# Initialization Using Perlin Noise for Training Networks with a Limited Amount of Data

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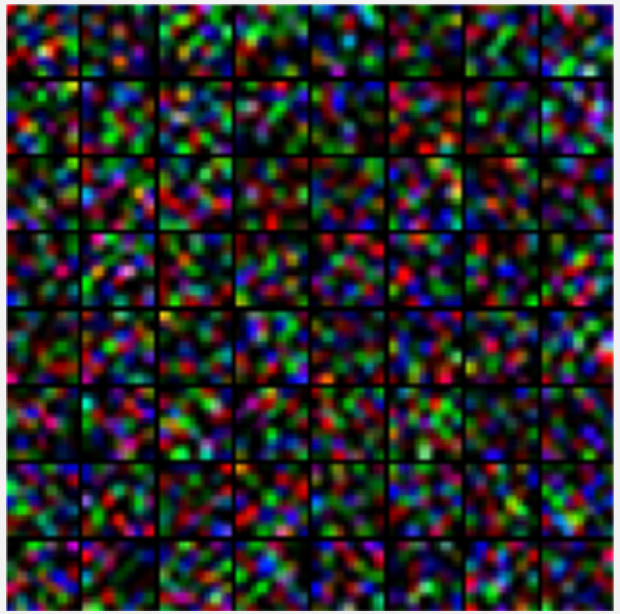
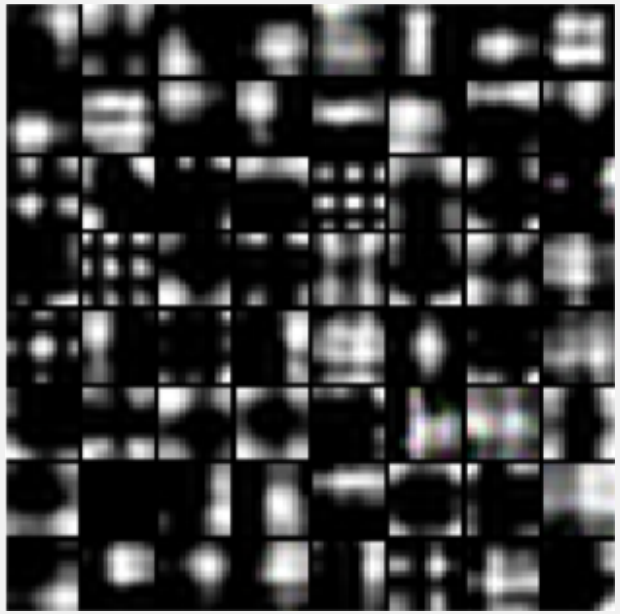
# Overview

We propose a network initialization method using Perlin noise.



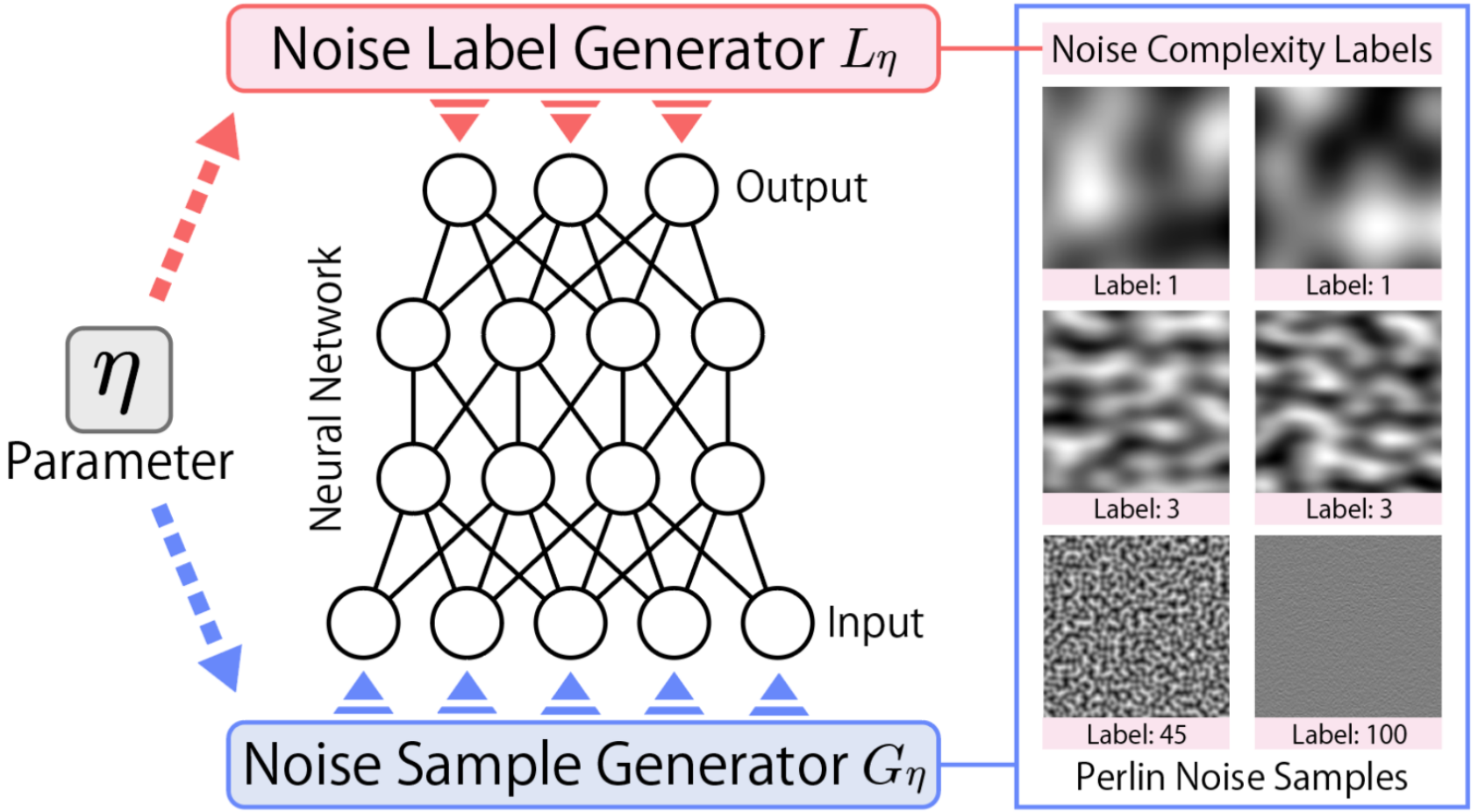
Gaussian Initialization



Proposed Initialization

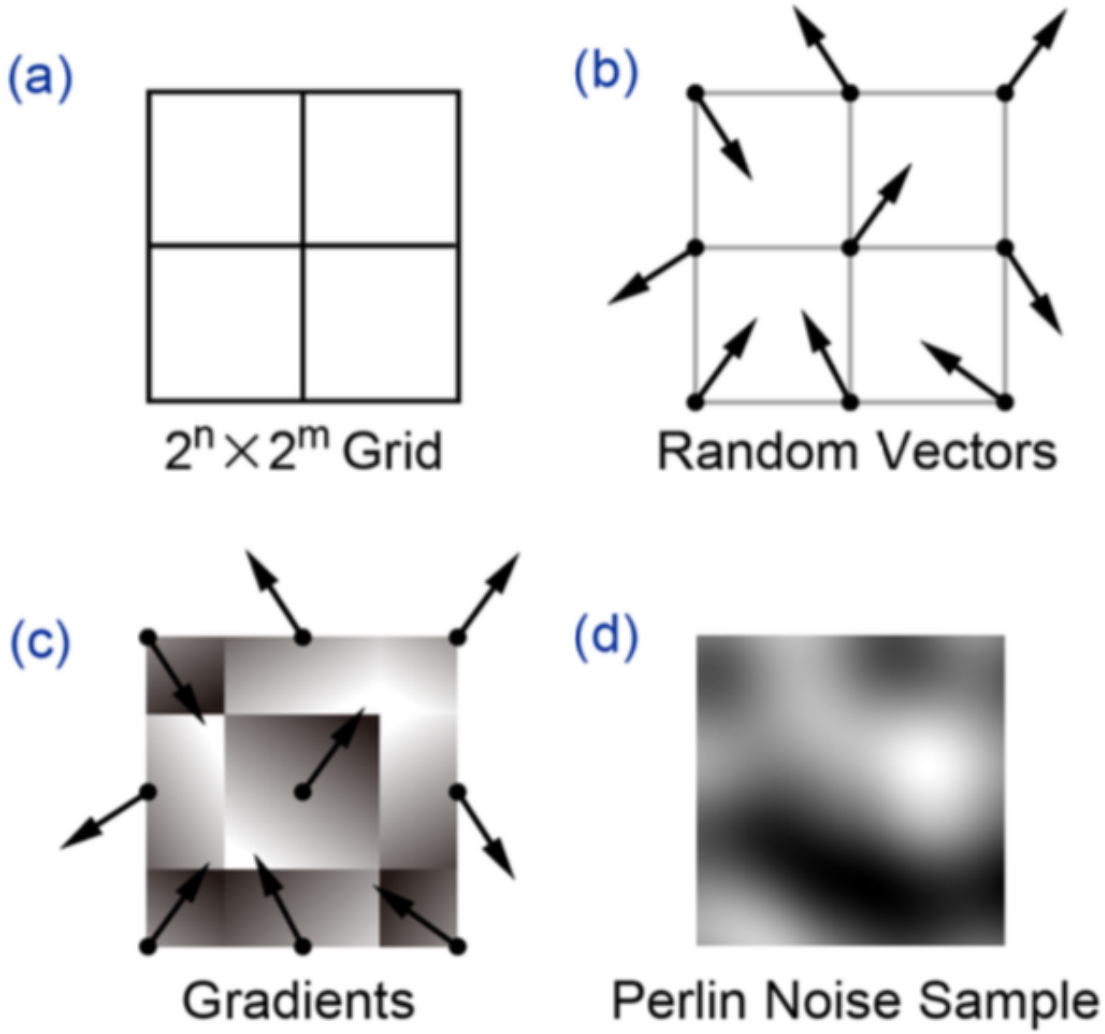
# Key Idea

## Initialize network parameters by solving an artificial Perlin noise classification problem



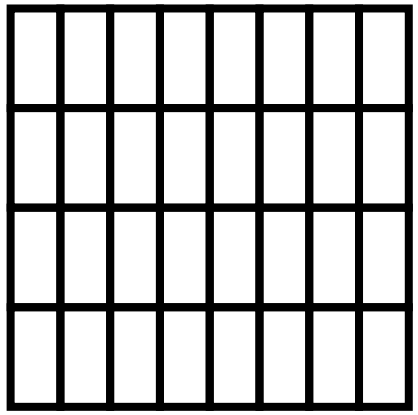
# Perlin Noise

## Gradient noise proposed by Ken Perlin in 1983



# Perlin Noise Categories

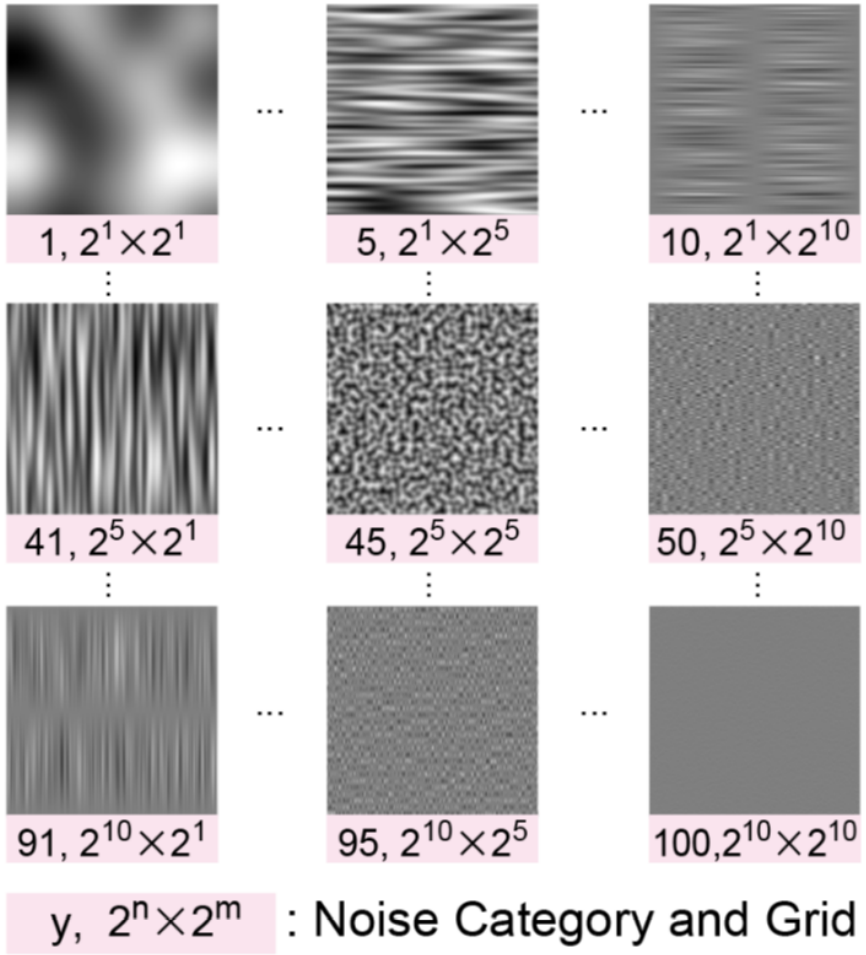
## Fine-to-cause categories on Perlin noise



$2^n \times 2^m$ grid

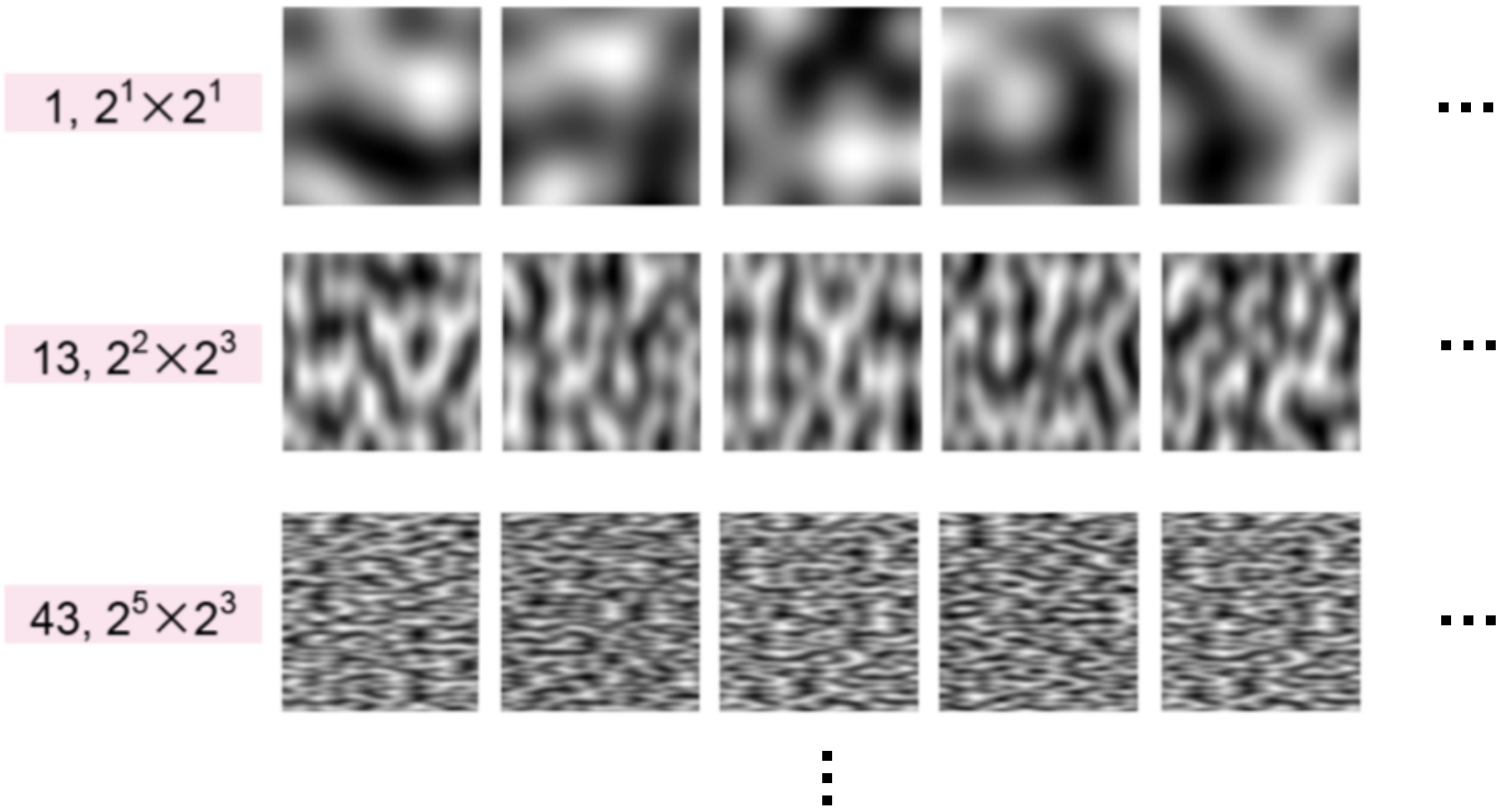
$1 \leq n \leq N, 1 \leq m \leq M$

$NM$ categories



# Instances

## Intra-category variation of noise samples



# Experiments

## Comparison with other methods on four datasets.

TABLE I

PERFORMANCE COMPARISON ON FOUR DATASETS. CLASSIFICATION ACCURACIES (%) FOR EACH DATASET WITH TWO TYPES OF NETWORK ARE SHOWN.

| Method | Cifar-10 | | Cifar-100 | | Omniglot | | DTD | |
|---|---|---|---|---|---|---|---|---|
| | ResNet50 | ResNet152 | ResNet50 | ResNet152 | ResNet50 | ResNet152 | ResNet50 | ResNet152 |
| Normal initialization | 92.62 | 93.47 | 75.16 | 75.59 | 2.66 | 2.37 | 13.68 | 5.24 |
| Xavier initialization [15] | 92.30 | 93.58 | 73.85 | 75.14 | 5.88 | 5.57 | 27.51 | 24.75 |
| He initialization [3] | 93.50 | 93.43 | 74.17 | 75.73 | 4.61 | 3.06 | 24.31 | 20.14 |
| Proposed method | **93.76** | **94.27** | **77.42** | **78.21** | **17.54** | **18.71** | **55.03** | **54.18** |

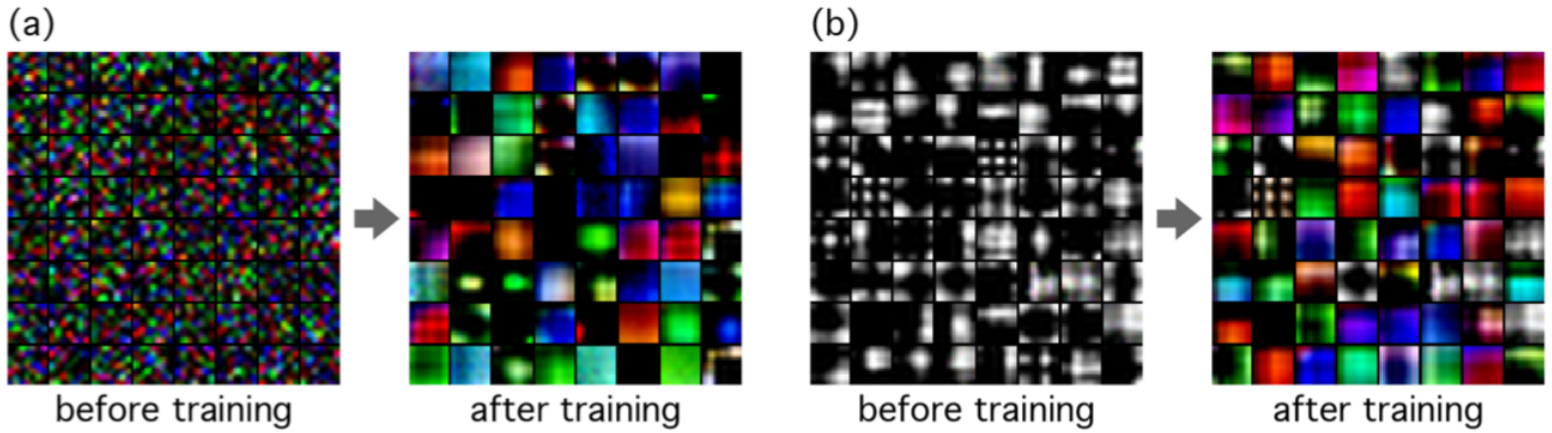



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Fig. 5. Visualization of filters of the first convolutional (conv1) layer. Filters before and after training on Cifar-10 are shown. (a) He initialization and (b) proposed method.