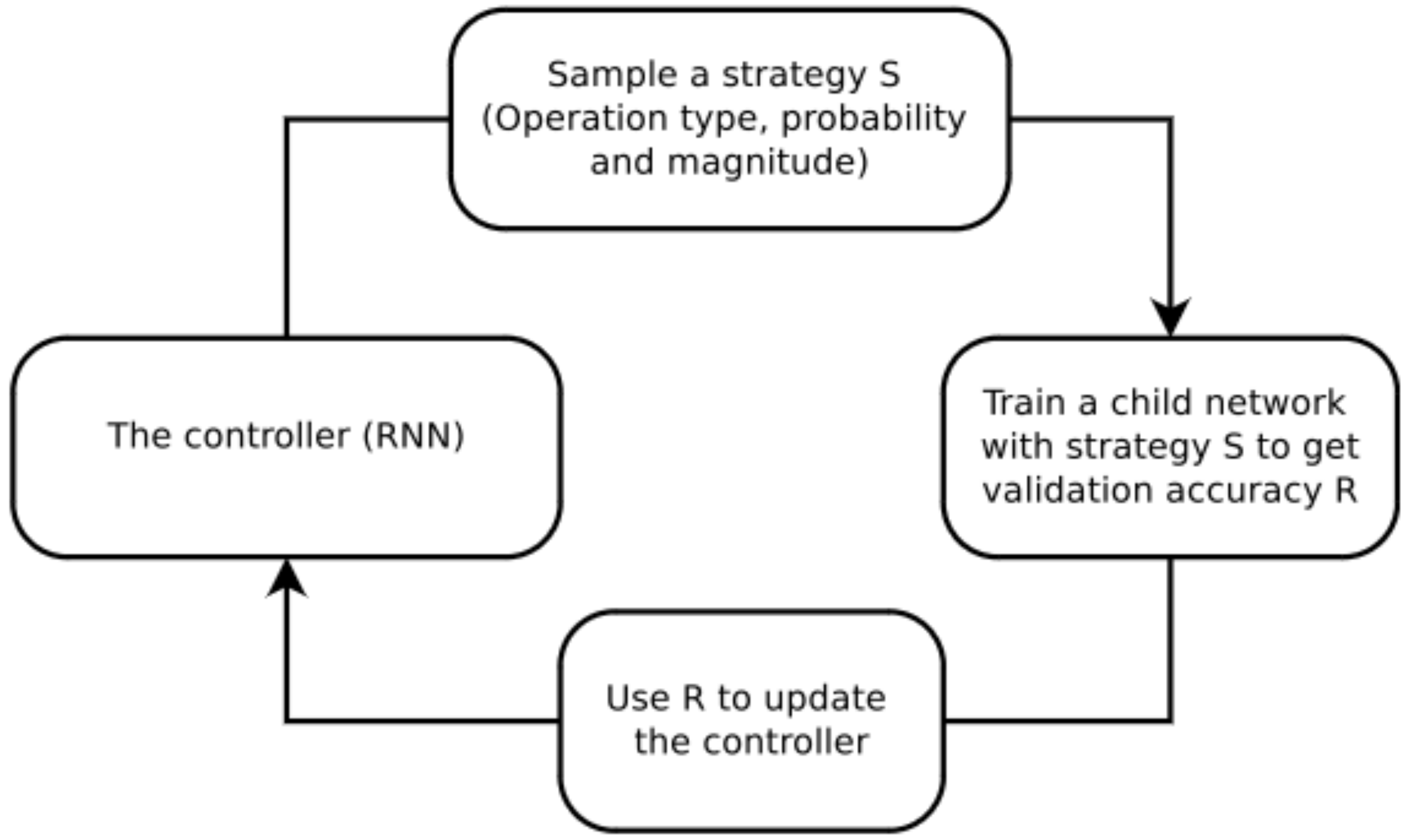
Contributions

- Automatically find the best augmentation policy （AutoAugment-direct） for any interested dataset.

- Find the transferable augmentation policy cross different datasets (AutoAugment-transfer)

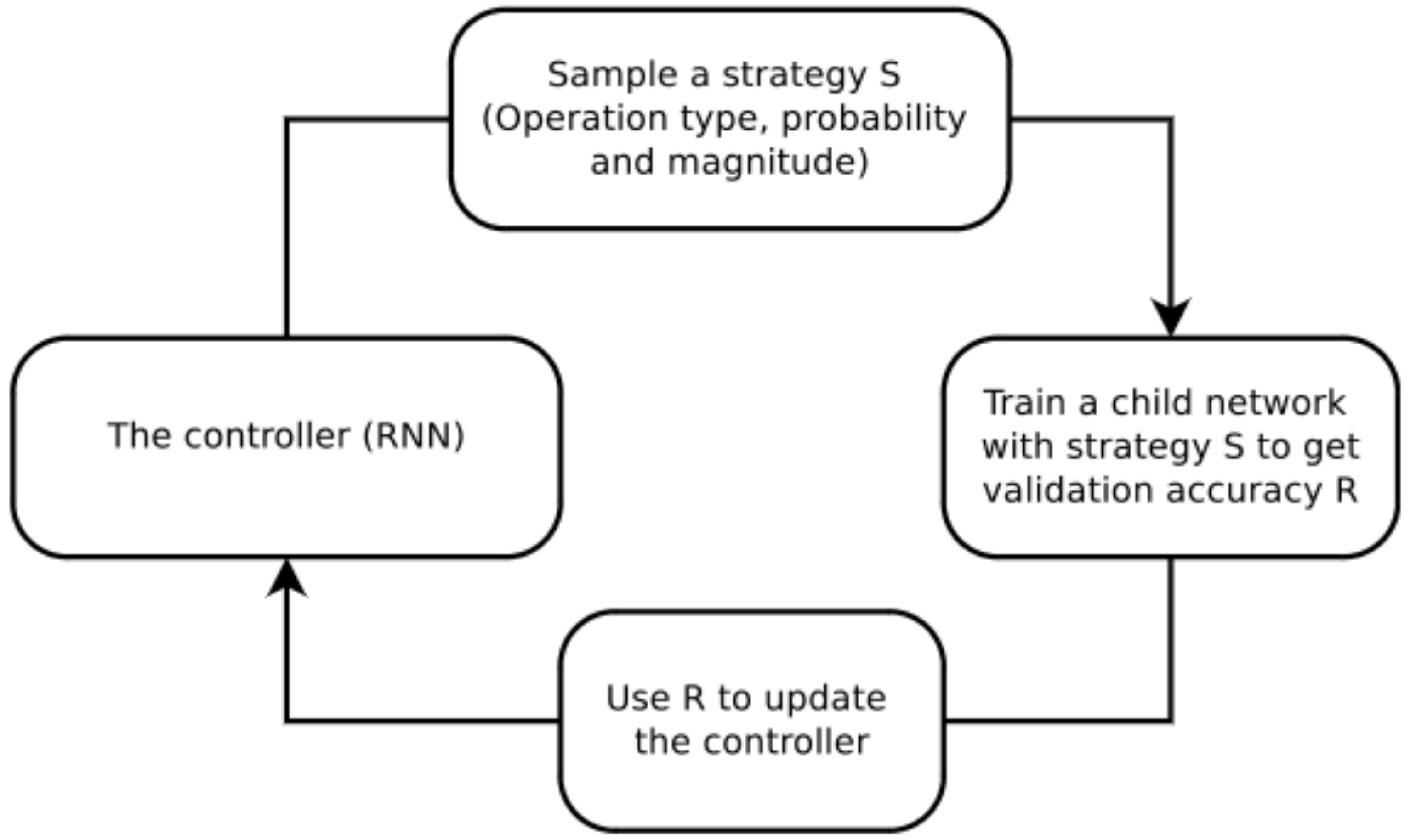
AutoAugment
Problem definition

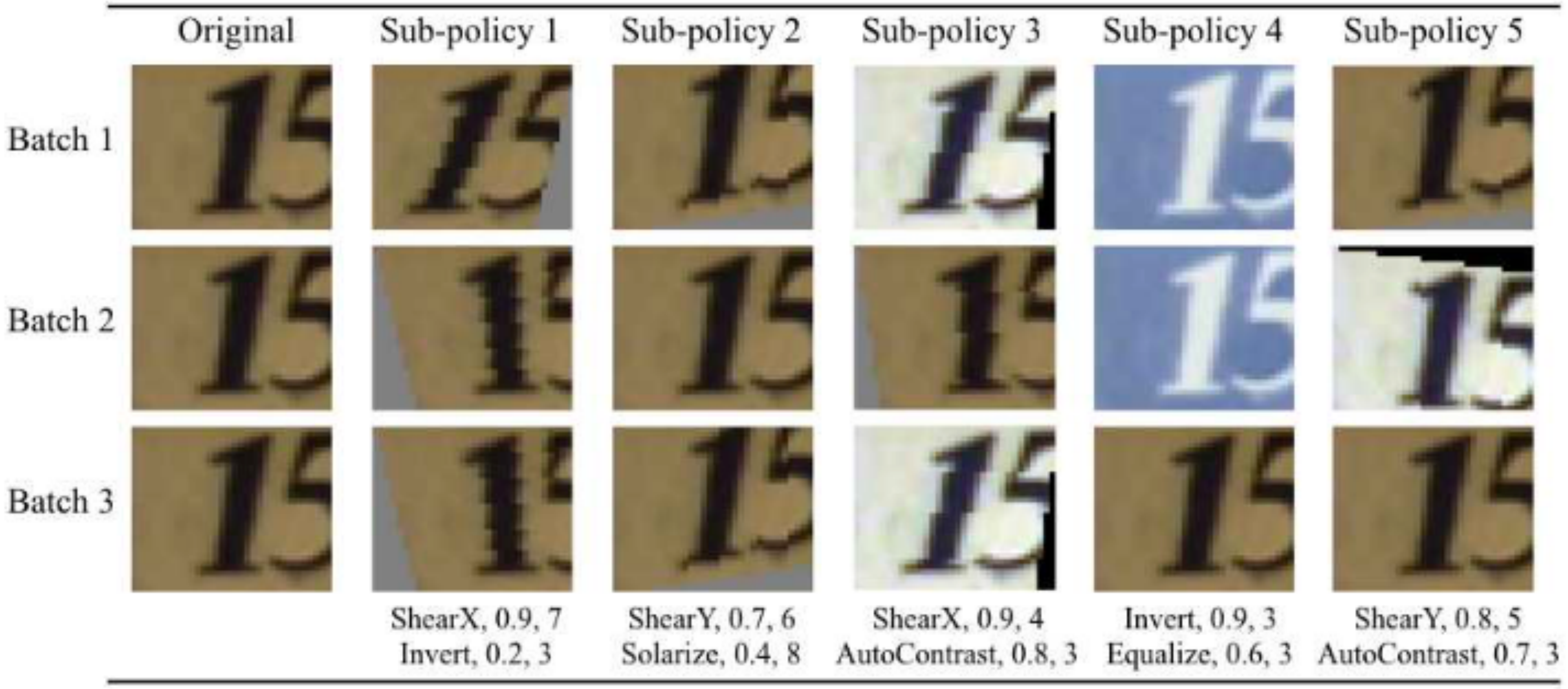
- Formulate the problem of finding the best augmentation policy as a discrete search problem.
- Two components: Search algorithm and Search space.
- Search algorithm: Reinforcement Learning
- Search space: 5 sub-policies or operations



AutoAugment

Workflow & Results





Dataset	Model	Baseline	Cutout [12]	AutoAugment
CIFAR-10	Wide-ResNet-28-10 [67]	3.9	3.1	2.6±0.1
	Shake-Shake (26 2x32d) [17]	3.6	3.0	2.5±0.1
	Shake-Shake (26 2x96d) [17]	2.9	2.6	2.0±0.1
	Shake-Shake (26 2x112d) [17]	2.8	2.6	1.9±0.1
	AmoebaNet-B (6,128) [48]	3.0	2.1	1.8±0.1
	PyramidNet+ShakeDrop [65]	2.7	2.3	**1.5 ± 0.1**
Reduced CIFAR-10	Wide-ResNet-28-10 [67]	18.8	16.5	14.1±0.3
	Shake-Shake (26 2x96d) [17]	17.1	13.4	**10.0 ± 0.2**
CIFAR-100	Wide-ResNet-28-10 [67]	18.8	18.4	17.1±0.3
	Shake-Shake (26 2x96d) [17]	17.1	16.0	14.3±0.2
	PyramidNet+ShakeDrop [65]	14.0	12.2	**10.7 ± 0.2**
SVHN	Wide-ResNet-28-10 [67]	1.5	1.3	1.1
	Shake-Shake (26 2x96d) [17]	1.4	1.2	**1.0**
Reduced SVHN	Wide-ResNet-28-10 [67]	13.2	32.5	8.2
	Shake-Shake (26 2x96d) [17]	12.3	24.2	**5.9**

Results