TABLE 1. The accuracy of different methods on MNIST and CIFAR.

|  |  |  |  |
| --- | --- | --- | --- |
| **Methods** | **MNIST** | **CIFAR10** | **CIFAR100** |
| CPN | 99.56 | 93.58 | 70.3 |
| ARPL\* | - | 94.0 | 72.8 |
| CSSR\*\* | - | **95.6** | - |
| AE (ce) | 99.56 | 94.70 | 76.92 |
| AE (ce+re,0.9) | **99.70** | 95.26 | 72.42 |
| AE (ce+re,0.1) | 99.66 | 95.02 | **77.21** |
| ConvAE | 99.42 | 83.47 | - |
| Sparse+ConvAE | 92.88 |  |  |
|  |  |  |  |
|  |  |  |  |

\*TPAMI2021(Peking), \*\*TPAMI2022 (TianJing)

TABLE 1-2. The accuracy of different conditions of the method on CIFAR10.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Backbone**  **AE** | **WideResNet** | | | **ResNet** | | |
| **16** | **28** | **40** | **18** | **34** | **50** |
| AE 1 (ld=20, ce) | 93.3 | 94.42 | 93.91 |  |  |  |
| AE 1 (ld=40, ce) |  |  |  |  |  |  |
| AE 2 |  |  |  |  |  |  |
| AE 3 |  |  |  |  |  |  |
| AE 4 |  |  |  |  |  |  |
| AE 5 |  |  |  |  |  |  |
| AE 6 |  |  |  |  |  |  |
| AE 7 |  |  |  |  |  |  |

TABLE 2. The AUROC results of detecting unknown samples by state-of-the-art methods.

The best results are highlighted in bold.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Methods** | **MNIST** | **SVHN** | **CIFAR10** | **CIFAR10+10** | **CIFAR10+50** | **TinyImageNet** |
| SoftMax | 97.8 | 88.6 | 67.7 | 81.6 | 80.5 | 57.7 |
| CROSR | 99.1 | 89.9 | 88.3 | 91.2 | 90.5 | 58.9 |
| C2AE | 98.9 | 92.2 | 89.5 | 95.5 | 93.7 | 74.8 |
| CPN | 99.0 | 92.6 | 82.8 | - | - | - |
| ARPL | **99.7** | 96.7 | 91.0 | 97.1 | 95.1 | 78.2 |
| OSRCI | 98.8 | 91.0 | 69.9 | 83.8 | 82.7 | 58.6 |
| CSSR | - | **97.9** | **91.5** | 96.3 | 96.3 | 82.3 |
| AE (ce) | 99.52 | 86.21 | 89.70 | **96.69** | **96.67** |  |
| AE (ce+re,0.9) | 97.66 | 88.79 | 84.74 | 92.36 | 92.62 |  |
| AE (ce+re,0.1) | 99.35 | 94.81 | 89.19 | 91.41 | 91.78 |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |

Unknown detection with area under the receiver operating characteristic (AUROC) curve. For MNIST, SVHN and CIFAR10, six classes were randomly sampled as the known classes, and the remaining four classes were used as the unknown classes. For the CIFAR+N datasets, the model was trained on four non animal classes from CIFAR10 as known classes, whereas N animal classes from the CIFAR100 dataset were randomly selected as unknown classes. For TinyImageNet, 20 classes were sampled as the known classes, and the remaining 180 classes as the unknown classes.

TABLE 3. Open-set recognition performance on CIFAR-10.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Methods** | **In:CIFAR 10 / Out:CIFAR 100** | | | | **In:CIFAR 10 / Out:SVHN** | | | |
| **DTACC** | **AUROC** | **AUIN** | **AUOUT** | **DTACC** | **AUROC** | **AUIN** | **AUOUT** |
| SoftMax | 79.8 | 86.3 | 88.4 | 82.5 | 86.4 | 90.6 | 88.3 | 93.6 |
| CPN | 80.2 | 86.4 | 86.6 | 84.1 | 86.1 | 91.3 | 86.6 | 94.8 |
| RPL | 80.6 | 87.1 | 88.8 | 83.8 | 87.1 | 92.0 | 89.6 | 95.1 |
| ARPL | 83.4 | 90.3 | 91.1 | 88.4 | 91.6 | 96.6 | 94.8 | 98.0 |
| CSSR | 85.3 | 92.3 | 92.9 | 91.0 | 95.7 | 99.1 | 98.3 | 99.6 |
| AE (ce) |  |  |  |  |  |  |  |  |
| AE (ce+re) |  |  |  |  |  |  |  |  |

Detection accuracy (DTACC), area under the precision-recall curve (AUROC), in- and out-distribution positive samples noted as AUIN and AUOUT.

TABLE 4. Comparison with discriminative-based OOD detection methods.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Din** | **Methods** | **FPR95** | **AUROC** | **AUPR** | **In-dist**  **Test Error** |
| CFAR10 | Softmax score | 51.04 | 90.90 | 97.92 | 5.16 |
| Energy score | 33.01 | 91.88 | 97.83 | 5.16 |
| ODIN | 35.71 | 91.09 | 97.62 | 5.16 |
| Mahalanobis | 37.08 | 93.27 | 98.49 | 5.16 |
| OE | 8.53 | 98.30 | 99.63 | 5.32 |
| AE (ce) |  |  |  |  |
| AE (ce+re,0.9) |  |  |  |  |
| AE (ce+re,0.1) |  |  |  |  |
| CFAR100 | Softmax score | 80.41 | 75.53 | 93.93 | 24.04 |
| Energy score | 73.60 | 79.56 | 94.87 | 24.04 |
| ODIN | 74.64 | 77.43 | 94.23 | 24.04 |
| Mahalanobis | 54.04 | 84.12 | 95.88 | 24.04 |
| OE | 58.10 | 85.19 | 96.40 | 24.30 |
| AE (ce) |  |  |  |  |
| AE (ce+re,0.9) |  |  |  |  |
| AE (ce+re,0.1) |  |  |  |  |

AE (ce) cifar100

Namespace(K=10, L1=True, batch\_size=64, cls\_weight=0.1, data\_channel=3, data\_name='cifar100', epochs=300, feature\_dim=512, gamma=0.1, kl\_weight=0.1, latent\_dim=20, lr=0.1, mse\_weight=0.1, num\_classes=100, temp=0.1, use\_mse=True, use\_sparse=False, weight\_decay=1e-10)