A. Additional Information of Datasets

In Table 1 we provide additional information on the in-distribution and out-of-distribution datasets. We use the entire test splits for each of these datasets and provide the respective test set sizes. Each out-of-distribution input is preprocessed by subtracting the mean of in-distribution data and dividing the standard deviation. MNIST, fashion-MNIST and K-MNIST are padded by 2 in spatial dimensions and then extended to 3 channels. For STL10, SVHN,Textures and Places365, the smaller sides of the images are resized to 32 and then center-cropped to 32x32. LSUN (crop) is a dataset created from LSUN by randomly cropping to 32x32 and LSUN (resize) is produced by downsampling each LSUN image to the size 32x32. As previously mentioned, these datasets span a range of complexities, and we present the average complexities per dataset. Table 1 also shows the negligible average compression latency per sample while the average inference time of a sample is 20 ms, using Nvidia 1080 Ti GPU card.

| Dataset      | # of Images | Mean Complexity (bytes) | Average Compression Latency (ms) |
|--------------|-------------|--------------------------|----------------------------------|
| MNIST        | 10,000      | 456                      | 0.426                            |
| K-MNIST      | 10,000      | 799                      | 0.480                            |
| fashion-MNIST| 10,000      | 917                      | 0.448                            |
| LSUN (crop)  | 10,000      | 1,498                    | 0.396                            |
| SVHN         | 10,000      | 1,736                    | 0.339                            |
| Textures     | 5,640       | 2,165                    | 0.348                            |
| STL10        | 8,000       | 2,222                    | 0.338                            |
| CIFAR-100    | 10,000      | 2,247                    | 0.352                            |
| Places365    | 328,500     | 2,255                    | 0.348                            |
| CIFAR-10     | 10,000      | 2,271                    | 0.355                            |
| iSUN         | 8,925       | 2,690                    | 0.350                            |
| LSUN (resize)| 10,000      | 2,695                    | 0.346                            |

Table 1. Additional information on the 12 datasets listed in the order of increasing complexity. The complexity is measured in bytes after PNG compression. The Compression Latency is measured on Intel(R) Core(TM) i7-7820X CPU @ 3.60GHz and the average inference time of each sample on Nvidia GPU 1080 Ti is 20 ms.

B. Experiment on JPEG2000

As seen previously, we choose the PNG compressor for encoding sample images and deriving bit lengths for optimal exit selection in the MOOD algorithm. In this section, we experiment with another lossless compressor JPEG2000. Figure 1 shows the complexity distribution of samples across the 12 datasets encoded using JPEG2000. The result of using JPEG2000 for MOOD is shown in Table 2. The JPEG2000 achieves competitive OOD detection results compared with PNG while using more inference time due to the lesser complexity distinguishability of JPEG2000.

| ID   | Dataset              | Method       | AUROC  | FLOPs (×10⁸) |
|------|----------------------|--------------|--------|--------------|
|      |                      | Exit@last    | 0.9048 | 1.05         |
|      | CIFAR-10             | MOOD (PNG)   | 0.9129 | 0.79         |
|      |                      | MOOD (JPEG2000) | 0.9123 | 0.84         |
|      | CIFAR-100            | Exit@last    | 0.8451 | 1.05         |
|      |                      | MOOD (PNG)   | 0.8507 | 0.79         |
|      |                      | MOOD (JPEG2000) | 0.8558 | 0.84         |

Table 2. OOD detection results of JPEG2000 compared to PNG and Exit@last.

C. Detailed Results for 10 OOD Datasets

In Table 3, we show detailed evaluation results for each of the 10 OOD datasets. We report performance of using both constant exiting at each exit, as well as the dynamic exit results with our MOOD algorithm.
| OOD Dataset     | ID Dataset | Measurement | Exit@1 | Exit@2 | Exit@3 | Exit@4 | Exit@5 | MOOD |
|-----------------|------------|-------------|--------|--------|--------|--------|--------|------|
| MNIST           | CIFAR10    | AUROC       | 0.9744 | 0.9875 | 0.9858 | 0.9889 | 0.9903 | 0.9979 |
|                 |            | FPR95       | 0.1453 | 0.0546 | 0.0589 | 0.0542 | 0.0413 | 0.0036 |
|                 | CIFAR100   | AUROC       | 0.9059 | 0.9440 | 0.9589 | 0.9669 | 0.9451 | 0.9134 |
|                 |            | FPR95       | 0.5505 | 0.2959 | 0.2491 | 0.2823 | 0.3103 | 0.5770 |
| K-MNIST         | CIFAR10    | AUROC       | 0.9800 | 0.9839 | 0.9847 | 0.9868 | 0.9844 | 0.9986 |
|                 |            | FPR95       | 0.0974 | 0.0805 | 0.0662 | 0.0586 | 0.0699 | 0.0033 |
|                 | CIFAR100   | AUROC       | 0.8654 | 0.9539 | 0.9410 | 0.9558 | 0.9416 | 0.9717 |
|                 |            | FPR95       | 0.7756 | 0.2675 | 0.3616 | 0.2990 | 0.3676 | 0.1663 |
| fashion-MNIST   | CIFAR10    | AUROC       | 0.9874 | 0.9876 | 0.9912 | 0.9930 | 0.9923 | 0.9991 |
|                 |            | FPR95       | 0.0548 | 0.0504 | 0.0296 | 0.0219 | 0.0248 | 0.0011 |
|                 | CIFAR100   | AUROC       | 0.9705 | 0.9813 | 0.9810 | 0.9827 | 0.9795 | 0.9911 |
|                 |            | FPR95       | 0.1524 | 0.0843 | 0.1061 | 0.1014 | 0.1226 | 0.0456 |
| LSUN (crop)     | CIFAR10    | AUROC       | 0.9796 | 0.9821 | 0.9878 | 0.9877 | 0.9873 | 0.9923 |
|                 |            | FPR95       | 0.0977 | 0.0953 | 0.0573 | 0.0609 | 0.0591 | 0.0320 |
|                 | CIFAR100   | AUROC       | 0.9439 | 0.9613 | 0.9610 | 0.9543 | 0.9495 | 0.9683 |
|                 |            | FPR95       | 0.2709 | 0.2090 | 0.2176 | 0.2598 | 0.2784 | 0.1702 |
| SVHN            | CIFAR10    | AUROC       | 0.7418 | 0.8144 | 0.8364 | 0.8238 | 0.8126 | 0.8588 |
|                 |            | FPR95       | 0.7600 | 0.5554 | 0.4006 | 0.2892 | 0.3409 | 0.1716 |
|                 | CIFAR100   | AUROC       | 0.7418 | 0.8144 | 0.8364 | 0.8238 | 0.8126 | 0.8588 |
|                 |            | FPR95       | 0.9077 | 0.8120 | 0.7778 | 0.7657 | 0.7756 | 0.6373 |
| Textures        | CIFAR10    | AUROC       | 0.8060 | 0.8426 | 0.8732 | 0.8483 | 0.8233 | 0.8332 |
|                 |            | FPR95       | 0.7259 | 0.6635 | 0.5856 | 0.6016 | 0.5512 | 0.5603 |
|                 | CIFAR100   | AUROC       | 0.6003 | 0.6408 | 0.6726 | 0.7073 | 0.7266 | 0.7169 |
|                 |            | FPR95       | 0.9101 | 0.8780 | 0.8883 | 0.8851 | 0.8690 | 0.8683 |
| STL10           | CIFAR10    | AUROC       | 0.6557 | 0.6733 | 0.6757 | 0.6422 | 0.6017 | 0.6131 |
|                 |            | FPR95       | 0.8479 | 0.8324 | 0.8287 | 0.8438 | 0.8456 | 0.8439 |
|                 | CIFAR100   | AUROC       | 0.7185 | 0.7433 | 0.7588 | 0.7743 | 0.7744 | 0.7758 |
|                 |            | FPR95       | 0.8538 | 0.8273 | 0.8150 | 0.8124 | 0.8131 | 0.7936 |
| Places365       | CIFAR10    | AUROC       | 0.8923 | 0.9090 | 0.9128 | 0.8910 | 0.8609 | 0.8674 |
|                 |            | FPR95       | 0.5004 | 0.4504 | 0.4216 | 0.4547 | 0.4568 | 0.4687 |
|                 | CIFAR100   | AUROC       | 0.7187 | 0.7622 | 0.7622 | 0.7656 | 0.7526 | 0.7567 |
|                 |            | FPR95       | 0.8433 | 0.8014 | 0.8204 | 0.8283 | 0.8265 | 0.8237 |
| iSUN            | CIFAR10    | AUROC       | 0.9282 | 0.9612 | 0.9476 | 0.9402 | 0.9384 | 0.9296 |
|                 |            | FPR95       | 0.3978 | 0.2376 | 0.3190 | 0.3576 | 0.3179 | 0.3882 |
|                 | CIFAR100   | AUROC       | 0.6113 | 0.7304 | 0.7901 | 0.8068 | 0.7863 | 0.7784 |
|                 |            | FPR95       | 0.9248 | 0.8069 | 0.7861 | 0.7394 | 0.7755 | 0.8147 |
| LSUN (resize)   | CIFAR10    | AUROC       | 0.9409 | 0.9612 | 0.9468 | 0.9450 | 0.9412 | 0.9325 |
|                 |            | FPR95       | 0.3433 | 0.2400 | 0.3362 | 0.3315 | 0.2911 | 0.3616 |
|                 | CIFAR100   | AUROC       | 0.6921 | 0.7816 | 0.8092 | 0.8035 | 0.7832 | 0.7760 |
|                 |            | FPR95       | 0.8938 | 0.7365 | 0.7542 | 0.7384 | 0.7763 | 0.8122 |
| Average         | CIFAR10    | AUROC       | 0.7769 | 0.8313 | 0.8471 | 0.8531 | 0.8451 | 0.8507 |
|                 |            | FPR95       | 0.7083 | 0.5719 | 0.5776 | 0.5712 | 0.5915 | 0.5709 |

Table 3. Results for 10 OOD datasets. Metrics are AUROC and FPR@95.