

APPENDIX

VISUALIZATION OF THE FPR@95 SCORES

In our study, we conducted a comprehensive comparison of the False Positive Rate at 95% True Positive Rate (FPR@95) scores between our DSGF method and various baseline methods, as shown in Fig. A.1. Specifically, the green markers in these subfigures denote the FPR@95 scores obtained using the six original OOD detection methods. In contrast, the blue markers signify the results achieved subsequent to the implementation of our DSGF method.

FEATURE DISTRIBUTION VISUALIZATION FOR CIFAR-100

For the CIFAR-100 dataset, we also used t-SNE [1] to visually distinguish ID and OOD samples. As shown in Fig. A.2, the DSGF method significantly improves OOD detection and ID accuracy performance on CIFAR-100. However, as a more challenging setting, Setting 2 does not achieve as high an AUROC score as Setting 1. Therefore, compared to Fig.5 in

the main text, the separation between ID and OOD is not as distinct.

COMPARISON WITH STATE-OF-THE-ART CLIP-BASED APPROACHES

Compared to models based on CLIP, single-modality visual pre-trained models do not require the design of context prompts, which is very important for some application domains. For instance, we evaluated the performance of five methods, include Zero-shot-CLIP [2], CoOp [3], CoCoOp [4], VPT-CLIP [5], and VLPT [6] in plant disease OOD detection. We observed that, regardless of how the context prompt tokens are designed, these methods are consistently suboptimal. We provide the dataset split in Table A.1 and the result in Table A.2. Besides, The comparison with the CLIP-based method is shown in Table A.3.

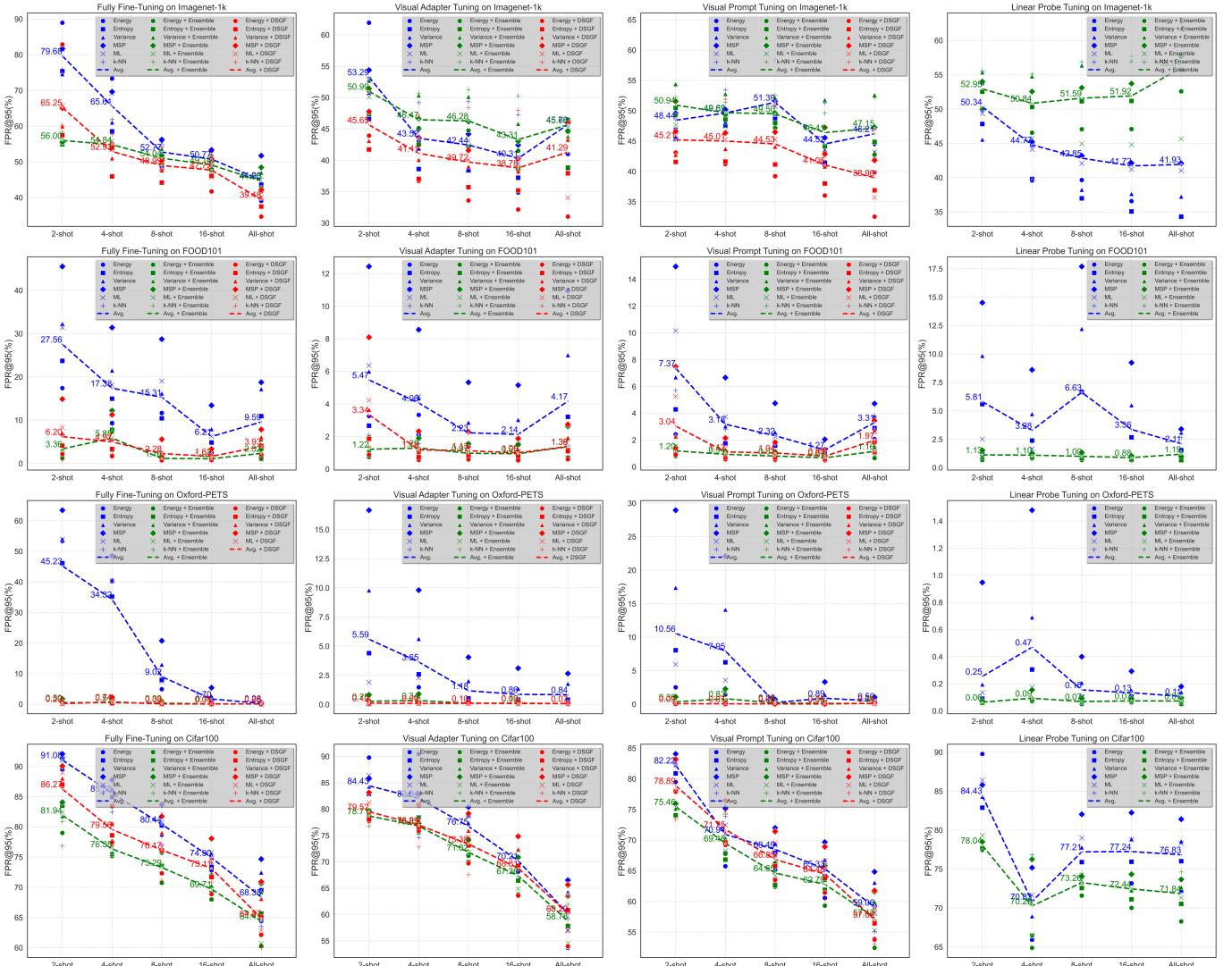


Fig. A.1. FPR@95 scores of FS-OOD detection on different tuning paradigms. Overall, the uncertainty score ensemble achieves more performance gains in a fully fine-tuning setting, while DSGF is effective across different fine-tuning paradigms, especially in small sample settings. ‘Avg.’ represents the arithmetic average of six OOD score evaluation methods.

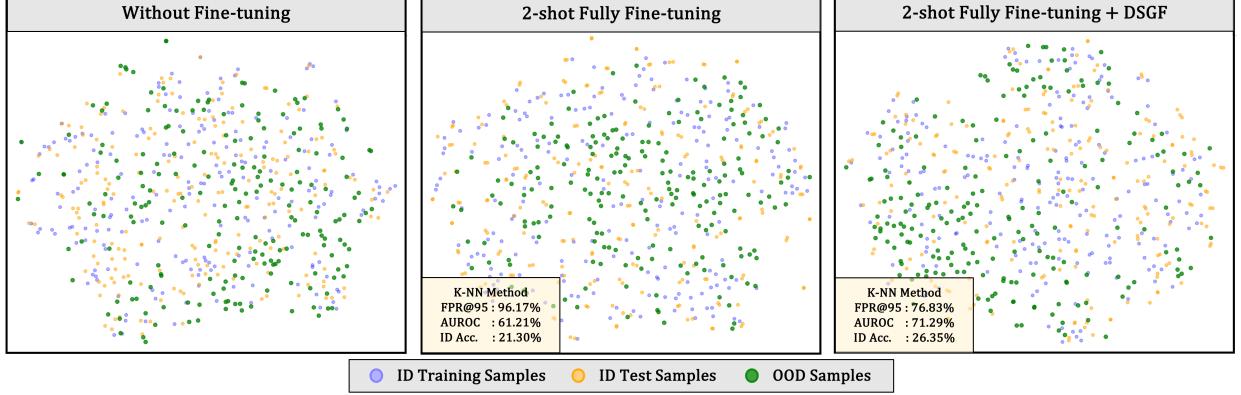


Fig. A.2. The t-SNE visualization on CIFAR-100 (ID) and Tiny-imageNet (OOD). We use the output features from the last layer of the Transformer to visualize the distribution of ID and OOD samples.

TABLE A.1

CLASSES INFORMATION OF THE PLANT VILLAGE DATASET. WE HAVE ASSIGNED A NUMBER TO EACH CATEGORY TO FACILITATE THE REPRESENTATION OF ID AND OOD CLASSES.

Plant Village Dataset Splits					
No.	ID class name	No.	OOD class name	No.	OOD class name
1	Healthy apple leaf	13	Apple Black rot leaf	26	Potato Late blight leaf
2	Healthy blueberry leaf	14	Apple Cedar apple rust leaf	27	Potato Early blight leaf
3	Healthy cherry leaf	15	Apple scab leaf	28	Squash Powdery mildew leaf
4	Healthy corn maize leaf	16	Cherry sour Powdery mildew leaf	29	Strawberry scorch leaf
5	Healthy grape leaf	17	Corn maize Northern Blight leaf	30	Tomato Early blight leaf
6	Healthy peach leaf	18	Corn maize Gray spot leaf	31	Tomato Mold leaf
7	Healthy pepper bell leaf	19	Corn maize Common rust leaf	32	Tomato Spider mites leaf
8	Healthy potato leaf	20	Grape Black rot leaf	33	Tomato Septoria spot leaf
9	Healthy raspberry leaf	21	Grape Esca Black Measles leaf	34	Tomato Mosaic virus leaf
10	Healthy soybean leaf	22	Grape blight Spot leaf	35	Tomato Bacterial spot leaf
11	Healthy strawberry leaf	23	Orange Citrus greening leaf	36	Tomato Late blight leaf
12	Healthy tomato leaf	24	Peach Bacterial spot leaf	37	Tomato Yellow Curl Virus leaf
-	-	25	Pepper bell Bacterial spot leaf	38	Tomato Target Spot Leaf

BENCHMARK DETAILS

In our endeavor to establish a comprehensive benchmark, we meticulously report extensive results encompassing each pairing of ID and OOD datasets. This detailed reporting includes an array of variables, such as different tuning paradigms, shot settings, OOD detection methods, and a comparative analysis with our DSGF method.

To facilitate a thorough and transparent evaluation, we present the FPR@95 and AUROC scores across a series of tables, specifically from Table A.4 to Table A.16. These tables collectively offer a granular view of the performance metrics under various conditions and configurations, thereby providing a nuanced understanding of the efficacy of each method. We also delineate the hyper-parameter settings for the fine-tuning and DSGF Stages in Table A.17.

- [4] ——, “Conditional prompt learning for vision-language models,” in *Proceedings of the IEEE/CVF conference on computer vision and pattern recognition*, 2022, pp. 16 816–16 825.
- [5] M. Jia, L. Tang, B.-C. Chen, C. Cardie, S. Belongie, B. Hariharan, and S.-N. Lim, “Visual prompt tuning,” in *European Conference on Computer Vision*. Springer, 2022, pp. 709–727.
- [6] Y. Zang, W. Li, K. Zhou, C. Huang, and C. C. Loy, “Unified vision and language prompt learning,” *arXiv preprint arXiv:2210.07225*, 2022.

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- [1] L. Van der Maaten and G. Hinton, “Visualizing data using t-sne.” *Journal of machine learning research*, vol. 9, no. 11, 2008.
- [2] Y. Ming, Z. Cai, J. Gu, Y. Sun, W. Li, and Y. Li, “Delving into out-of-distribution detection with vision-language representations,” *Advances in Neural Information Processing Systems*, vol. 35, pp. 35 087–35 102, 2022.
- [3] K. Zhou, J. Yang, C. C. Loy, and Z. Liu, “Learning to prompt for vision-language models,” *International Journal of Computer Vision*, vol. 130, no. 9, pp. 2337–2348, 2022.

TABLE A.2

THE RESULT ON THE PLANT-VILLAGE DATASET. IN THIS CASE, THE OOD DATASET INCLUDES 39220 IMAGES ACROSS 26 CLASSES.

2-shot		FPR@95 ↓ / AUROC ↑ (%)					
	Energy	Entropy	Variance	MSP	Max-Logits	k-NN	
FFT	72.42 / 78.32	74.76 / 76.43	75.29 / 75.33	76.92 / 74.58	72.59 / 78.20	46.94 / 87.56	
FFT + DSGF	34.39 / 93.13	43.59 / 88.77	45.38 / 87.14	49.33 / 87.65	34.82 / 92.87	36.90 / 92.93	
VAT	58.60 / 84.35	62.88 / 81.50	59.94 / 80.80	64.50 / 79.60	53.93 / 83.90	46.22 / 91.88	
VAT + DSGF	26.06 / 94.60	37.53 / 90.22	39.63 / 88.37	44.62 / 88.69	26.25 / 94.38	41.59 / 92.93	
VPT	54.74 / 88.62	55.89 / 87.91	58.04 / 87.28	64.94 / 85.72	58.75 / 87.55	36.98 / 92.49	
VPT + DSGF	30.73 / 94.41	29.19 / 94.47	27.29 / 94.72	28.30 / 94.10	29.79 / 94.12	35.54 / 93.83	
LPT	74.52 / 71.48	88.11 / 65.08	89.27 / 63.70	89.46 / 64.07	74.64 / 71.42	41.65 / 92.68	
4-shot		FPR@95 ↓ / AUROC ↑ (%)					
	Energy	Entropy	Variance	MSP	Max-Logits	k-NN	
FFT	68.10 / 83.26	63.77 / 84.26	65.56 / 83.79	69.99 / 83.61	65.58 / 83.60	29.39 / 94.99	
FFT + DSGF	27.11 / 95.40	41.76 / 93.46	45.34 / 92.76	46.57 / 93.20	28.07 / 95.33	31.62 / 95.20	
VAT	58.40 / 84.30	55.60 / 84.47	55.20 / 79.13	60.10 / 79.92	65.60 / 84.29	37.25 / 92.80	
VAT + DSGF	26.18 / 93.34	33.59 / 90.34	41.09 / 89.35	38.52 / 89.57	37.77 / 93.16	38.95 / 92.95	
VPT	51.80 / 89.60	53.44 / 88.10	52.55 / 87.82	55.47 / 87.50	52.70 / 89.90	34.54 / 91.93	
VPT + DSGF	29.23 / 94.37	30.30 / 93.62	31.06 / 93.25	34.02 / 93.15	29.43 / 94.31	37.35 / 94.22	
LPT	60.06 / 76.96	76.91 / 67.18	79.03 / 66.73	79.57 / 66.58	62.04 / 76.24	42.74 / 92.76	
8-shot		FPR@95 ↓ / AUROC ↑ (%)					
	Energy	Entropy	Variance	MSP	Max-Logits	k-NN	
FFT	26.47 / 94.93	44.22 / 90.63	50.94 / 89.89	52.28 / 89.65	28.62 / 94.70	24.81 / 95.35	
FFT + DSGF	10.36 / 98.06	23.73 / 95.75	28.87 / 95.19	29.69 / 95.31	10.91 / 97.99	24.73 / 96.01	
VAT	29.08 / 92.80	32.46 / 92.47	34.00 / 84.06	65.11 / 84.03	49.58 / 86.79	26.18 / 95.09	
VAT + DSGF	16.95 / 96.94	29.88 / 94.89	34.62 / 94.49	38.82 / 94.78	13.79 / 96.97	27.28 / 95.75	
VPT	22.49 / 95.91	33.79 / 93.88	38.23 / 93.38	39.71 / 93.17	24.34 / 95.68	23.10 / 95.42	
VPT + DSGF	11.06 / 97.96	19.53 / 96.73	23.67 / 96.37	23.52 / 96.40	11.90 / 97.85	13.27 / 97.51	
LPT	64.12 / 82.87	76.91 / 78.73	76.45 / 78.66	77.17 / 78.65	65.55 / 82.56	31.46 / 94.58	
16-shot		FPR@95 ↓ / AUROC ↑ (%)					
	Energy	Entropy	Variance	MSP	Max-Logits	k-NN	
FFT	21.87 / 95.65	40.40 / 93.43	45.56 / 92.90	46.31 / 92.75	21.78 / 95.59	15.29 / 96.49	
FFT + DSGF	7.84 / 98.33	19.12 / 96.92	25.09 / 96.43	23.64 / 96.47	7.96 / 98.30	15.85 / 97.03	
VAT	33.50 / 92.50	35.80 / 92.30	43.60 / 91.60	42.80 / 91.05	43.10 / 92.90	22.38 / 95.41	
VAT + DSGF	14.79 / 96.86	28.49 / 95.53	32.00 / 95.05	32.93 / 95.26	16.00 / 96.81	19.55 / 96.32	
VPT	23.91 / 95.28	30.83 / 94.10	33.56 / 93.69	33.88 / 93.61	24.54 / 95.14	16.73 / 96.21	
VPT + DSGF	11.40 / 97.73	14.22 / 97.35	16.32 / 97.10	14.01 / 97.23	11.46 / 97.70	8.03 / 98.34	
LPT	52.32 / 83.29	74.25 / 75.29	74.63 / 74.50	74.65 / 73.56	52.41 / 83.28	26.17 / 95.31	

TABLE A.3

COMPARISON OF FPR@95 AND AUROC SCORES BETWEEN ViT-B/16 PER-TRAINED ON IMAGENET-21K AND CLIP-ViT-B/16. ID DATASET IS PLANT VILLAGE DATASET.

Method	Context Prompt	2 -shot	4-shot	8-shot	16-shot	All-shot
$FFT_{MaxLogits}$	-	72.59 / 78.20	65.58 / 83.60	28.62 / 94.70	21.78 / 95.59	6.13 / 98.61
$VAT_{MaxLogits}$	-	53.93 / 83.04	65.60 / 84.29	49.58 / 86.79	43.10 / 92.90	6.25 / 98.44
$VPT_{MaxLogits}$	-	58.75 / 87.55	52.70 / 89.90	24.34 / 95.68	24.54 / 95.14	8.81 / 98.35
$CLIP_{MCM}$	This is a photo of [CLS]			Zero shot: 85.31 / 62.82		
$CoOp_{MCM}$	Learnable Prompt+[CLS]	93.50 / 54.40	86.93 / 56.91	89.32 / 60.09	81.94 / 66.87	68.97 / 75.28
$CoCoOp_{MCM}$	Learnable Prompt+[CLS]	91.81 / 60.92	85.39 / 63.99	77.37 / 76.63	64.89 / 81.20	40.08 / 88.61
VPT_{MCM}	This is a photo of [CLS]	85.01 / 68.24	72.90 / 73.66	61.74 / 84.61	51.55 / 84.20	15.67 / 96.23
$VLPT_{MCM}$	Learnable Prompt+[CLS]	80.60 / 72.00	73.48 / 72.64	63.88 / 80.34	43.88 / 87.77	15.38 / 96.50

TABLE A.4
COMPARISON OF BASELINE AND OUR DSGF. ID AND OOD DATASETS ARE IMAGENET-1K AND SUN.

2-shot		FPR@95 ↓ / AUROC ↑ (%)					
	Energy	Entropy	Variance	MSP	Max-Logits	k-NN	
FFT	91.70 / 64.25	83.10 / 70.07	82.66 / 69.64	87.07 / 67.13	87.10 / 67.20	83.54 / 71.11	
FFT + Ensemble	70.80 / 81.23	70.74 / 81.24	71.39 / 81.23	71.20 / 81.01	71.63 / 79.26	73.57 / 78.98	
FFT + DSGF	84.25 / 73.32	67.31 / 78.52	70.63 / 77.35	75.64 / 76.30	75.61 / 76.29	74.29 / 77.34	
VAT	61.36 / 83.16	54.53 / 83.52	60.37 / 82.12	64.22 / 81.33	61.41 / 82.65	66.56 / 80.76	
VAT + Ensemble	64.18 / 83.22	59.01 / 83.53	67.48 / 82.11	65.05 / 82.17	62.63 / 83.23	68.25 / 81.28	
VAT + DSGF	47.11 / 86.87	48.03 / 85.94	51.92 / 84.89	58.74 / 83.76	56.65 / 84.47	61.27 / 82.78	
VPT	44.56 / 85.46	47.01 / 84.52	52.20 / 83.58	58.96 / 82.58	57.37 / 82.99	67.39 / 81.34	
VPT + Ensemble	61.16 / 83.67	63.72 / 83.10	69.92 / 81.81	66.09 / 82.56	59.17 / 83.84	67.93 / 81.97	
VPT + DSGF	46.63 / 86.23	47.86 / 85.60	52.16 / 84.83	58.07 / 84.00	56.79 / 84.41	62.24 / 83.35	
LPT	56.01 / 85.99	52.51 / 85.91	53.30 / 85.06	60.71 / 83.65	59.7 / 84.02	71.43 / 81.25	
LPT + Ensemble	62.52 / 84.16	67.14 / 83.03	71.06 / 81.63	69.26 / 82.27	62.94 / 83.49	71.43 / 81.25	
4-shot		FPR@95 ↓ / AUROC ↑ (%)					
	Energy	Entropy	Variance	MSP	Max-Logits	k-NN	
FFT	78.87 / 73.83	73.65 / 75.65	76.04 / 74.85	82.66 / 73.57	82.21 / 73.70	76.22 / 78.11	
FFT + Ensemble	67.00 / 83.73	67.09 / 83.52	67.63 / 83.80	67.86 / 83.22	71.03 / 81.51	71.10 / 82.43	
FFT + DSGF	65.48 / 82.12	60.51 / 82.87	68.79 / 81.23	68.79 / 81.23	67.64 / 81.78	75.18 / 81.06	
VAT	44.86 / 88.35	44.71 / 88.55	50.37 / 87.59	54.41 / 86.89	51.67 / 87.66	58.03 / 85.85	
VAT + Ensemble	53.59 / 87.51	50.62 / 88.02	61.72 / 86.55	57.08 / 87.05	52.55 / 87.69	62.14 / 85.25	
VAT + DSGF	38.51 / 89.24	42.09 / 88.69	47.74 / 87.99	53.02 / 87.37	50.69 / 87.96	55.95 / 86.26	
VPT	55.59 / 85.20	57.26 / 85.51	60.82 / 85.54	63.72 / 85.20	62.58 / 85.31	67.01 / 85.12	
VPT + Ensemble	58.23 / 86.17	59.25 / 86.23	64.78 / 85.60	61.54 / 86.29	59.88 / 86.56	65.24 / 85.37	
VPT + DSGF	47.26 / 87.45	51.16 / 87.23	56.00 / 86.95	59.58 / 86.51	57.94 / 86.79	65.96 / 84.78	
LPT	44.31 / 88.49	41.78 / 88.56	45.16 / 88.08	54.13 / 87.23	52.45 / 87.55	67.82 / 84.16	
LPT + Ensemble	54.22 / 87.09	60.89 / 86.04	67.42 / 84.58	64.46 / 85.56	54.93 / 87.12	67.82 / 84.16	
8-shot		FPR@95 ↓ / AUROC ↑ (%)					
	Energy	Entropy	Variance	MSP	Max-Logits	k-NN	
FFT	62.47 / 81.42	63.63 / 80.87	67.23 / 79.89	70.35 / 79.28	69.43 / 80.11	67.78 / 81.98	
FFT + Ensemble	67.34 / 83.62	65.91 / 83.05	70.45 / 82.41	68.54 / 82.28	66.25 / 83.41	68.34 / 83.82	
FFT + DSGF	59.92 / 83.61	58.34 / 83.55	62.55 / 82.53	64.99 / 81.96	64.17 / 82.82	72.67 / 82.28	
VAT	43.52 / 89.30	47.28 / 88.81	53.06 / 87.86	55.96 / 87.21	53.05 / 88.30	64.53 / 85.07	
VAT + Ensemble	57.41 / 87.63	53.96 / 87.99	65.66 / 86.47	60.36 / 86.97	56.08 / 87.61	69.25 / 84.04	
VAT + DSGF	39.74 / 90.23	45.12 / 89.28	50.63 / 88.35	54.22 / 87.68	52.05 / 88.57	62.88 / 84.29	
VPT	58.80 / 84.69	61.42 / 84.81	64.47 / 84.57	66.34 / 84.12	64.84 / 84.53	73.49 / 81.71	
VPT + Ensemble	60.49 / 85.82	63.33 / 85.62	68.63 / 84.98	66.30 / 85.32	63.61 / 85.73	72.26 / 83.14	
VPT + DSGF	49.21 / 87.64	53.68 / 87.15	58.19 / 86.54	60.89 / 85.98	59.27 / 86.60	67.98 / 83.32	
LPT	40.58 / 89.83	41.85 / 89.32	46.95 / 88.41	54.69 / 87.36	52.95 / 87.77	73.44 / 82.68	
LPT + Ensemble	59.82 / 86.62	66.43 / 85.51	72.85 / 83.49	69.32 / 84.83	58.26 / 86.69	73.44 / 82.68	
16-shot		FPR@95 ↓ / AUROC ↑ (%)					
	Energy	Entropy	Variance	MSP	Max-Logits	k-NN	
FFT	62.05 / 83.16	63.29 / 82.66	65.72 / 81.49	67.14 / 80.78	66.36 / 82.12	64.22 / 84.60	
FFT + Ensemble	64.49 / 84.95	62.99 / 84.71	67.12 / 83.71	65.22 / 83.66	64.21 / 84.87	64.92 / 85.06	
FFT + DSGF	52.84 / 88.24	58.32 / 85.13	61.10 / 83.14	62.47 / 82.57	57.13 / 87.49	69.81 / 83.57	
VAT	41.66 / 90.44	47.06 / 89.25	52.67 / 87.77	55.00 / 87.07	50.31 / 89.31	61.95 / 85.93	
VAT + Ensemble	53.08 / 88.94	50.43 / 88.90	59.60 / 87.41	56.81 / 87.44	53.65 / 88.54	66.70 / 84.55	
VAT + DSGF	39.05 / 90.67	45.20 / 89.66	50.28 / 88.68	52.96 / 88.06	50.88 / 89.15	61.00 / 86.14	
VPT	46.32 / 88.78	51.02 / 88.06	56.33 / 87.32	59.22 / 86.69	57.00 / 87.47	61.50 / 85.10	
VPT + Ensemble	52.70 / 88.27	56.74 / 87.66	66.70 / 86.20	61.95 / 86.87	57.02 / 87.55	64.92 / 84.70	
VPT + DSGF	42.31 / 89.80	48.47 / 88.88	54.01 / 87.98	57.05 / 87.33	54.38 / 88.24	60.63 / 85.16	
LPT	38.17 / 90.49	40.97 / 89.68	46.52 / 88.75	53.01 / 87.79	51.58 / 88.2	73.53 / 82.73	
LPT + Ensemble	59.18 / 87.05	65.22 / 85.93	72.81 / 83.77	68.74 / 85.23	58.12 / 87.12	73.53 / 82.73	
All-shot		FPR@95 ↓ / AUROC ↑ (%)					
	Energy	Entropy	Variance	MSP	Max-Logits	k-NN	
FFT	45.45 / 89.72	50.87 / 86.77	55.84 / 84.60	58.30 / 83.92	49.36 / 89.06	54.39 / 88.13	
FFT + Ensemble	54.36 / 88.69	52.74 / 87.79	57.27 / 86.19	58.06 / 85.99	55.50 / 88.31	63.83 / 85.50	
FFT + DSGF	41.36 / 90.76	45.60 / 89.90	48.79 / 89.13	51.15 / 88.61	48.74 / 89.51	52.49 / 88.03	
VAT	49.70 / 89.83	47.05 / 88.91	52.54 / 86.89	55.51 / 86.19	50.57 / 89.72	72.45 / 83.99	
VAT + Ensemble	62.64 / 87.95	49.38 / 88.67	55.56 / 87.23	56.32 / 86.95	59.09 / 88.09	78.66 / 82.52	
VAT + DSGF	36.16 / 92.21	46.47 / 88.63	52.81 / 86.60	55.45 / 85.89	40.58 / 91.51	78.66 / 82.52	
VPT	47.74 / 88.08	51.93 / 87.75	54.52 / 87.02	56.16 / 86.36	54.25 / 87.38	67.89 / 85.05	
VPT + Ensemble	55.46 / 87.60	59.55 / 87.19	72.13 / 85.49	64.44 / 86.28	57.65 / 87.18	69.09 / 83.87	
VPT + DSGF	39.55 / 91.67	48.29 / 88.03	53.15 / 85.82	55.53 / 85.16	43.79 / 90.89	61.30 / 84.63	
LPT	37.93 / 90.57	41.67 / 89.63	47.68 / 88.62	54.41 / 87.62	52.95 / 88.06	82.57 / 80.45	
LPT + Ensemble	70.98 / 85.00	75.41 / 84.17	81.83 / 81.72	77.48 / 83.56	61.77 / 86.17	82.57 / 80.45	

TABLE A.5
COMPARISON OF BASELINE AND OUR DSGF. ID AND OOD DATASETS ARE IMAGENET-1K AND iNATURALIST.

2-shot		FPR@95 ↓ / AUROC ↑ (%)					
	Energy	Entropy	Variance	MSP	Max-Logits	k-NN	
FFT	85.62 / 75.41	57.74 / 86.66	56.89 / 86.11	70.80 / 81.69	70.50 / 81.83	59.26 / 85.46	
FFT + Ensemble	18.25 / 96.30	17.96 / 96.30	18.69 / 96.20	18.72 / 96.22	22.76 / 95.41	25.72 / 94.74	
FFT + DSGF	66.19 / 88.12	23.58 / 94.51	28.55 / 93.33	37.85 / 91.75	36.96 / 92.07	28.79 / 94.21	
VAT	35.95 / 94.77	10.28 / 97.79	15.20 / 97.01	20.65 / 96.21	18.63 / 96.71	16.84 / 96.62	
VAT + Ensemble	13.65 / 97.33	10.45 / 97.85	15.83 / 97.00	14.96 / 97.09	13.04 / 97.44	17.06 / 96.57	
VAT + DSGF	5.42 / 98.46	4.73 / 98.69	6.23 / 98.56	10.71 / 97.95	9.44 / 98.15	17.69 / 96.39	
VPT	6.79 / 98.38	6.17 / 98.54	7.52 / 98.37	11.86 / 97.71	11.03 / 97.84	12.39 / 97.71	
VPT + Ensemble	11.87 / 97.62	13.27 / 97.47	17.53 / 96.54	14.67 / 97.23	10.03 / 98.10	13.29 / 97.46	
VPT + DSGF	4.27 / 98.93	3.94 / 99.03	5.06 / 98.87	8.36 / 98.32	7.76 / 98.44	15.82 / 97.01	
LPT	13.63 / 97.08	8.37 / 97.94	8.16 / 98.00	13.99 / 97.24	13.29 / 97.37	18.70 / 96.19	
LPT + Ensemble	12.69 / 97.41	15.28 / 96.95	18.46 / 96.28	16.98 / 96.59	13.53 / 97.26	18.70 / 96.19	
4-shot		FPR@95 ↓ / AUROC ↑ (%)					
	Energy	Entropy	Variance	MSP	Max-Logits	k-NN	
FFT	49.26 / 91.22	23.23 / 95.00	26.30 / 94.24	40.46 / 91.78	39.63 / 91.96	27.75 / 94.84	
FFT + Ensemble	13.98 / 97.59	14.34 / 97.48	15.91 / 97.22	15.22 / 97.33	16.12 / 97.10	16.48 / 97.14	
FFT + DSGF	14.24 / 97.08	7.40 / 98.23	11.62 / 97.57	17.65 / 96.69	15.89 / 97.02	20.13 / 96.48	
VAT	7.82 / 97.92	3.57 / 99.08	4.88 / 98.89	6.53 / 98.58	5.94 / 98.75	11.91 / 97.86	
VAT + Ensemble	7.25 / 98.59	5.03 / 98.86	11.62 / 97.96	7.52 / 98.47	5.31 / 98.91	12.07 / 97.87	
VAT + DSGF	2.95 / 99.04	3.04 / 99.15	4.21 / 98.99	6.06 / 98.69	5.28 / 98.85	11.95 / 97.88	
VPT	6.21 / 98.56	6.26 / 98.62	7.32 / 98.46	10.38 / 98.02	9.29 / 98.16	9.36 / 98.18	
VPT + Ensemble	7.95 / 98.52	8.08 / 98.49	13.67 / 97.70	9.51 / 98.25	6.44 / 98.74	8.70 / 98.36	
VPT + DSGF	3.52 / 99.18	3.92 / 99.11	5.13 / 98.93	7.13 / 98.56	6.29 / 98.70	10.71 / 98.11	
LPT	6.46 / 98.28	4.41 / 98.74	4.92 / 98.73	8.14 / 98.29	7.66 / 98.39	16.03 / 97.22	
LPT + Ensemble	8.49 / 98.38	11.32 / 97.97	15.69 / 97.29	13.35 / 97.67	7.35 / 98.48	16.03 / 97.22	
8-shot		FPR@95 ↓ / AUROC ↑ (%)					
	Energy	Entropy	Variance	MSP	Max-Logits	k-NN	
FFT	9.56 / 97.74	11.55 / 97.45	15.97 / 96.72	20.55 / 95.95	19.16 / 96.34	18.68 / 96.51	
FFT + Ensemble	8.43 / 98.16	8.42 / 98.10	11.95 / 97.51	10.66 / 97.66	10.09 / 98.05	11.81 / 97.81	
FFT + DSGF	7.09 / 98.11	7.03 / 98.45	10.55 / 97.88	14.12 / 97.30	12.95 / 97.61	15.18 / 97.20	
VAT	3.83 / 98.51	3.43 / 99.13	4.84 / 98.90	6.39 / 98.59	5.50 / 98.78	10.04 / 98.00	
VAT + Ensemble	5.70 / 98.75	4.37 / 98.98	9.26 / 98.15	6.19 / 98.60	4.82 / 98.96	10.71 / 97.86	
VAT + DSGF	2.30 / 99.32	2.96 / 99.28	4.16 / 99.09	5.60 / 98.75	4.90 / 98.93	11.81 / 97.70	
VPT	13.58 / 97.36	12.14 / 97.57	13.03 / 97.43	15.80 / 96.96	14.91 / 97.16	23.09 / 96.30	
VPT + Ensemble	7.02 / 98.55	7.22 / 98.45	10.79 / 97.89	8.26 / 98.23	7.80 / 98.36	11.95 / 97.69	
VPT + DSGF	4.72 / 98.86	5.62 / 98.76	7.46 / 98.47	9.85 / 97.95	8.74 / 98.19	10.65 / 97.82	
LPT	4.07 / 98.82	3.40 / 99.04	4.51 / 98.93	7.71 / 98.46	7.16 / 98.57	15.60 / 97.11	
LPT + Ensemble	6.82 / 98.47	9.50 / 98.06	15.04 / 97.27	11.62 / 97.75	6.77 / 98.58	15.60 / 97.11	
16-shot		FPR@95 ↓ / AUROC ↑ (%)					
	Energy	Entropy	Variance	MSP	Max-Logits	k-NN	
FFT	12.17 / 97.30	13.92 / 96.91	16.90 / 96.18	18.87 / 95.65	17.57 / 96.29	14.50 / 97.23	
FFT + Ensemble	11.11 / 98.05	10.75 / 97.84	14.77 / 97.17	13.31 / 97.32	11.01 / 97.99	9.24 / 98.31	
FFT + DSGF	9.25 / 98.30	12.38 / 97.19	15.68 / 96.18	17.25 / 95.76	12.14 / 97.77	15.46 / 97.32	
VAT	3.28 / 99.04	3.71 / 99.17	4.87 / 98.90	5.94 / 98.65	4.68 / 98.97	9.50 / 98.29	
VAT + Ensemble	6.38 / 98.85	3.53 / 99.14	9.39 / 98.35	5.59 / 98.72	4.07 / 99.10	13.07 / 97.78	
VAT + DSGF	2.12 / 99.45	2.67 / 99.37	3.68 / 99.21	4.57 / 98.95	4.08 / 99.12	14.58 / 98.58	
VPT	5.95 / 98.43	5.85 / 98.60	6.89 / 98.48	8.61 / 98.14	7.72 / 98.33	17.74 / 97.22	
VPT + Ensemble	6.13 / 98.81	7.47 / 98.67	14.38 / 97.76	9.93 / 98.34	5.89 / 98.80	12.01 / 97.94	
VPT + DSGF	3.24 / 99.08	3.92 / 99.02	5.43 / 98.77	7.24 / 98.32	6.13 / 98.56	12.46 / 97.90	
LPT	3.16 / 99.04	2.96 / 99.14	4.21 / 99.01	6.71 / 98.56	6.11 / 98.66	18.79 / 96.59	
LPT + Ensemble	9.90 / 98.34	13.16 / 97.81	18.22 / 96.80	15.36 / 97.47	6.93 / 98.67	18.79 / 96.59	
All-shot		FPR@95 ↓ / AUROC ↑ (%)					
	Energy	Entropy	Variance	MSP	Max-Logits	k-NN	
FFT	12.89 / 97.46	16.44 / 95.97	22.49 / 94.32	25.54 / 93.65	16.05 / 96.90	11.70 / 97.85	
FFT + Ensemble	7.85 / 98.48	12.30 / 97.98	16.25 / 96.72	18.62 / 96.68	8.77 / 98.37	7.35 / 98.54	
FFT + DSGF	8.98 / 98.29	11.06 / 97.94	13.30 / 97.47	15.57 / 96.99	13.72 / 97.43	10.92 / 98.54	
VAT	6.67 / 98.16	7.24 / 98.33	11.01 / 97.49	13.82 / 96.96	8.21 / 98.19	11.35 / 97.85	
VAT + Ensemble	6.00 / 98.56	5.53 / 98.89	7.90 / 98.22	9.42 / 98.12	5.79 / 98.72	13.89 / 97.60	
VAT + DSGF	3.93 / 99.15	6.22 / 98.49	9.66 / 97.69	12.29 / 97.20	4.96 / 98.89	13.89 / 97.60	
VPT	6.96 / 98.57	8.00 / 98.39	8.92 / 98.08	10.36 / 97.68	9.13 / 98.02	59.88 / 92.03	
VPT + Ensemble	4.63 / 98.96	5.79 / 98.71	11.42 / 97.87	7.47 / 98.31	5.82 / 98.76	18.41 / 96.85	
VPT + DSGF	3.39 / 99.18	4.38 / 99.01	5.64 / 98.74	6.92 / 98.38	5.93 / 98.66	11.45 / 97.77	
LPT	2.88 / 99.12	3.07 / 99.16	4.45 / 99.01	7.18 / 98.54	6.65 / 98.64	21.53 / 96.51	
LPT + Ensemble	10.06 / 98.19	13.16 / 97.74	20.61 / 96.70	15.43 / 97.44	5.55 / 98.80	21.53 / 96.51	

TABLE A.6
COMPARISON OF BASELINE AND OUR DSGF. ID AND OOD DATASETS ARE IMAGENET-1K AND PLACES.

2-shot		FPR@95 ↓ / AUROC ↑ (%)					
	Energy	Entropy	Variance	MSP	Max-Logits	k-NN	
FFT	92.35 / 62.56	88.09 / 65.43	87.68 / 65.42	89.42 / 64.20	89.37 / 64.28	86.12 / 68.48	
FFT + Ensemble	74.33 / 79.16	74.03 / 79.17	74.34 / 79.27	74.35 / 79.00	75.39 / 76.73	76.41 / 76.87	
FFT + DSGF	88.74 / 69.38	77.37 / 74.02	78.66 / 73.50	81.02 / 72.97	81.33 / 72.73	78.00 / 75.10	
VAT	71.97 / 79.47	66.18 / 79.93	69.81 / 79.03	72.10 / 78.48	70.23 / 79.35	71.18 / 78.86	
VAT + Ensemble	70.14 / 80.54	67.81 / 80.54	72.11 / 79.86	71.04 / 79.73	69.89 / 80.48	72.03 / 79.36	
VAT + DSGF	62.23 / 82.25	61.36 / 81.70	63.23 / 81.14	67.23 / 80.49	65.87 / 81.01	68.61 / 79.87	
VPT	57.23 / 81.70	58.60 / 81.08	61.98 / 80.54	67.02 / 79.90	66.13 / 80.17	71.04 / 79.27	
VPT + Ensemble	66.67 / 81.09	68.92 / 80.71	73.33 / 79.88	70.54 / 80.49	66.28 / 81.23	72.11 / 79.91	
VPT + DSGF	60.08 / 82.07	59.80 / 81.80	62.31 / 81.47	66.25 / 80.99	65.47 / 81.25	68.25 / 80.59	
LPT	69.74 / 80.80	66.11 / 81.38	64.94 / 81.13	68.74 / 80.37	68.15 / 80.63	74.38 / 79.31	
LPT + Ensemble	69.12 / 81.17	71.73 / 80.45	74.26 / 79.59	73.12 / 79.99	69.69 / 80.67	74.38 / 79.31	
4-shot		FPR@95 ↓ / AUROC ↑ (%)					
	Energy	Entropy	Variance	MSP	Max-Logits	k-NN	
FFT	85.82 / 68.71	79.73 / 71.28	81.20 / 70.87	84.94 / 70.14	84.83 / 70.16	80.31 / 74.72	
FFT + Ensemble	74.25 / 79.92	73.74 / 79.84	73.97 / 80.42	74.47 / 79.63	76.23 / 77.74	75.74 / 79.17	
FFT + DSGF	73.51 / 77.93	69.35 / 78.76	72.94 / 78.04	75.15 / 77.53	74.53 / 77.90	77.34 / 77.96	
VAT	57.01 / 84.42	55.80 / 84.76	60.39 / 84.10	63.80 / 83.58	61.55 / 84.19	66.29 / 82.55	
VAT + Ensemble	63.25 / 83.89	60.80 / 84.42	69.48 / 83.39	65.50 / 83.82	62.41 / 84.17	69.41 / 81.95	
VAT + DSGF	52.61 / 84.80	54.61 / 84.51	59.05 / 84.10	62.97 / 83.68	60.85 / 84.14	59.38 / 87.38	
VPT	63.99 / 82.00	64.07 / 82.67	65.84 / 83.14	67.51 / 83.12	66.69 / 83.03	72.79 / 82.07	
VPT + Ensemble	66.94 / 82.89	67.24 / 83.18	71.75 / 82.77	68.38 / 83.61	65.73 / 83.74	71.68 / 82.26	
VPT + DSGF	58.26 / 83.69	60.31 / 83.81	63.27 / 83.92	65.58 / 83.77	64.50 / 83.87	73.31 / 81.69	
LPT	59.67 / 83.44	56.78 / 83.94	58.09 / 83.83	64.10 / 83.33	62.78 / 83.57	73.99 / 80.97	
LPT + Ensemble	65.40 / 83.20	69.61 / 82.47	73.71 / 81.43	71.81 / 82.24	65.19 / 83.35	73.99 / 80.97	
8-shot		FPR@95 ↓ / AUROC ↑ (%)					
	Energy	Entropy	Variance	MSP	Max-Logits	k-NN	
FFT	67.93 / 78.42	68.16 / 78.21	71.12 / 77.54	73.42 / 77.07	72.83 / 77.57	71.73 / 79.35	
FFT + Ensemble	70.58 / 81.20	69.68 / 80.71	73.52 / 80.35	71.69 / 80.18	69.73 / 81.13	71.40 / 81.72	
FFT + DSGF	64.88 / 80.60	63.17 / 80.76	66.24 / 80.03	68.38 / 79.57	67.62 / 80.11	73.33 / 81.10	
VAT	52.11 / 86.28	54.80 / 86.00	58.95 / 85.31	61.13 / 84.78	58.87 / 85.66	67.30 / 83.15	
VAT + Ensemble	62.34 / 85.25	59.86 / 85.54	69.02 / 84.45	64.68 / 84.83	61.30 / 85.27	70.87 / 82.43	
VAT + DSGF	48.21 / 87.43	52.89 / 86.77	56.99 / 86.14	59.56 / 85.65	57.85 / 86.34	64.97 / 83.11	
VPT	63.05 / 82.23	65.16 / 82.72	67.07 / 82.90	68.36 / 82.65	67.25 / 82.75	75.08 / 80.51	
VPT + Ensemble	64.51 / 83.61	66.62 / 83.64	71.35 / 83.32	68.69 / 83.71	66.58 / 83.89	73.71 / 81.69	
VPT + DSGF	55.72 / 84.81	59.18 / 84.71	62.49 / 84.47	64.37 / 84.11	63.07 / 84.46	72.32 / 82.13	
LPT	52.67 / 86.36	52.04 / 86.26	55.40 / 85.71	61.11 / 85.02	59.66 / 85.33	75.86 / 80.98	
LPT + Ensemble	65.24 / 84.27	70.21 / 83.45	75.32 / 81.85	72.19 / 83.03	63.62 / 84.51	75.86 / 80.98	
16-shot		FPR@95 ↓ / AUROC ↑ (%)					
	Energy	Entropy	Variance	MSP	Max-Logits	k-NN	
FFT	66.96 / 79.69	67.28 / 79.56	69.25 / 78.76	70.10 / 78.25	69.68 / 79.16	67.21 / 81.97	
FFT + Ensemble	68.73 / 82.05	66.85 / 81.95	70.60 / 81.17	68.69 / 81.23	67.53 / 82.33	67.45 / 83.09	
FFT + DSGF	58.33 / 85.14	62.66 / 82.33	65.19 / 80.67	66.46 / 80.18	62.07 / 84.51	71.56 / 82.06	
VAT	49.29 / 87.64	52.99 / 86.73	57.14 / 85.53	59.11 / 84.95	55.44 / 86.86	66.09 / 84.24	
VAT + Ensemble	59.00 / 86.55	56.10 / 86.54	63.90 / 85.35	61.02 / 85.40	58.45 / 86.29	70.06 / 82.84	
VAT + DSGF	48.06 / 87.75	52.87 / 87.00	56.62 / 86.27	58.63 / 85.78	56.87 / 86.69	64.08 / 84.03	
VPT	53.10 / 85.30	56.54 / 85.03	60.22 / 84.72	62.72 / 84.34	60.84 / 84.83	66.13 / 83.29	
VPT + Ensemble	58.55 / 85.42	61.57 / 85.03	70.20 / 83.96	65.77 / 84.65	60.95 / 85.22	69.15 / 82.92	
VPT + DSGF	50.34 / 86.49	54.97 / 85.97	59.05 / 85.46	60.98 / 85.03	58.75 / 85.65	65.63 / 83.45	
LPT	51.00 / 86.77	51.54 / 86.34	55.34 / 85.76	60.21 / 85.13	59.15 / 85.46	76.49 / 80.88	
LPT + Ensemble	65.59 / 84.46	70.23 / 83.62	75.99 / 81.94	72.61 / 83.18	63.95 / 84.68	76.49 / 80.88	
All-shot		FPR@95 ↓ / AUROC ↑ (%)					
	Energy	Entropy	Variance	MSP	Max-Logits	k-NN	
FFT	51.77 / 88.27	55.18 / 85.83	59.44 / 83.93	61.61 / 83.28	54.39 / 87.78	57.23 / 86.57	
FFT + Ensemble	58.55 / 87.12	56.46 / 86.20	60.41 / 85.12	61.21 / 84.80	58.73 / 86.76	65.34 / 84.18	
FFT + DSGF	51.00 / 87.12	53.91 / 86.85	56.15 / 86.60	57.59 / 86.28	55.70 / 86.87	58.29 / 85.36	
VAT	57.02 / 87.68	52.28 / 87.34	56.49 / 85.64	58.86 / 84.99	56.31 / 87.74	73.01 / 83.04	
VAT + Ensemble	66.36 / 86.12	54.41 / 86.96	60.03 / 85.93	60.22 / 85.59	63.35 / 86.29	77.32 / 81.49	
VAT + DSGF	44.57 / 89.75	52.02 / 86.73	57.22 / 85.00	59.36 / 84.39	47.25 / 89.22	77.32 / 81.49	
VPT	54.80 / 84.90	58.17 / 85.10	59.80 / 84.83	60.98 / 84.41	59.50 / 85.07	72.37 / 82.70	
VPT + Ensemble	60.94 / 84.94	64.03 / 84.88	72.64 / 83.81	66.90 / 84.51	62.27 / 85.02	72.13 / 82.01	
VPT + DSGF	45.50 / 90.01	52.42 / 86.84	56.46 / 84.91	58.84 / 84.27	48.40 / 89.38	66.11 / 83.21	
LPT	50.23 / 87.01	51.85 / 86.46	55.85 / 85.87	60.29 / 85.28	59.05 / 85.60	81.78 / 79.10	
LPT + Ensemble	73.13 / 82.85	76.34 / 82.27	81.04 / 80.41	78.14 / 81.92	66.79 / 83.87	81.78 / 79.10	

TABLE A.7
COMPARISON OF BASELINE AND OUR DSGF. ID AND OOD DATASETS ARE IMAGENET-1K AND TEXTURE.

2-shot	FPR@95 ↓ / AUROC ↑ (%)					
	Energy	Entropy	Variance	MSP	Max-Logits	k-NN
FFT	86.19 / 74.20	72.62 / 81.15	71.17 / 80.43	79.56 / 76.72	79.29 / 76.93	74.45 / 79.12
FFT + Ensemble	56.19 / 87.37	56.88 / 87.13	57.73 / 86.81	57.85 / 86.99	56.83 / 87.17	58.32 / 86.82
FFT + DSGF	92.41 / 74.34	61.72 / 85.17	62.07 / 84.56	65.78 / 83.57	69.04 / 83.15	60.14 / 85.70
VAT	78.46 / 84.15	55.43 / 87.07	57.80 / 86.06	60.57 / 85.28	61.67 / 85.97	57.50 / 86.67
VAT + Ensemble	56.26 / 87.73	52.30 / 88.03	55.35 / 87.31	54.68 / 87.01	54.86 / 87.77	55.59 / 87.52
VAT + DSGF	60.96 / 87.89	52.78 / 88.90	51.03 / 88.74	54.41 / 88.02	53.46 / 88.42	56.44 / 87.12
VPT	79.08 / 82.68	69.59 / 85.84	61.01 / 86.87	60.50 / 86.70	60.89 / 86.72	66.17 / 86.04
VPT + Ensemble	57.36 / 87.70	56.01 / 88.18	56.88 / 87.55	54.98 / 88.25	55.28 / 88.53	55.51 / 88.36
VPT + DSGF	61.45 / 87.93	54.65 / 88.99	51.40 / 89.05	53.69 / 88.46	53.35 / 88.70	59.49 / 87.53
LPT	75.66 / 82.20	64.34 / 86.02	55.83 / 87.27	56.35 / 87.00	56.29 / 87.07	57.80 / 86.79
LPT + Ensemble	55.94 / 87.29	55.99 / 87.42	57.66 / 86.96	56.67 / 87.26	54.45 / 87.63	57.80 / 86.79
4-shot	FPR@95 ↓ / AUROC ↑ (%)					
	Energy	Entropy	Variance	MSP	Max-Logits	k-NN
FFT	79.34 / 81.96	57.54 / 85.96	60.73 / 84.36	70.50 / 81.83	70.16 / 82.02	63.24 / 84.80
FFT + Ensemble	61.42 / 87.31	60.71 / 87.22	62.29 / 86.49	61.88 / 86.80	59.72 / 87.05	57.91 / 87.44
FFT + DSGF	66.81 / 86.42	46.51 / 88.49	50.80 / 87.21	56.05 / 86.18	55.87 / 86.87	58.12 / 87.33
VAT	62.11 / 87.36	50.37 / 88.55	51.90 / 87.77	55.25 / 87.14	54.73 / 87.91	60.55 / 86.71
VAT + Ensemble	56.45 / 88.57	53.67 / 88.98	58.53 / 87.84	56.37 / 88.14	53.67 / 88.91	59.24 / 87.44
VAT + DSGF	52.75 / 89.42	48.39 / 89.54	49.33 / 88.93	52.45 / 88.27	51.24 / 88.96	61.42 / 85.04
VPT	69.82 / 83.69	62.80 / 85.96	58.74 / 86.58	59.18 / 86.39	59.38 / 86.41	64.50 / 86.60
VPT + Ensemble	61.31 / 87.39	59.80 / 87.91	60.92 / 87.55	58.21 / 88.03	57.39 / 88.40	59.88 / 88.10
VPT + DSGF	55.80 / 88.28	51.10 / 88.92	50.50 / 88.73	53.14 / 88.26	52.22 / 88.65	57.61 / 88.53
LPT	68.62 / 85.47	56.31 / 88.23	50.28 / 88.56	54.43 / 87.80	53.60 / 88.02	62.59 / 86.41
LPT + Ensemble	58.09 / 87.85	59.40 / 87.67	62.27 / 86.69	60.60 / 87.32	55.44 / 88.36	62.59 / 86.41
8-shot	FPR@95 ↓ / AUROC ↑ (%)					
	Energy	Entropy	Variance	MSP	Max-Logits	k-NN
FFT	54.33 / 87.25	54.77 / 86.79	57.04 / 85.87	60.67 / 85.18	59.82 / 85.99	58.24 / 86.62
FFT + Ensemble	55.48 / 88.38	54.29 / 88.27	58.76 / 87.22	55.96 / 87.46	53.63 / 88.45	52.09 / 88.77
FFT + DSGF	59.06 / 87.59	48.33 / 88.44	51.35 / 87.52	53.99 / 86.87	53.76 / 87.61	56.06 / 87.59
VAT	54.08 / 88.38	48.10 / 88.59	50.92 / 87.72	53.30 / 87.13	51.99 / 88.24	55.51 / 87.49
VAT + Ensemble	53.56 / 88.94	50.73 / 89.11	56.63 / 87.88	53.51 / 88.18	50.25 / 89.10	54.18 / 87.82
VAT + DSGF	44.11 / 90.52	41.86 / 90.22	44.24 / 89.48	46.93 / 88.90	45.53 / 89.75	53.81 / 87.83
VPT	61.38 / 86.73	55.82 / 87.77	54.79 / 87.68	55.89 / 87.27	55.74 / 87.66	61.90 / 87.04
VPT + Ensemble	56.47 / 88.72	54.82 / 88.95	57.73 / 88.10	55.11 / 88.57	52.61 / 89.13	52.16 / 88.84
VPT + DSGF	47.16 / 89.89	46.13 / 89.76	48.23 / 89.14	50.83 / 88.56	50.05 / 89.26	52.91 / 88.61
LPT	61.31 / 87.70	50.66 / 89.29	46.13 / 89.23	49.29 / 88.55	48.62 / 88.83	62.64 / 85.94
LPT + Ensemble	56.38 / 88.08	58.40 / 87.80	62.23 / 86.47	59.31 / 87.38	51.21 / 88.72	62.64 / 85.94
16-shot	FPR@95 ↓ / AUROC ↑ (%)					
	Energy	Entropy	Variance	MSP	Max-Logits	k-NN
FFT	50.82 / 86.91	52.30 / 86.06	55.21 / 84.71	57.34 / 83.96	56.31 / 85.53	53.30 / 87.12
FFT + Ensemble	51.65 / 88.72	50.51 / 88.17	55.37 / 87.02	53.58 / 86.98	51.58 / 88.46	47.57 / 89.23
FFT + DSGF	46.47 / 88.34	51.12 / 85.40	55.20 / 83.44	57.29 / 82.84	51.31 / 87.57	53.83 / 87.99
VAT	45.18 / 89.08	45.12 / 88.31	47.68 / 87.05	49.72 / 86.45	47.46 / 88.54	51.65 / 88.14
VAT + Ensemble	47.57 / 89.70	44.57 / 89.49	50.39 / 88.13	48.69 / 88.23	45.99 / 89.67	51.29 / 88.43
VAT + DSGF	39.36 / 90.96	40.00 / 90.45	42.38 / 89.59	44.93 / 89.04	43.74 / 90.08	52.18 / 88.17
VPT	58.24 / 86.93	52.36 / 88.56	50.71 / 88.58	51.65 / 88.17	51.97 / 88.48	59.89 / 88.17
VPT + Ensemble	53.37 / 89.13	50.78 / 89.60	55.87 / 88.74	51.35 / 89.23	47.98 / 89.75	52.38 / 89.23
VPT + DSGF	48.23 / 89.90	44.68 / 90.22	44.72 / 89.73	46.29 / 89.20	45.94 / 89.89	50.50 / 89.09
LPT	54.01 / 88.92	44.86 / 89.65	44.52 / 89.25	48.62 / 88.45	47.94 / 88.76	61.88 / 86.19
LPT + Ensemble	53.67 / 88.66	56.15 / 88.19	61.17 / 86.76	58.16 / 87.61	50.28 / 88.94	61.88 / 86.19
All-shot	FPR@95 ↓ / AUROC ↑ (%)					
	Energy	Entropy	Variance	MSP	Max-Logits	k-NN
FFT	46.24 / 89.06	52.18 / 85.22	58.30 / 82.69	61.49 / 81.91	50.62 / 88.17	49.79 / 88.85
FFT + Ensemble	46.17 / 90.23	49.15 / 88.74	54.04 / 86.34	55.94 / 86.33	47.77 / 89.85	44.96 / 89.91
FFT + DSGF	37.39 / 91.25	39.50 / 90.64	41.58 / 89.73	44.38 / 89.00	42.43 / 89.92	47.81 / 89.91
VAT	50.66 / 88.22	48.30 / 86.83	53.69 / 84.75	56.63 / 83.96	65.82 / 85.46	81.49 / 79.45
VAT + Ensemble	51.03 / 89.34	46.03 / 89.44	51.65 / 87.47	52.64 / 87.36	50.12 / 89.40	52.29 / 88.57
VAT + DSGF	39.41 / 90.81	46.97 / 86.91	53.49 / 84.64	56.72 / 83.86	43.19 / 90.09	52.29 / 88.57
VPT	49.95 / 89.27	49.47 / 89.21	49.40 / 88.47	50.87 / 87.85	49.96 / 88.82	57.94 / 88.22
VPT + Ensemble	49.93 / 90.13	50.09 / 89.92	54.22 / 88.68	50.28 / 89.04	47.06 / 89.94	49.22 / 89.34
VPT + DSGF	41.74 / 90.65	42.46 / 90.19	44.34 / 89.34	46.03 / 88.74	44.63 / 89.81	48.74 / 89.26
LPT	46.52 / 90.23	40.35 / 90.58	40.64 / 90.06	45.78 / 89.25	44.93 / 89.57	64.45 / 85.49
LPT + Ensemble	56.15 / 88.35	58.23 / 87.99	63.56 / 86.29	59.73 / 87.50	48.55 / 89.38	64.45 / 85.49

TABLE A.8
COMPARISON OF BASELINE AND OUR DSGF. ID AND OOD DATASETS ARE FOOD-101 AND SUN.

2-shot		FPR@95 ↓ / AUROC ↑ (%)					
	Energy	Entropy	Variance	MSP	Max-Logits	k-NN	
FFT	10.42 / 97.29	17.00 / 95.31	24.67 / 93.06	37.86 / 90.12	23.37 / 94.22	10.68 / 97.50	
FFT + Ensemble	0.32 / 99.91	1.98 / 99.50	1.70 / 99.48	3.98 / 98.96	0.74 / 99.81	1.29 / 99.73	
FFT + DSGF	0.49 / 99.89	1.66 / 99.66	3.75 / 99.21	9.97 / 97.97	4.63 / 99.09	0.28 / 99.90	
VAT	1.34 / 99.38	1.16 / 99.66	3.37 / 99.25	9.10 / 98.29	3.57 / 99.19	0.68 / 99.84	
VAT + Ensemble	0.24 / 99.91	0.32 / 99.88	0.45 / 99.85	0.90 / 99.75	0.39 / 99.87	0.49 / 99.88	
VAT + DSGF	0.21 / 99.89	0.70 / 99.79	1.38 / 99.59	4.82 / 98.99	1.84 / 99.53	0.35 / 99.90	
VPT	0.64 / 99.81	1.41 / 99.62	2.80 / 99.29	9.39 / 98.02	5.51 / 98.79	2.66 / 99.40	
VPT + Ensemble	0.19 / 99.93	0.26 / 99.90	0.39 / 99.87	0.43 / 99.85	0.43 / 99.87	0.46 / 99.87	
VPT + DSGF	0.20 / 99.93	0.37 / 99.89	0.82 / 99.77	4.78 / 99.00	2.79 / 99.36	0.31 / 99.92	
LPT	0.61 / 99.89	3.21 / 99.78	6.33 / 99.56	10.14 / 98.62	1.28 / 99.29	0.43 / 99.87	
LPT + Ensemble	0.17 / 99.91	0.36 / 99.88	0.46 / 99.85	0.63 / 99.79	0.57 / 99.81	0.43 / 99.87	
4-shot		FPR@95 ↓ / AUROC ↑ (%)					
	Energy	Entropy	Variance	MSP	Max-Logits	k-NN	
FFT	5.46 / 98.78	9.33 / 97.81	15.16 / 96.43	24.75 / 94.51	12.53 / 97.35	3.94 / 99.21	
FFT + Ensemble	0.57 / 99.84	5.54 / 98.58	5.39 / 98.23	10.02 / 97.26	1.84 / 99.61	1.92 / 99.60	
FFT + DSGF	0.51 / 99.88	1.59 / 99.69	3.24 / 99.37	7.13 / 98.6	3.39 / 99.37	0.5 / 99.9	
VAT	0.93 / 99.47	0.93 / 99.76	2.75 / 99.40	6.54 / 98.68	2.43 / 99.41	0.26 / 99.94	
VAT + Ensemble	0.13 / 99.93	0.25 / 99.92	0.36 / 99.87	0.71 / 99.81	0.23 / 99.92	0.29 / 99.93	
VAT + DSGF	0.03 / 99.97	0.10 / 99.95	0.35 / 99.90	1.19 / 99.72	0.45 / 99.88	0.20 / 99.94	
VPT	0.19 / 99.92	0.52 / 99.88	1.15 / 99.75	3.45 / 99.27	1.55 / 99.62	0.88 / 99.83	
VPT + Ensemble	0.07 / 99.97	0.07 / 99.96	0.14 / 99.93	0.21 / 99.93	0.15 / 99.95	0.19 / 99.95	
VPT + DSGF	0.02 / 99.99	0.06 / 99.98	0.14 / 99.96	0.68 / 99.83	0.31 / 99.90	0.28 / 99.93	
LPT	0.33 / 99.85	1.39 / 99.52	3.11 / 99.12	6.30 / 98.51	0.79 / 99.70	0.36 / 99.86	
LPT + Ensemble	0.11 / 99.94	0.21 / 99.91	0.30 / 99.86	0.38 / 99.85	0.34 / 99.90	0.36 / 99.86	
8-shot		FPR@95 ↓ / AUROC ↑ (%)					
	Energy	Entropy	Variance	MSP	Max-Logits	k-NN	
FFT	7.37 / 98.53	6.99 / 98.53	11.37 / 97.59	23.21 / 95.60	13.55 / 97.37	3.08 / 99.36	
FFT + Ensemble	0.21 / 99.92	0.43 / 99.90	0.40 / 99.87	0.88 / 99.79	0.39 / 99.90	0.53 / 99.84	
FFT + DSGF	0.11 / 99.96	0.47 / 99.89	1.16 / 99.75	3.23 / 99.36	1.02 / 99.76	0.61 / 99.82	
VAT	0.21 / 99.90	0.55 / 99.83	1.52 / 99.64	3.02 / 99.29	0.58 / 99.81	0.71 / 99.83	
VAT + Ensemble	0.16 / 99.95	0.33 / 99.91	0.51 / 99.85	0.80 / 99.81	0.21 / 99.94	0.49 / 99.86	
VAT + DSGF	0.04 / 99.98	0.27 / 99.94	0.71 / 99.85	1.44 / 99.70	0.29 / 99.92	0.20 / 99.94	
VPT	0.08 / 99.98	0.30 / 99.94	0.69 / 99.85	1.93 / 99.61	0.51 / 99.86	0.77 / 99.81	
VPT + Ensemble	0.09 / 99.97	0.18 / 99.96	0.24 / 99.93	0.39 / 99.91	0.21 / 99.95	0.45 / 99.87	
VPT + DSGF	0.02 / 99.99	0.14 / 99.97	0.31 / 99.93	0.79 / 99.82	0.41 / 99.90	0.59 / 99.85	
LPT	0.82 / 99.94	6.25 / 99.84	10.72 / 99.64	15.48 / 99.22	1.06 / 99.67	0.43 / 99.85	
LPT + Ensemble	0.14 / 99.93	0.36 / 99.90	0.52 / 99.85	0.92 / 99.79	0.52 / 99.87	0.43 / 99.85	
16-shot		FPR@95 ↓ / AUROC ↑ (%)					
	Energy	Entropy	Variance	MSP	Max-Logits	k-NN	
FFT	1.30 / 99.68	3.26 / 99.34	6.29 / 98.85	11.55 / 98.01	4.46 / 99.13	0.87 / 99.80	
FFT + Ensemble	0.09 / 99.95	0.26 / 99.93	0.30 / 99.91	0.68 / 99.85	0.13 / 99.95	0.21 / 99.95	
FFT + DSGF	0.12 / 99.96	0.52 / 99.90	1.01 / 99.79	1.86 / 99.59	0.64 / 99.85	0.13 / 99.96	
VAT	0.02 / 99.98	0.28 / 99.91	1.12 / 99.74	2.88 / 99.44	0.10 / 99.93	0.30 / 99.94	
VAT + Ensemble	0.03 / 99.98	0.13 / 99.97	0.24 / 99.94	0.41 / 99.90	0.04 / 99.98	0.23 / 99.94	
VAT + DSGF	0.01 / 99.99	0.09 / 99.97	0.48 / 99.91	0.97 / 99.81	0.08 / 99.97	0.05 / 99.98	
VPT	0.06 / 99.99	0.12 / 99.97	0.34 / 99.93	0.77 / 99.82	0.21 / 99.94	0.34 / 99.94	
VPT + Ensemble	0.02 / 99.98	0.04 / 99.98	0.07 / 99.96	0.11 / 99.96	0.03 / 99.98	0.15 / 99.96	
VPT + DSGF	0.01 / 100.00	0.04 / 99.99	0.13 / 99.97	0.58 / 99.90	0.19 / 99.95	0.15 / 99.96	
LPT	0.13 / 99.96	2.07 / 99.91	4.25 / 99.80	6.74 / 99.55	0.48 / 99.83	0.46 / 99.87	
LPT + Ensemble	0.11 / 99.94	0.15 / 99.93	0.32 / 99.89	0.49 / 99.87	0.24 / 99.92	0.46 / 99.87	
All-shot		FPR@95 ↓ / AUROC ↑ (%)					
	Energy	Entropy	Variance	MSP	Max-Logits	k-NN	
FFT	0.98 / 99.72	7.06 / 98.88	12.55 / 98.31	13.94 / 97.99	1.16 / 99.64	1.43 / 99.69	
FFT + Ensemble	0.06 / 99.98	0.25 / 99.81	2.05 / 99.58	0.75 / 99.56	0.07 / 99.98	0.11 / 99.95	
FFT + DSGF	0.47 / 99.88	1.41 / 99.65	3.01 / 99.39	4.73 / 99.17	0.60 / 99.78	0.10 / 99.96	
VAT	0.05 / 99.94	1.14 / 99.74	3.93 / 99.26	7.37 / 98.72	0.16 / 99.87	0.38 / 99.92	
VAT + Ensemble	0.05 / 99.99	0.09 / 99.97	0.38 / 99.92	0.60 / 99.86	0.02 / 99.99	0.19 / 99.95	
VAT + DSGF	0.00 / 100.00	0.08 / 99.98	0.23 / 99.94	0.55 / 99.84	0.01 / 99.99	0.07 / 99.98	
VPT	0.46 / 99.92	0.86 / 99.83	1.25 / 99.74	1.80 / 99.66	0.78 / 99.86	0.67 / 99.87	
VPT + Ensemble	0.04 / 99.99	0.26 / 99.96	0.40 / 99.93	0.52 / 99.92	0.05 / 99.98	0.15 / 99.97	
VPT + DSGF	0.16 / 99.97	0.46 / 99.91	0.81 / 99.85	1.10 / 99.78	0.39 / 99.93	0.06 / 99.98	
LPT	0.03 / 99.96	0.32 / 99.94	1.12 / 99.90	3.24 / 99.79	0.14 / 99.90	0.48 / 99.86	
LPT + Ensemble	0.06 / 99.96	0.07 / 99.96	0.17 / 99.93	0.20 / 99.93	0.05 / 99.97	0.48 / 99.86	

TABLE A.9
COMPARISON OF BASELINE AND OUR DSGF. ID AND OOD DATASETS ARE FOOD-101 AND iNATURALIST.

2-shot	FPR@95 ↓ / AUROC ↑ (%)					
	Energy	Entropy	Variance	MSP	Max-Logits	k-NN
FFT	2.00 / 97.96	8.60 / 96.32	14.39 / 94.02	22.99 / 90.84	38.01 / 94.98	21.92 / 97.90
FFT + Ensemble	0.12 / 99.94	1.16 / 99.67	1.02 / 99.65	2.61 / 99.28	0.38 / 99.88	0.29 / 99.90
FFT + DSGF	0.33 / 99.91	0.92 / 99.80	2.09 / 99.55	7.05 / 98.65	2.92 / 99.41	0.11 / 99.95
VAT	1.01 / 99.42	0.74 / 99.73	2.93 / 99.37	8.32 / 98.44	3.19 / 99.27	0.28 / 99.91
VAT + Ensemble	0.08 / 99.96	0.17 / 99.94	0.16 / 99.93	0.36 / 99.87	0.15 / 99.94	0.16 / 99.94
VAT + DSGF	0.10 / 99.92	0.24 / 99.91	0.44 / 99.85	1.91 / 99.55	0.58 / 99.79	0.19 / 99.93
VPT	0.48 / 99.88	1.01 / 99.76	1.86 / 99.55	6.82 / 98.65	3.77 / 99.20	2.05 / 99.51
VPT + Ensemble	0.11 / 99.97	0.11 / 99.96	0.12 / 99.95	0.20 / 99.94	0.21 / 99.94	0.22 / 99.94
VPT + DSGF	0.12 / 99.94	0.20 / 99.94	0.43 / 99.90	2.31 / 99.52	1.34 / 99.69	0.16 / 99.95
LPT	0.13 / 99.92	1.26 / 99.91	4.21 / 99.86	8.99 / 99.49	0.36 / 99.73	0.12 / 99.94
LPT + Ensemble	0.06 / 99.96	0.09 / 99.95	0.15 / 99.94	0.23 / 99.93	0.22 / 99.93	0.12 / 99.94
4-shot	FPR@95 ↓ / AUROC ↑ (%)					
	Energy	Entropy	Variance	MSP	Max-Logits	k-NN
FFT	5.34 / 98.69	9.61 / 97.62	15.68 / 96.13	25.83 / 94.13	12.99 / 97.14	5.05 / 98.89
FFT + Ensemble	0.96 / 99.74	7.79 / 97.78	7.65 / 97.24	12.38 / 96.18	2.53 / 99.42	1.96 / 99.50
FFT + DSGF	0.51 / 99.89	1.73 / 99.67	3.49 / 99.31	8.06 / 98.45	3.58 / 99.33	0.42 / 99.89
VAT	1.39 / 99.29	0.72 / 99.79	2.39 / 99.47	5.82 / 98.76	2.42 / 99.37	0.12 / 99.95
VAT + Ensemble	0.03 / 99.96	0.07 / 99.95	0.12 / 99.93	0.52 / 99.88	0.05 / 99.95	0.02 / 99.97
VAT + DSGF	0.03 / 99.96	0.06 / 99.96	0.14 / 99.94	0.73 / 99.80	0.19 / 99.91	0.06 / 99.97
VPT	0.27 / 99.92	0.48 / 99.87	1.04 / 99.76	2.97 / 99.31	1.41 / 99.64	1.15 / 99.76
VPT + Ensemble	0.04 / 99.97	0.08 / 99.97	0.07 / 99.95	0.14 / 99.95	0.09 / 99.97	0.11 / 99.97
VPT + DSGF	0.05 / 99.98	0.06 / 99.98	0.11 / 99.97	0.52 / 99.87	0.24 / 99.92	0.08 / 99.96
LPT	0.10 / 99.95	0.98 / 99.95	2.82 / 99.91	6.93 / 99.62	0.50 / 99.83	0.25 / 99.91
LPT + Ensemble	0.03 / 99.96	0.02 / 99.96	0.05 / 99.93	0.05 / 99.94	0.03 / 99.96	0.25 / 99.91
8-shot	FPR@95 ↓ / AUROC ↑ (%)					
	Energy	Entropy	Variance	MSP	Max-Logits	k-NN
FFT	11.49 / 97.68	9.03 / 97.89	15.15 / 96.58	28.71 / 94.18	18.98 / 96.18	4.63 / 99.05
FFT + Ensemble	0.11 / 99.94	0.52 / 99.86	0.42 / 99.86	1.12 / 99.69	0.37 / 99.89	0.20 / 99.92
FFT + DSGF	0.17 / 99.94	0.62 / 99.85	1.62 / 99.63	4.87 / 99.08	1.53 / 99.65	0.25 / 99.91
VAT	0.17 / 99.87	0.58 / 99.83	1.95 / 99.56	4.57 / 99.08	0.56 / 99.77	0.09 / 99.97
VAT + Ensemble	0.02 / 99.98	0.16 / 99.96	0.32 / 99.93	0.51 / 99.88	0.03 / 99.97	0.05 / 99.98
VAT + DSGF	0.05 / 99.98	0.11 / 99.96	0.44 / 99.89	1.31 / 99.71	0.14 / 99.92	0.05 / 99.98
VPT	0.22 / 99.93	0.38 / 99.90	0.74 / 99.82	1.67 / 99.60	0.65 / 99.82	0.36 / 99.92
VPT + Ensemble	0.06 / 99.98	0.12 / 99.97	0.11 / 99.97	0.21 / 99.95	0.09 / 99.97	0.04 / 99.98
VPT + DSGF	0.08 / 99.98	0.10 / 99.97	0.21 / 99.96	0.53 / 99.86	0.29 / 99.92	0.07 / 99.98
LPT	0.11 / 99.93	4.22 / 99.87	9.75 / 99.69	15.70 / 99.11	0.25 / 99.65	0.11 / 99.94
LPT + Ensemble	0.03 / 99.97	0.05 / 99.96	0.08 / 99.95	0.28 / 99.92	0.08 / 99.94	0.11 / 99.94
16-shot	FPR@95 ↓ / AUROC ↑ (%)					
	Energy	Entropy	Variance	MSP	Max-Logits	k-NN
FFT	1.70 / 99.53	3.39 / 99.28	6.34 / 98.76	11.60 / 97.87	5.28 / 98.95	0.81 / 99.82
FFT + Ensemble	0.04 / 99.97	0.36 / 99.92	0.34 / 99.91	0.82 / 99.83	0.09 / 99.96	0.10 / 99.97
FFT + DSGF	0.14 / 99.96	0.58 / 99.88	1.27 / 99.74	2.80 / 99.43	0.79 / 99.80	0.08 / 99.97
VAT	0.08 / 99.95	0.41 / 99.88	1.70 / 99.64	3.96 / 99.24	0.16 / 99.89	0.11 / 99.97
VAT + Ensemble	0.01 / 99.99	0.09 / 99.97	0.22 / 99.95	0.31 / 99.91	0.01 / 99.98	0.02 / 99.97
VAT + DSGF	0.02 / 99.99	0.11 / 99.98	0.28 / 99.93	0.77 / 99.81	0.04 / 99.96	0.03 / 99.98
VPT	0.15 / 99.97	0.25 / 99.94	0.36 / 99.91	0.74 / 99.81	0.29 / 99.92	0.32 / 99.93
VPT + Ensemble	0.02 / 99.99	0.10 / 99.98	0.10 / 99.97	0.11 / 99.97	0.04 / 99.99	0.04 / 99.98
VPT + DSGF	0.07 / 99.99	0.12 / 99.98	0.13 / 99.97	0.31 / 99.92	0.14 / 99.96	0.08 / 99.98
LPT	0.07 / 99.95	1.49 / 99.94	4.54 / 99.87	8.88 / 99.57	0.19 / 99.84	0.06 / 99.94
LPT + Ensemble	0.02 / 99.97	0.02 / 99.97	0.02 / 99.96	0.07 / 99.95	0.02 / 99.96	0.06 / 99.94
All-shot	FPR@95 ↓ / AUROC ↑ (%)					
	Energy	Entropy	Variance	MSP	Max-Logits	k-NN
FFT	1.77 / 99.58	8.33 / 98.65	14.52 / 98.08	16.22 / 97.77	1.96 / 99.49	1.48 / 99.62
FFT + Ensemble	0.08 / 99.96	0.28 / 99.76	3.00 / 99.48	1.10 / 99.47	0.08 / 99.96	0.07 / 99.97
FFT + DSGF	0.77 / 99.81	2.34 / 99.52	4.14 / 99.23	5.66 / 99.00	1.04 / 99.69	0.06 / 99.97
VAT	0.24 / 99.88	2.29 / 99.51	6.36 / 98.85	10.38 / 98.20	0.44 / 99.76	0.05 / 99.98
VAT + Ensemble	0.07 / 99.98	0.17 / 99.94	0.75 / 99.86	1.10 / 99.77	0.04 / 99.98	0.05 / 99.98
VAT + DSGF	0.05 / 99.99	0.26 / 99.94	0.77 / 99.84	1.50 / 99.65	0.07 / 99.98	0.12 / 99.96
VPT	0.47 / 99.91	0.90 / 99.82	1.18 / 99.72	1.66 / 99.65	0.75 / 99.86	0.58 / 99.87
VPT + Ensemble	0.08 / 99.98	0.26 / 99.96	0.44 / 99.92	0.52 / 99.91	0.10 / 99.98	0.05 / 99.98
VPT + DSGF	0.20 / 99.97	0.50 / 99.91	0.84 / 99.84	1.05 / 99.78	0.36 / 99.93	0.07 / 99.99
LPT	0.03 / 99.96	0.29 / 99.96	1.08 / 99.95	3.38 / 99.88	0.17 / 99.93	1.00 / 99.77
LPT + Ensemble	0.07 / 99.96	0.02 / 99.97	0.40 / 99.91	0.07 / 99.95	0.01 / 99.98	1.00 / 99.77

TABLE A.10
COMPARISON OF BASELINE AND OUR DSGF. ID AND OOD DATASETS ARE FOOD-101 AND PLACES.

2-shot	FPR@95 ↓ / AUROC ↑ (%)					
	Energy	Entropy	Variance	MSP	Max-Logits	k-NN
FFT	14.70 / 96.30	20.97 / 91.80	28.95 / 91.80	42.26 / 88.79	27.94 / 92.97	11.06 / 97.35
FFT + Ensemble	0.40 / 99.87	2.57 / 99.35	2.02 / 99.36	4.56 / 98.74	0.91 / 99.74	0.92 / 99.77
FFT + DSGF	0.83 / 99.78	2.70 / 98.78	5.40 / 98.78	13.02 / 97.30	6.70 / 98.68	0.34 / 99.89
VAT	2.25 / 99.20	1.89 / 98.95	4.89 / 98.95	11.26 / 97.86	5.20 / 98.93	0.59 / 99.84
VAT + Ensemble	0.23 / 99.91	0.49 / 99.85	0.53 / 99.82	1.03 / 99.70	0.36 / 99.86	0.34 / 99.89
VAT + DSGF	0.47 / 99.83	1.04 / 99.37	2.43 / 99.37	6.45 / 98.60	2.92 / 99.32	0.41 / 99.88
VPT	1.53 / 99.54	3.13 / 98.51	5.37 / 98.51	12.94 / 96.90	8.63 / 97.94	4.19 / 99.03
VPT + Ensemble	0.34 / 99.90	0.63 / 99.82	0.51 / 99.82	1.00 / 99.69	1.07 / 99.74	0.62 / 99.84
VPT + DSGF	0.58 / 99.82	1.04 / 99.47	1.85 / 99.47	6.87 / 98.43	4.79 / 98.91	0.31 / 99.90
LPT	0.50 / 99.85	2.97 / 99.69	6.37 / 99.40	10.41 / 98.30	1.14 / 99.11	0.31 / 99.88
LPT + Ensemble	0.23 / 99.91	0.31 / 99.87	0.35 / 99.86	0.75 / 99.78	0.71 / 99.79	0.31 / 99.88
4-shot	FPR@95 ↓ / AUROC ↑ (%)					
	Energy	Entropy	Variance	MSP	Max-Logits	k-NN
FFT	7.22 / 98.3	11.39 / 97.17	17.25 / 95.71	27.24 / 93.73	14.53 / 96.74	5.23 / 98.9
FFT + Ensemble	0.52 / 99.84	5.14 / 98.70	4.85 / 98.43	9.13 / 97.51	1.48 / 99.65	0.95 / 99.73
FFT + DSGF	1.12 / 99.77	2.18 / 99.52	3.78 / 99.16	8.12 / 98.34	4.03 / 99.19	0.62 / 99.86
VAT	1.00 / 99.49	0.79 / 99.47	2.30 / 99.47	5.70 / 98.80	2.24 / 99.46	0.20 / 99.92
VAT + Ensemble	0.11 / 99.94	0.21 / 99.93	0.30 / 99.90	0.53 / 99.84	0.17 / 99.93	0.17 / 99.93
VAT + DSGF	0.05 / 99.96	0.09 / 99.92	0.29 / 99.92	0.76 / 99.80	0.34 / 99.90	0.15 / 99.94
VPT	0.38 / 99.86	0.74 / 99.67	1.49 / 99.67	3.78 / 99.19	1.91 / 99.55	0.90 / 99.81
VPT + Ensemble	0.10 / 99.96	0.11 / 99.95	0.15 / 99.94	0.22 / 99.93	0.17 / 99.95	0.16 / 99.95
VPT + DSGF	0.07 / 99.97	0.13 / 99.94	0.19 / 99.94	0.76 / 99.82	0.32 / 99.89	0.14 / 99.94
LPT	0.15 / 99.94	0.67 / 99.91	2.15 / 99.85	4.91 / 99.58	0.42 / 99.80	0.26 / 99.90
LPT + Ensemble	0.08 / 99.94	0.15 / 99.93	0.16 / 99.91	0.30 / 99.90	0.23 / 99.92	0.26 / 99.90
8-shot	FPR@95 ↓ / AUROC ↑ (%)					
	Energy	Entropy	Variance	MSP	Max-Logits	k-NN
FFT	9.95 / 98.07	9.14 / 97.05	14.40 / 97.05	26.28 / 94.99	16.69 / 96.84	3.49 / 99.28
FFT + Ensemble	0.26 / 99.91	0.45 / 99.87	0.43 / 99.85	0.80 / 99.77	0.35 / 99.88	0.72 / 99.81
FFT + DSGF	0.17 / 99.92	0.44 / 99.74	1.07 / 99.74	2.99 / 99.37	1.00 / 99.74	0.77 / 99.81
VAT	0.15 / 99.91	0.34 / 99.71	1.16 / 99.71	3.04 / 99.36	0.33 / 99.83	0.75 / 99.84
VAT + Ensemble	0.10 / 99.96	0.17 / 99.94	0.26 / 99.90	0.49 / 99.87	0.12 / 99.95	0.61 / 99.86
VAT + DSGF	0.07 / 99.97	0.13 / 99.91	0.35 / 99.91	0.72 / 99.81	0.15 / 99.94	0.14 / 99.95
VPT	0.21 / 99.94	0.45 / 99.78	0.95 / 99.78	2.22 / 99.54	0.74 / 99.80	1.14 / 99.76
VPT + Ensemble	0.13 / 99.96	0.18 / 99.94	0.28 / 99.91	0.55 / 99.88	0.25 / 99.93	0.69 / 99.86
VPT + DSGF	0.12 / 99.97	0.17 / 99.94	0.20 / 99.94	0.49 / 99.86	0.22 / 99.91	0.72 / 99.84
LPT	0.25 / 99.94	3.70 / 99.91	7.71 / 99.84	12.44 / 99.56	0.33 / 99.81	0.56 / 99.85
LPT + Ensemble	0.08 / 99.93	0.11 / 99.92	0.31 / 99.88	0.32 / 99.88	0.20 / 99.91	0.56 / 99.85
16-shot	FPR@95 ↓ / AUROC ↑ (%)					
	Energy	Entropy	Variance	MSP	Max-Logits	k-NN
FFT	1.82 / 99.58	4.25 / 98.61	7.43 / 98.61	12.89 / 97.73	5.62 / 98.94	1.02 / 99.75
FFT + Ensemble	0.13 / 99.96	0.41 / 99.91	0.38 / 99.89	0.87 / 99.81	0.20 / 99.94	0.14 / 99.95
FFT + DSGF	0.16 / 99.95	0.36 / 99.81	0.94 / 99.81	1.71 / 99.61	0.59 / 99.85	0.11 / 99.96
VAT	0.09 / 99.96	0.30 / 99.76	1.10 / 99.76	2.24 / 99.49	0.12 / 99.92	0.21 / 99.95
VAT + Ensemble	0.06 / 99.98	0.11 / 99.97	0.18 / 99.95	0.31 / 99.92	0.06 / 99.98	0.15 / 99.96
VAT + DSGF	0.07 / 99.99	0.11 / 99.95	0.19 / 99.95	0.46 / 99.88	0.08 / 99.97	0.08 / 99.98
VPT	0.08 / 99.98	0.15 / 99.92	0.33 / 99.92	0.74 / 99.81	0.20 / 99.93	0.25 / 99.94
VPT + Ensemble	0.07 / 99.98	0.08 / 99.98	0.12 / 99.97	0.15 / 99.96	0.08 / 99.98	0.11 / 99.97
VPT + DSGF	0.05 / 99.99	0.07 / 99.97	0.12 / 99.97	0.26 / 99.94	0.14 / 99.96	0.12 / 99.97
LPT	0.09 / 99.95	1.12 / 99.93	2.86 / 99.88	5.45 / 99.70	0.15 / 99.88	0.39 / 99.90
LPT + Ensemble	0.07 / 99.95	0.08 / 99.95	0.18 / 99.93	0.24 / 99.92	0.11 / 99.94	0.39 / 99.90
All-shot	FPR@95 ↓ / AUROC ↑ (%)					
	Energy	Entropy	Variance	MSP	Max-Logits	k-NN
FFT	0.66 / 99.66	1.85 / 98.16	3.38 / 98.16	5.04 / 97.84	0.94 / 99.57	0.38 / 99.59
FFT + Ensemble	0.22 / 99.95	0.52 / 99.72	2.81 / 99.45	1.31 / 99.44	0.22 / 99.95	0.39 / 99.86
FFT + DSGF	0.16 / 99.85	1.44 / 99.33	4.18 / 99.33	7.28 / 99.11	0.35 / 99.74	0.48 / 99.88
VAT	0.09 / 99.92	0.13 / 99.21	0.27 / 99.21	0.67 / 98.69	0.09 / 99.84	0.24 / 99.83
VAT + Ensemble	0.13 / 99.97	0.19 / 99.95	0.60 / 99.89	0.94 / 99.82	0.07 / 99.97	0.41 / 99.83
VAT + DSGF	0.53 / 99.99	0.77 / 99.92	1.09 / 99.92	1.60 / 99.83	0.75 / 99.98	0.95 / 99.95
VPT	0.18 / 99.91	0.45 / 99.76	0.77 / 99.76	1.05 / 99.68	0.41 / 99.86	0.18 / 99.80
VPT + Ensemble	0.06 / 99.98	0.24 / 99.96	0.37 / 99.92	0.49 / 99.92	0.08 / 99.98	0.34 / 99.87
VPT + DSGF	0.09 / 99.96	1.12 / 99.85	2.86 / 99.85	5.45 / 99.79	0.15 / 99.93	0.39 / 99.95
LPT	0.09 / 99.94	0.47 / 99.93	1.33 / 99.91	3.31 / 99.83	0.31 / 99.90	0.95 / 99.73
LPT + Ensemble	0.21 / 99.93	0.14 / 99.94	0.31 / 99.88	0.26 / 99.92	0.13 / 99.95	0.95 / 99.73

TABLE A.11
COMPARISON OF BASELINE AND OUR DSGF. ID AND OOD DATASETS ARE FOOD-101 AND TEXTURE.

2-shot		FPR@95 ↓ / AUROC ↑ (%)					
	Energy	Entropy	Variance	MSP	Max-Logits	k-NN	
FFT	35.89 / 89.42	42.52 / 86.33	52.61 / 82.78	64.04 / 79.41	52.29 / 84.55	29.36 / 91.15	
FFT + Ensemble	4.29 / 98.80	10.80 / 96.70	9.01 / 96.70	15.12 / 95.19	7.25 / 98.22	7.11 / 98.29	
FFT + DSGF	7.04 / 98.21	11.21 / 97.10	16.45 / 95.56	29.49 / 92.86	19.06 / 95.44	2.25 / 99.36	
VAT	8.44 / 97.98	6.88 / 98.37	12.82 / 97.27	21.08 / 95.71	13.51 / 97.42	6.84 / 98.45	
VAT + Ensemble	2.43 / 99.30	3.12 / 99.15	3.53 / 99.01	5.48 / 98.62	3.35 / 99.15	4.56 / 99.01	
VAT + DSGF	2.75 / 99.21	5.48 / 98.63	10.34 / 97.63	19.20 / 95.89	11.56 / 97.69	4.45 / 98.99	
VPT	7.07 / 98.25	11.63 / 97.10	16.74 / 95.73	30.69 / 92.99	22.73 / 94.81	13.90 / 96.90	
VPT + Ensemble	2.55 / 99.32	3.01 / 99.14	3.53 / 99.10	4.17 / 98.80	4.49 / 98.89	3.69 / 99.11	
VPT + DSGF	2.75 / 99.23	3.83 / 99.01	6.01 / 98.47	15.96 / 96.58	12.13 / 97.42	3.09 / 99.19	
LPT	4.08 / 99.15	14.9 / 98.79	22.45 / 98.15	28.53 / 96.55	7.29 / 97.79	3.42 / 99.17	
LPT + Ensemble	2.25 / 99.30	2.98 / 99.19	3.44 / 99.12	4.49 / 98.87	4.29 / 98.94	3.42 / 99.17	
4-shot		FPR@95 ↓ / AUROC ↑ (%)					
	Energy	Entropy	Variance	MSP	Max-Logits	k-NN	
FFT	19.33 / 95.04	29.52 / 91.83	37.93 / 89.18	47.82 / 86.72	32.55 / 91.78	21.45 / 94.77	
FFT + Ensemble	5.23 / 98.43	12.59 / 96.29	11.60 / 96.03	17.29 / 94.67	7.23 / 97.93	5.74 / 98.23	
FFT + DSGF	4.49 / 98.68	7.85 / 97.73	12.25 / 96.67	21.7 / 94.89	12.45 / 97	6.6 / 98.11	
VAT	10.00 / 97.41	5.87 / 98.14	9.96 / 97.30	16.19 / 96.19	10.83 / 97.40	5.69 / 98.13	
VAT + Ensemble	3.53 / 98.82	3.90 / 98.68	4.47 / 98.46	5.85 / 98.21	4.10 / 98.71	4.96 / 98.42	
VAT + DSGF	2.15 / 99.09	2.70 / 98.85	3.44 / 98.59	6.63 / 98.05	3.69 / 98.62	4.59 / 98.49	
VPT	3.58 / 98.89	5.30 / 98.48	8.46 / 97.84	16.45 / 96.45	10.02 / 97.64	8.24 / 97.82	
VPT + Ensemble	2.82 / 99.09	3.05 / 98.98	3.49 / 98.81	3.95 / 98.71	3.37 / 98.90	3.51 / 98.70	
VPT + DSGF	2.09 / 99.32	2.61 / 99.11	3.30 / 98.87	6.63 / 98.17	4.66 / 98.60	3.32 / 98.78	
LPT	3.05 / 99.01	6.51 / 98.78	10.83 / 98.45	16.29 / 97.61	4.95 / 98.40	4.68 / 98.60	
LPT + Ensemble	3.01 / 98.98	3.37 / 98.87	4.02 / 98.70	4.27 / 98.60	3.79 / 98.78	4.68 / 98.60	
8-shot		FPR@95 ↓ / AUROC ↑ (%)					
	Energy	Entropy	Variance	MSP	Max-Logits	k-NN	
FFT	17.77 / 96.55	16.54 / 96.29	23.81 / 94.67	36.70 / 92.13	26.91 / 94.52	12.16 / 97.43	
FFT + Ensemble	2.43 / 99.41	2.82 / 99.28	2.82 / 99.24	4.27 / 98.93	3.03 / 99.27	3.78 / 99.13	
FFT + DSGF	2.36 / 99.26	4.27 / 98.79	6.15 / 98.24	11.22 / 97.37	5.83 / 98.50	2.73 / 99.31	
VAT	3.49 / 98.71	4.33 / 98.49	6.83 / 97.97	10.69 / 97.29	4.50 / 98.49	3.44 / 99.17	
VAT + Ensemble	2.27 / 99.29	2.77 / 99.12	3.46 / 98.87	4.43 / 98.78	2.45 / 99.26	2.66 / 99.37	
VAT + DSGF	2.23 / 99.20	2.94 / 98.86	3.99 / 98.60	5.67 / 98.25	2.93 / 98.97	2.75 / 99.34	
VPT	3.32 / 99.06	5.21 / 98.61	7.94 / 98.04	13.17 / 97.14	7.13 / 98.29	5.00 / 98.78	
VPT + Ensemble	1.67 / 99.52	2.54 / 99.30	2.66 / 99.15	3.26 / 99.03	2.43 / 99.39	2.52 / 99.44	
VPT + DSGF	1.97 / 99.44	2.41 / 99.24	3.09 / 99.00	5.51 / 98.51	3.62 / 98.90	2.82 / 99.30	
LPT	2.75 / 98.93	12.4 / 98.61	20.69 / 98.18	27.18 / 97.38	3.01 / 98.31	3.07 / 99.22	
LPT + Ensemble	2.43 / 99.25	2.91 / 99.03	3.40 / 98.87	3.85 / 98.73	3.24 / 99.06	3.07 / 99.22	
16-shot		FPR@95 ↓ / AUROC ↑ (%)					
	Energy	Entropy	Variance	MSP	Max-Logits	k-NN	
FFT	5.07 / 98.48	8.42 / 97.81	11.67 / 97.08	17.62 / 96.09	9.63 / 97.62	6.67 / 98.08	
FFT + Ensemble	2.64 / 99.12	3.24 / 98.84	3.42 / 98.71	4.65 / 98.55	2.94 / 99.03	3.16 / 98.89	
FFT + DSGF	2.62 / 99.06	3.65 / 98.76	4.91 / 98.46	6.90 / 98.03	4.22 / 98.72	2.70 / 99.05	
VAT	3.30 / 98.82	5.09 / 98.37	8.19 / 97.78	11.54 / 97.15	3.87 / 98.63	4.10 / 98.71	
VAT + Ensemble	2.25 / 99.15	3.24 / 98.95	4.02 / 98.71	4.98 / 98.60	2.36 / 99.13	3.24 / 98.99	
VAT + DSGF	2.06 / 99.19	2.93 / 98.91	3.83 / 98.69	5.32 / 98.42	2.71 / 99.05	3.17 / 98.97	
VPT	2.64 / 99.25	3.53 / 98.99	4.31 / 98.73	5.96 / 98.41	3.76 / 98.97	4.49 / 98.63	
VPT + Ensemble	2.00 / 99.41	2.39 / 99.27	2.64 / 99.13	2.85 / 99.07	2.23 / 99.33	2.62 / 99.09	
VPT + DSGF	1.81 / 99.46	2.20 / 99.30	2.73 / 99.14	3.97 / 98.92	3.07 / 99.16	2.71 / 99.06	
LPT	2.39 / 99.00	6.01 / 98.76	10.34 / 98.48	15.89 / 97.94	2.96 / 98.62	3.74 / 98.94	
LPT + Ensemble	2.38 / 99.12	2.61 / 98.99	3.35 / 98.84	3.33 / 98.78	2.73 / 99.03	3.74 / 98.94	
All-shot		FPR@95 ↓ / AUROC ↑ (%)					
	Energy	Entropy	Variance	MSP	Max-Logits	k-NN	
FFT	9.68 / 97.85	20.32 / 96.08	27.87 / 95.46	29.49 / 95.08	9.95 / 97.72	9.29 / 97.70	
FFT + Ensemble	3.87 / 98.94	5.87 / 98.32	14.50 / 97.72	10.37 / 97.77	3.88 / 98.94	3.90 / 98.77	
FFT + DSGF	6.47 / 98.56	10.60 / 97.75	13.72 / 97.24	15.92 / 96.96	7.23 / 98.36	3.81 / 98.86	
VAT	3.85 / 98.57	7.98 / 97.71	13.53 / 96.77	18.76 / 96.04	4.41 / 98.37	4.82 / 98.61	
VAT + Ensemble	2.61 / 98.98	4.20 / 98.74	5.76 / 98.38	7.87 / 98.20	2.57 / 98.98	4.24 / 98.70	
VAT + DSGF	2.30 / 99.08	3.97 / 98.58	6.44 / 98.16	8.28 / 97.79	2.61 / 99.00	4.65 / 98.28	
VPT	6.86 / 98.59	9.04 / 97.96	11.61 / 97.43	13.83 / 97.00	8.12 / 98.27	13.01 / 97.10	
VPT + Ensemble	2.43 / 99.27	3.72 / 98.89	4.73 / 98.65	5.94 / 98.51	2.85 / 99.15	3.62 / 98.71	
VPT + DSGF	3.85 / 99.08	6.19 / 98.47	8.62 / 98.01	10.55 / 97.65	5.37 / 98.78	3.71 / 98.67	
LPT	2.96 / 98.95	5.11 / 98.74	8.88 / 98.54	3.63 / 98.23	4.26 / 98.71	8.16 / 97.94	
LPT + Ensemble	2.64 / 98.91	2.43 / 98.84	4.47 / 98.50	3.48 / 98.61	2.70 / 98.91	8.16 / 97.94	

TABLE A.12
COMPARISON OF BASELINE AND OUR DSGF, ID AND OOD DATASETS ARE OXFORD-PETS AND SUN.

2-shot	FPR@95 ↓ / AUROC ↑ (%)					
	Energy	Entropy	Variance	MSP	Max-Logits	k-NN
FFT	45.60 / 91.21	43.45 / 90.88	52.00 / 88.89	62.29 / 86.06	50.00 / 90.26	0.17 / 99.92
FFT + Ensemble	0.05 / 99.95	0.53 / 99.84	0.50 / 99.85	1.87 / 99.60	0.13 / 99.89	0.02 / 99.98
FFT + DSGF	0.04 / 99.96	0.04 / 99.97	0.15 / 99.94	0.57 / 99.82	0.05 / 99.94	0.02 / 99.98
VAT	0.55 / 99.56	3.22 / 99.10	7.64 / 98.39	13.55 / 97.53	1.38 / 99.39	0.04 / 99.96
VAT + Ensemble	0.02 / 99.98	0.08 / 99.89	0.32 / 99.88	0.56 / 99.76	0.02 / 99.96	0.02 / 99.99
VAT + DSGF	0.02 / 99.98	0.03 / 99.98	0.05 / 99.97	0.06 / 99.95	0.02 / 99.98	0.02 / 99.98
VPT	1.24 / 99.42	4.16 / 98.97	10.80 / 98.00	20.67 / 96.50	3.34 / 99.09	0.40 / 99.80
VPT + Ensemble	0.02 / 99.98	0.02 / 99.94	0.06 / 99.95	0.25 / 99.85	0.02 / 99.97	0.02 / 99.99
VPT + DSGF	0.02 / 99.98	0.02 / 99.97	0.02 / 99.97	0.04 / 99.93	0.02 / 99.95	0.02 / 99.99
LPT	0.03 / 99.75	0.04 / 99.72	0.10 / 99.67	0.53 / 99.50	0.06 / 99.69	0.02 / 99.99
LPT + Ensemble	0.02 / 99.98	0.02 / 99.97	0.02 / 99.98	0.02 / 99.97	0.02 / 99.97	0.02 / 99.99
4-shot	FPR@95 ↓ / AUROC ↑ (%)					
	Energy	Entropy	Variance	MSP	Max-Logits	k-NN
FFT	41.74 / 93.22	32.71 / 94.31	37.97 / 92.70	46.40 / 90.58	39.61 / 93.32	0.52 / 99.85
FFT + Ensemble	0.03 / 99.98	0.32 / 99.90	0.39 / 99.90	1.27 / 99.73	0.03 / 99.96	0.02 / 99.99
FFT + DSGF	0.04 / 99.96	0.16 / 99.94	0.41 / 99.87	1.14 / 99.69	0.12 / 99.91	0.02 / 99.99
VAT	0.66 / 99.43	1.39 / 99.57	3.63 / 99.16	7.06 / 98.59	1.23 / 99.46	0.02 / 99.98
VAT + Ensemble	0.01 / 99.98	0.07 / 99.94	0.30 / 99.92	0.39 / 99.85	0.02 / 99.96	0.01 / 99.99
VAT + DSGF	0.03 / 99.98	0.03 / 99.97	0.03 / 99.96	0.12 / 99.94	0.03 / 99.97	0.02 / 99.99
VPT	0.97 / 99.41	4.32 / 98.84	11.24 / 97.91	19.48 / 96.66	2.32 / 99.17	0.16 / 99.95
VPT + Ensemble	0.02 / 99.97	0.09 / 99.92	0.28 / 99.90	0.47 / 99.81	0.02 / 99.96	0.02 / 100.00
VPT + DSGF	0.02 / 99.97	0.02 / 99.97	0.02 / 99.97	0.05 / 99.95	0.05 / 99.96	0.02 / 99.99
LPT	0.04 / 99.97	0.08 / 99.93	0.24 / 99.86	0.74 / 99.64	0.05 / 99.90	0.01 / 99.99
LPT + Ensemble	0.02 / 99.99	0.02 / 99.99	0.02 / 99.99	0.03 / 99.97	0.02 / 99.99	0.01 / 99.99
8-shot	FPR@95 ↓ / AUROC ↑ (%)					
	Energy	Entropy	Variance	MSP	Max-Logits	k-NN
FFT	3.14 / 99.24	6.14 / 98.82	10.67 / 98.02	18.58 / 96.84	5.30 / 98.87	0.03 / 99.97
FFT + Ensemble	0.03 / 99.98	0.11 / 99.94	0.16 / 99.94	0.41 / 99.86	0.03 / 99.97	0.02 / 99.98
FFT + DSGF	0.02 / 99.95	0.03 / 99.95	0.03 / 99.94	0.14 / 99.90	0.03 / 99.94	0.03 / 99.97
VAT	0.08 / 99.83	0.48 / 99.78	1.92 / 99.54	3.78 / 99.20	0.13 / 99.80	0.03 / 99.96
VAT + Ensemble	0.02 / 99.98	0.03 / 99.96	0.06 / 99.96	0.05 / 99.93	0.02 / 99.98	0.02 / 99.98
VAT + DSGF	0.03 / 99.98	0.05 / 99.97	0.05 / 99.96	0.09 / 99.92	0.04 / 99.96	0.01 / 99.98
VPT	0.06 / 99.98	0.10 / 99.96	0.17 / 99.93	0.32 / 99.86	0.08 / 99.96	0.03 / 99.98
VPT + Ensemble	0.02 / 100.00	0.01 / 99.99	0.03 / 99.99	0.03 / 99.99	0.02 / 100.00	0.02 / 99.99
VPT + DSGF	0.02 / 99.99	0.02 / 99.99	0.02 / 99.99	0.02 / 99.98	0.02 / 99.98	0.02 / 99.98
LPT	0.03 / 99.97	0.06 / 99.95	0.08 / 99.94	0.13 / 99.87	0.05 / 99.93	0.03 / 99.99
LPT + Ensemble	0.02 / 99.99	0.02 / 99.99	0.02 / 99.99	0.05 / 99.98	0.02 / 99.99	0.03 / 99.99
16-shot	FPR@95 ↓ / AUROC ↑ (%)					
	Energy	Entropy	Variance	MSP	Max-Logits	k-NN
FFT	0.18 / 99.78	0.82 / 99.72	2.10 / 99.45	4.63 / 99.02	0.36 / 99.72	0.02 / 99.98
FFT + Ensemble	0.02 / 99.98	0.04 / 99.97	0.09 / 99.96	0.07 / 99.93	0.02 / 99.98	0.02 / 99.98
FFT + DSGF	0.02 / 99.98	0.03 / 99.98	0.04 / 99.98	0.06 / 99.96	0.02 / 99.97	0.02 / 99.99
VAT	0.05 / 99.91	0.29 / 99.87	1.23 / 99.70	2.44 / 99.43	0.07 / 99.89	0.01 / 99.98
VAT + Ensemble	0.02 / 99.98	0.03 / 99.96	0.06 / 99.96	0.05 / 99.93	0.02 / 99.97	0.01 / 99.98
VAT + DSGF	0.03 / 99.97	0.06 / 99.97	0.06 / 99.96	0.10 / 99.95	0.03 / 99.96	0.02 / 99.98
VPT	0.05 / 99.92	0.27 / 99.82	1.24 / 99.64	2.87 / 99.36	0.08 / 99.80	0.04 / 99.96
VPT + Ensemble	0.02 / 99.98	0.03 / 99.97	0.03 / 99.97	0.03 / 99.95	0.02 / 99.98	0.02 / 99.98
VPT + DSGF	0.02 / 99.99	0.03 / 99.99	0.03 / 99.99	0.04 / 99.98	0.03 / 99.98	0.02 / 99.95
LPT	0.02 / 99.98	0.02 / 99.97	0.04 / 99.95	0.09 / 99.90	0.02 / 99.95	0.02 / 99.98
LPT + Ensemble	0.02 / 99.99	0.02 / 99.98	0.02 / 99.98	0.02 / 99.98	0.02 / 99.98	0.02 / 99.98
All-shot	FPR@95 ↓ / AUROC ↑ (%)					
	Energy	Entropy	Variance	MSP	Max-Logits	k-NN
FFT	0.02 / 99.90	0.17 / 99.93	0.38 / 99.86	0.38 / 99.79	0.02 / 99.96	0.01 / 99.99
FFT + Ensemble	0.02 / 99.99	0.01 / 99.99	0.01 / 99.98	0.01 / 99.98	0.02 / 99.99	0.02 / 100.00
FFT + DSGF	0.02 / 99.99	0.03 / 99.99	0.04 / 99.99	0.04 / 99.98	0.02 / 99.99	0.03 / 99.98
VAT	0.03 / 99.97	0.23 / 99.91	1.37 / 99.76	2.21 / 99.57	0.03 / 99.96	0.02 / 99.99
VAT + Ensemble	0.02 / 99.98	0.02 / 99.98	0.04 / 99.97	0.04 / 99.95	0.02 / 99.98	0.02 / 99.99
VAT + DSGF	0.02 / 99.99	0.03 / 99.99	0.03 / 99.98	0.03 / 99.95	0.02 / 99.98	0.02 / 99.99
VPT	0.10 / 99.97	0.31 / 99.92	0.59 / 99.86	0.90 / 99.74	0.16 / 99.93	0.06 / 99.96
VPT + Ensemble	0.02 / 99.99	0.03 / 99.99	0.04 / 99.98	0.04 / 99.98	0.02 / 99.99	0.02 / 100.00
VPT + DSGF	0.02 / 99.99	0.06 / 99.98	0.10 / 99.97	0.16 / 99.94	0.05 / 99.97	0.02 / 100.00
LPT	0.02 / 99.99	0.03 / 99.98	0.07 / 99.97	0.10 / 99.94	0.03 / 99.97	0.02 / 99.98
LPT + Ensemble	0.02 / 99.99	0.02 / 99.99	0.02 / 99.98	0.03 / 99.98	0.02 / 99.99	0.02 / 99.98

TABLE A.13

COMPARISON OF BASELINE AND OUR DSGF. ID AND OOD DATASETS ARE OXFORD-PETS AND iNATURALIST.

TABLE A.14
COMPARISON OF BASELINE AND OUR DSGF. ID AND OOD DATASETS ARE OXFORD-PETS AND PLACES.

2-shot	FPR@95 ↓ / AUROC ↑ (%)					
	Energy	Entropy	Variance	MSP	Max-Logits	k-NN
FFT	49.28 / 90.50	46.33 / 90.23	54.20 / 88.26	63.34 / 85.56	51.55 / 89.64	0.67 / 99.80
FFT + Ensemble	0.20 / 99.91	0.80 / 99.79	0.69 / 99.82	2.08 / 99.54	0.31 / 99.84	0.15 / 99.95
FFT + DSGF	0.15 / 99.93	0.23 / 99.93	0.38 / 99.89	0.83 / 99.78	0.26 / 99.91	0.18 / 99.95
VAT	0.75 / 99.48	3.56 / 99.01	8.32 / 98.27	14.68 / 97.38	1.56 / 99.31	0.19 / 99.92
VAT + Ensemble	0.14 / 99.96	0.23 / 99.85	0.54 / 99.84	0.81 / 99.71	0.16 / 99.94	0.15 / 99.96
VAT + DSGF	0.08 / 99.96	0.21 / 99.94	0.35 / 99.93	0.45 / 99.88	0.09 / 99.95	0.18 / 99.96
VPT	2.12 / 99.33	5.65 / 98.73	12.85 / 97.56	22.86 / 95.95	4.53 / 98.94	0.76 / 99.71
VPT + Ensemble	0.12 / 99.96	0.23 / 99.91	0.32 / 99.90	0.73 / 99.77	0.12 / 99.94	0.20 / 99.96
VPT + DSGF	0.16 / 99.95	0.16 / 99.95	0.16 / 99.94	0.28 / 99.88	0.22 / 99.91	0.15 / 99.96
LPT	0.21 / 99.73	0.17 / 99.68	0.26 / 99.63	0.80 / 99.46	0.24 / 99.67	0.18 / 99.96
LPT + Ensemble	0.13 / 99.96	0.14 / 99.95	0.13 / 99.96	0.16 / 99.94	0.14 / 99.95	0.18 / 99.96
4-shot	FPR@95 ↓ / AUROC ↑ (%)					
	Energy	Entropy	Variance	MSP	Max-Logits	k-NN
FFT	44.08 / 92.42	34.99 / 93.58	40.92 / 91.95	48.35 / 89.89	42.00 / 92.54	1.76 / 99.62
FFT + Ensemble	0.22 / 99.92	0.89 / 99.78	0.98 / 99.76	2.02 / 99.55	0.30 / 99.89	0.19 / 99.94
FFT + DSGF	0.25 / 99.91	0.55 / 99.84	1.22 / 99.71	2.30 / 99.47	0.50 / 99.83	0.18 / 99.94
VAT	1.09 / 99.36	1.92 / 99.47	4.44 / 99.02	8.31 / 98.43	1.54 / 99.38	0.21 / 99.95
VAT + Ensemble	0.19 / 99.95	0.27 / 99.89	0.60 / 99.86	0.79 / 99.78	0.21 / 99.93	0.18 / 99.96
VAT + DSGF	0.14 / 99.96	0.16 / 99.93	0.24 / 99.91	0.35 / 99.88	0.13 / 99.94	0.18 / 99.95
VPT	1.59 / 99.34	5.64 / 98.62	13.19 / 97.53	20.81 / 96.24	3.27 / 99.05	0.44 / 99.88
VPT + Ensemble	0.22 / 99.93	0.38 / 99.86	0.79 / 99.80	1.06 / 99.69	0.20 / 99.92	0.17 / 99.96
VPT + DSGF	0.14 / 99.94	0.11 / 99.94	0.12 / 99.94	0.25 / 99.91	0.17 / 99.92	0.15 / 99.97
LPT	0.19 / 99.94	0.34 / 99.86	0.60 / 99.75	1.55 / 99.49	0.26 / 99.85	0.20 / 99.95
LPT + Ensemble	0.18 / 99.96	0.20 / 99.95	0.23 / 99.94	0.26 / 99.91	0.17 / 99.96	0.20 / 99.95
8-shot	FPR@95 ↓ / AUROC ↑ (%)					
	Energy	Entropy	Variance	MSP	Max-Logits	k-NN
FFT	5.43 / 98.86	8.42 / 98.35	13.34 / 97.44	20.97 / 96.21	7.91 / 98.43	0.16 / 99.94
FFT + Ensemble	0.18 / 99.95	0.54 / 99.87	0.79 / 99.83	1.24 / 99.73	0.18 / 99.93	0.09 / 99.96
FFT + DSGF	0.12 / 99.94	0.15 / 99.93	0.22 / 99.91	0.44 / 99.84	0.15 / 99.92	0.13 / 99.94
VAT	0.25 / 99.78	0.69 / 99.72	2.13 / 99.48	4.13 / 99.14	0.37 / 99.75	0.19 / 99.93
VAT + Ensemble	0.12 / 99.97	0.17 / 99.94	0.25 / 99.92	0.28 / 99.89	0.12 / 99.96	0.15 / 99.96
VAT + DSGF	0.14 / 99.96	0.19 / 99.93	0.24 / 99.90	0.32 / 99.84	0.15 / 99.93	0.21 / 99.96
VPT	0.10 / 99.95	0.27 / 99.91	0.61 / 99.84	1.25 / 99.71	0.19 / 99.90	0.17 / 99.94
VPT + Ensemble	0.08 / 99.98	0.08 / 99.98	0.10 / 99.97	0.13 / 99.96	0.06 / 99.98	0.12 / 99.97
VPT + DSGF	0.07 / 99.98	0.07 / 99.97	0.10 / 99.97	0.12 / 99.96	0.10 / 99.96	0.09 / 99.96
LPT	0.13 / 99.94	0.16 / 99.91	0.28 / 99.88	0.43 / 99.80	0.14 / 99.89	0.16 / 99.96
LPT + Ensemble	0.09 / 99.97	0.12 / 99.96	0.13 / 99.96	0.17 / 99.95	0.11 / 99.97	0.16 / 99.96
16-shot	FPR@95 ↓ / AUROC ↑ (%)					
	Energy	Entropy	Variance	MSP	Max-Logits	k-NN
FFT	0.58 / 99.69	1.63 / 99.58	3.20 / 99.26	5.97 / 98.79	1.00 / 99.61	0.25 / 99.93
FFT + Ensemble	0.16 / 99.95	0.19 / 99.93	0.38 / 99.90	0.40 / 99.86	0.18 / 99.95	0.15 / 99.95
FFT + DSGF	0.09 / 99.96	0.17 / 99.95	0.25 / 99.93	0.32 / 99.90	0.15 / 99.95	0.12 / 99.95
VAT	0.17 / 99.87	0.61 / 99.80	1.78 / 99.57	3.83 / 99.24	0.19 / 99.84	0.19 / 99.95
VAT + Ensemble	0.13 / 99.95	0.16 / 99.93	0.26 / 99.91	0.30 / 99.88	0.12 / 99.95	0.18 / 99.95
VAT + DSGF	0.11 / 99.96	0.22 / 99.94	0.29 / 99.93	0.38 / 99.90	0.11 / 99.94	0.10 / 99.95
VPT	0.13 / 99.92	0.35 / 99.82	1.09 / 99.67	2.46 / 99.42	0.25 / 99.81	0.14 / 99.93
VPT + Ensemble	0.10 / 99.97	0.12 / 99.96	0.15 / 99.95	0.16 / 99.93	0.11 / 99.96	0.14 / 99.95
VPT + DSGF	0.07 / 99.98	0.08 / 99.98	0.09 / 99.97	0.13 / 99.96	0.10 / 99.97	0.17 / 99.92
LPT	0.15 / 99.94	0.21 / 99.92	0.28 / 99.88	0.50 / 99.81	0.21 / 99.90	0.19 / 99.94
LPT + Ensemble	0.14 / 99.96	0.14 / 99.95	0.14 / 99.94	0.19 / 99.93	0.13 / 99.95	0.19 / 99.94
All-shot	FPR@95 ↓ / AUROC ↑ (%)					
	Energy	Entropy	Variance	MSP	Max-Logits	k-NN
FFT	0.14 / 99.94	0.50 / 99.88	0.78 / 99.81	0.84 / 99.73	0.14 / 99.93	0.16 / 99.97
FFT + Ensemble	0.08 / 99.98	0.13 / 99.96	0.19 / 99.95	0.16 / 99.94	0.08 / 99.97	0.10 / 99.98
FFT + DSGF	0.12 / 99.98	0.18 / 99.97	0.25 / 99.96	0.27 / 99.95	0.12 / 99.98	0.26 / 99.92
VAT	0.12 / 99.94	0.49 / 99.85	1.86 / 99.69	2.55 / 99.51	0.12 / 99.93	0.17 / 99.97
VAT + Ensemble	0.11 / 99.96	0.15 / 99.95	0.21 / 99.93	0.26 / 99.92	0.11 / 99.96	0.17 / 99.97
VAT + DSGF	0.13 / 99.98	0.14 / 99.96	0.17 / 99.94	0.21 / 99.91	0.13 / 99.97	0.15 / 99.97
VPT	0.29 / 99.94	0.62 / 99.88	0.94 / 99.80	1.28 / 99.67	0.38 / 99.90	0.18 / 99.94
VPT + Ensemble	0.10 / 99.98	0.14 / 99.97	0.17 / 99.96	0.20 / 99.95	0.11 / 99.98	0.13 / 99.98
VPT + DSGF	0.09 / 99.98	0.14 / 99.97	0.25 / 99.95	0.38 / 99.90	0.14 / 99.96	0.15 / 99.97
LPT	0.14 / 99.96	0.18 / 99.95	0.25 / 99.93	0.28 / 99.89	0.17 / 99.94	0.25 / 99.94
LPT + Ensemble	0.11 / 99.96	0.14 / 99.96	0.15 / 99.95	0.20 / 99.95	0.13 / 99.96	0.25 / 99.94

TABLE A.15
COMPARISON OF BASELINE AND OUR DSGF. ID AND OOD DATASETS ARE OXFORD-PETS AND TEXTURE.

2-shot	FPR@95 ↓ / AUROC ↑ (%)					
	Energy	Entropy	Variance	MSP	Max-Logits	k-NN
FFT	55.59 / 89.80	48.39 / 90.38	56.44 / 88.52	65.28 / 85.81	55.50 / 89.46	0.37 / 99.89
FFT + Ensemble	0.11 / 99.93	0.44 / 99.86	0.35 / 99.89	1.65 / 99.64	0.11 / 99.87	0.07 / 99.97
FFT + DSGF	0.09 / 99.95	0.12 / 99.95	0.23 / 99.92	0.55 / 99.81	0.12 / 99.93	0.07 / 99.97
VAT	0.85 / 99.37	6.01 / 98.66	12.57 / 97.63	20.37 / 96.55	2.43 / 99.12	0.07 / 99.95
VAT + Ensemble	0.07 / 99.96	0.21 / 99.83	0.62 / 99.80	1.10 / 99.64	0.07 / 99.94	0.07 / 99.97
VAT + DSGF	0.04 / 99.97	0.12 / 99.96	0.34 / 99.94	0.59 / 99.88	0.04 / 99.95	0.05 / 99.96
VPT	5.96 / 98.49	18.26 / 96.75	33.95 / 94.16	48.58 / 91.43	13.17 / 97.63	0.44 / 99.78
VPT + Ensemble	0.09 / 99.95	0.12 / 99.83	0.48 / 99.83	1.28 / 99.55	0.09 / 99.92	0.09 / 99.98
VPT + DSGF	0.09 / 99.97	0.09 / 99.96	0.11 / 99.96	0.20 / 99.89	0.14 / 99.92	0.12 / 99.95
LPT	0.12 / 99.66	0.14 / 99.57	0.39 / 99.49	1.52 / 99.24	0.23 / 99.56	0.07 / 99.96
LPT + Ensemble	0.09 / 99.96	0.09 / 99.94	0.09 / 99.95	0.11 / 99.93	0.09 / 99.94	0.07 / 99.96
4-shot	FPR@95 ↓ / AUROC ↑ (%)					
	Energy	Entropy	Variance	MSP	Max-Logits	k-NN
FFT	36.29 / 93.75	35.14 / 93.57	40.99 / 91.84	49.02 / 89.71	39.08 / 93.12	1.01 / 99.74
FFT + Ensemble	0.12 / 99.95	0.82 / 99.82	0.80 / 99.82	2.00 / 99.61	0.14 / 99.92	0.09 / 99.96
FFT + DSGF	0.25 / 99.91	1.01 / 99.74	2.75 / 99.43	5.16 / 98.98	0.74 / 99.75	0.09 / 99.95
VAT	3.40 / 98.85	5.83 / 98.72	10.66 / 97.80	16.44 / 96.93	5.14 / 98.81	0.09 / 99.97
VAT + Ensemble	0.09 / 99.96	0.55 / 99.81	1.86 / 99.68	2.29 / 99.58	0.09 / 99.93	0.09 / 99.97
VAT + DSGF	0.05 / 99.97	0.09 / 99.95	0.12 / 99.93	0.23 / 99.87	0.07 / 99.94	0.07 / 99.97
VPT	3.00 / 99.03	13.21 / 97.32	26.38 / 95.04	37.48 / 93.12	7.85 / 98.40	0.23 / 99.90
VPT + Ensemble	0.07 / 99.94	0.39 / 99.80	1.60 / 99.63	2.43 / 99.41	0.07 / 99.92	0.09 / 99.97
VPT + DSGF	0.05 / 99.94	0.07 / 99.94	0.09 / 99.94	0.16 / 99.89	0.12 / 99.91	0.05 / 99.98
LPT	0.11 / 99.95	0.20 / 99.90	0.34 / 99.82	1.13 / 99.60	0.14 / 99.88	0.09 / 99.97
LPT + Ensemble	0.09 / 99.97	0.11 / 99.96	0.12 / 99.96	0.16 / 99.94	0.09 / 99.97	0.09 / 99.97
8-shot	FPR@95 ↓ / AUROC ↑ (%)					
	Energy	Entropy	Variance	MSP	Max-Logits	k-NN
FFT	4.63 / 98.97	8.19 / 98.40	13.10 / 97.48	20.59 / 96.25	7.36 / 98.51	0.18 / 99.95
FFT + Ensemble	0.11 / 99.96	0.48 / 99.88	0.76 / 99.84	1.28 / 99.74	0.12 / 99.94	0.07 / 99.96
FFT + DSGF	0.07 / 99.95	0.09 / 99.94	0.11 / 99.93	0.27 / 99.88	0.09 / 99.93	0.11 / 99.92
VAT	0.30 / 99.65	0.71 / 99.64	2.82 / 99.34	5.32 / 98.92	0.41 / 99.65	0.14 / 99.94
VAT + Ensemble	0.12 / 99.96	0.16 / 99.92	0.28 / 99.91	0.28 / 99.88	0.12 / 99.96	0.11 / 99.96
VAT + DSGF	0.07 / 99.96	0.09 / 99.94	0.20 / 99.89	0.32 / 99.80	0.07 / 99.92	0.09 / 99.95
VPT	0.18 / 99.95	0.34 / 99.90	0.74 / 99.81	1.24 / 99.65	0.28 / 99.89	0.07 / 99.95
VPT + Ensemble	0.09 / 99.98	0.09 / 99.98	0.11 / 99.97	0.14 / 99.96	0.09 / 99.98	0.11 / 99.98
VPT + DSGF	0.09 / 99.98	0.09 / 99.98	0.12 / 99.98	0.14 / 99.96	0.12 / 99.97	0.09 / 99.96
LPT	0.07 / 99.92	0.18 / 99.88	0.46 / 99.83	0.94 / 99.68	0.14 / 99.86	0.11 / 99.96
LPT + Ensemble	0.09 / 99.96	0.12 / 99.96	0.12 / 99.95	0.14 / 99.93	0.11 / 99.95	0.11 / 99.96
16-shot	FPR@95 ↓ / AUROC ↑ (%)					
	Energy	Entropy	Variance	MSP	Max-Logits	k-NN
FFT	0.48 / 99.63	1.40 / 99.58	3.37 / 99.22	6.76 / 98.70	0.98 / 99.56	0.11 / 99.96
FFT + Ensemble	0.05 / 99.96	0.09 / 99.95	0.27 / 99.93	0.30 / 99.89	0.05 / 99.95	0.09 / 99.97
FFT + DSGF	0.05 / 99.96	0.11 / 99.96	0.12 / 99.94	0.18 / 99.92	0.09 / 99.95	0.07 / 99.97
VAT	0.18 / 99.85	0.59 / 99.80	1.47 / 99.60	3.30 / 99.27	0.18 / 99.83	0.09 / 99.96
VAT + Ensemble	0.11 / 99.97	0.09 / 99.95	0.23 / 99.94	0.21 / 99.91	0.11 / 99.96	0.09 / 99.97
VAT + DSGF	0.09 / 99.96	0.16 / 99.95	0.30 / 99.93	0.53 / 99.89	0.09 / 99.94	0.05 / 99.97
VPT	0.09 / 99.88	0.53 / 99.74	2.18 / 99.47	4.95 / 99.08	0.23 / 99.73	0.09 / 99.91
VPT + Ensemble	0.05 / 99.98	0.05 / 99.96	0.09 / 99.96	0.09 / 99.92	0.04 / 99.97	0.07 / 99.97
VPT + DSGF	0.02 / 99.99	0.02 / 99.99	0.05 / 99.98	0.07 / 99.96	0.07 / 99.97	0.07 / 99.98
LPT	0.12 / 99.92	0.18 / 99.89	0.25 / 99.84	0.53 / 99.74	0.16 / 99.87	0.11 / 99.96
LPT + Ensemble	0.07 / 99.96	0.11 / 99.96	0.14 / 99.95	0.16 / 99.94	0.07 / 99.96	0.09 / 99.95
All-shot	FPR@95 ↓ / AUROC ↑ (%)					
	Energy	Entropy	Variance	MSP	Max-Logits	k-NN
FFT	0.09 / 99.96	0.30 / 99.92	0.51 / 99.85	0.55 / 99.77	0.11 / 99.95	0.07 / 99.98
FFT + Ensemble	0.07 / 99.99	0.07 / 99.97	0.09 / 99.97	0.11 / 99.96	0.07 / 99.98	0.09 / 99.99
FFT + DSGF	0.05 / 99.99	0.07 / 99.99	0.11 / 99.98	0.12 / 99.97	0.05 / 99.99	0.09 / 99.95
VAT	0.09 / 99.94	0.76 / 99.79	2.78 / 99.56	4.04 / 99.30	0.09 / 99.93	0.09 / 99.98
VAT + Ensemble	0.05 / 99.97	0.07 / 99.95	0.12 / 99.93	0.16 / 99.90	0.04 / 99.97	0.09 / 99.98
VAT + DSGF	0.04 / 99.98	0.07 / 99.96	0.16 / 99.92	0.21 / 99.87	0.05 / 99.97	0.05 / 99.99
VPT	0.48 / 99.91	0.89 / 99.82	1.42 / 99.71	1.84 / 99.58	0.62 / 99.87	0.37 / 99.92
VPT + Ensemble	0.05 / 99.99	0.09 / 99.97	0.21 / 99.95	0.20 / 99.95	0.05 / 99.99	0.04 / 99.99
VPT + DSGF	0.14 / 99.98	0.27 / 99.96	0.43 / 99.93	0.51 / 99.88	0.23 / 99.95	0.09 / 99.99
LPT	0.07 / 99.96	0.14 / 99.94	0.21 / 99.91	0.32 / 99.85	0.14 / 99.93	0.09 / 99.95
LPT + Ensemble	0.07 / 99.96	0.11 / 99.96	0.14 / 99.95	0.16 / 99.94	0.07 / 99.96	0.09 / 99.95

TABLE A.16
COMPARISON OF BASELINE AND OUR DSGF. ID AND OOD DATASETS ARE CIFAR-100 AND TINY-IMAGENET.

2-shot		FPR@95 ↓ / AUROC ↑ (%)					
	Energy	Entropy	Variance	MSP	Max-Logits	k-NN	
FFT	89.56 / 61.56	91.30 / 59.63	91.34 / 58.90	92.08 / 58.37	91.04 / 60.18	91.17 / 61.21	
FFT + Ensemble	79.00 / 69.99	83.51 / 66.13	81.79 / 66.34	84.09 / 64.75	82.41 / 68.42	80.85 / 69.40	
FFT + DSGF	86.73 / 65.30	87.03 / 64.64	88.03 / 63.82	90.07 / 62.66	88.96 / 63.58	76.83 / 71.29	
VAT	89.78 / 64.60	82.88 / 67.25	84.30 / 65.70	85.79 / 64.53	86.41 / 65.18	77.40 / 71.32	
VAT + Ensemble	79.41 / 69.89	78.74 / 69.66	77.86 / 69.40	79.66 / 68.17	79.79 / 69.42	76.78 / 71.44	
VAT + DSGF	77.79 / 71.86	78.06 / 70.44	79.37 / 69.21	83.15 / 67.52	81.23 / 69.35	77.50 / 71.86	
VPT	79.48 / 72.54	80.89 / 71.21	82.29 / 69.79	84.06 / 67.93	82.59 / 69.52	84.03 / 69.49	
VPT + Ensemble	74.05 / 74.13	74.07 / 73.77	75.15 / 72.65	75.96 / 72.61	75.76 / 73.24	77.78 / 71.80	
VPT + DSGF	78.06 / 72.84	77.93 / 72.83	77.92 / 72.52	83.19 / 69.17	82.80 / 69.54	73.41 / 75.11	
LPT	89.78 / 64.60	82.88 / 67.25	84.30 / 65.70	85.79 / 64.53	86.41 / 65.18	77.40 / 71.32	
LPT + Ensemble	77.56 / 71.09	77.68 / 70.75	77.48 / 70.64	78.49 / 69.98	79.33 / 70.05	77.70 / 71.32	
4-shot		FPR@95 ↓ / AUROC ↑ (%)					
	Energy	Entropy	Variance	MSP	Max-Logits	k-NN	
FFT	85.93 / 67.34	84.95 / 66.19	86.28 / 65.21	87.79 / 63.93	86.08 / 65.60	82.44 / 68.50	
FFT + Ensemble	75.17 / 72.79	75.48 / 71.47	75.76 / 71.61	77.55 / 70.33	76.76 / 71.70	77.36 / 72.05	
FFT + DSGF	77.45 / 71.53	78.61 / 70.29	80.58 / 69.16	83.48 / 67.94	80.36 / 70.06	76.88 / 72.09	
VAT	90.47 / 67.07	78.47 / 71.23	80.74 / 69.56	82.85 / 68.26	85.08 / 68.53	74.63 / 74.22	
VAT + Ensemble	78.41 / 72.79	75.76 / 73.79	75.64 / 74.79	77.31 / 75.79	77.98 / 76.79	75.73 / 77.79	
VAT + DSGF	75.90 / 73.88	76.62 / 72.20	77.91 / 70.77	80.83 / 69.32	77.85 / 71.74	72.82 / 75.68	
VPT	65.75 / 78.86	67.84 / 77.55	70.46 / 76.23	75.24 / 74.77	72.45 / 76.45	73.88 / 75.78	
VPT + Ensemble	67.76 / 72.79	66.83 / 73.79	70.27 / 74.79	69.55 / 75.79	68.24 / 76.79	74.22 / 77.79	
VPT + DSGF	69.22 / 77.93	69.63 / 77.15	71.18 / 76.12	76.46 / 74.34	74.66 / 75.35	69.34 / 78.02	
LPT	65.92 / 78.76	66.47 / 76.51	68.94 / 74.28	75.17 / 71.73	71.63 / 74.46	76.84 / 71.34	
LPT + Ensemble	64.88 / 79.64	66.46 / 77.79	66.49 / 75.79	76.25 / 70.13	70.61 / 76.79	76.84 / 71.34	
8-shot		FPR@95 ↓ / AUROC ↑ (%)					
	Energy	Entropy	Variance	MSP	Max-Logits	k-NN	
FFT	78.69 / 73.13	80.24 / 71.88	82.17 / 70.47	83.70 / 69.35	80.75 / 71.70	77.07 / 74.52	
FFT + Ensemble	70.73 / 76.15	73.55 / 75.14	73.62 / 74.41	75.78 / 73.36	73.44 / 75.61	72.60 / 75.52	
FFT + DSGF	72.31 / 76.13	76.08 / 74.33	79.02 / 73.08	81.75 / 72.08	76.68 / 75.07	71.17 / 76.66	
VAT	78.80 / 74.50	74.19 / 74.89	77.36 / 73.26	80.40 / 72.15	78.70 / 74.29	71.05 / 76.20	
VAT + Ensemble	71.15 / 76.45	69.93 / 76.40	71.84 / 75.33	74.14 / 74.48	71.71 / 76.34	72.14 / 74.67	
VAT + DSGF	69.71 / 77.21	73.11 / 75.36	75.93 / 74.03	79.17 / 72.99	74.76 / 75.75	67.57 / 77.66	
VPT	65.10 / 80.84	67.96 / 79.67	69.41 / 78.59	72.00 / 77.73	69.21 / 79.55	67.24 / 79.41	
VPT + Ensemble	62.40 / 81.40	62.66 / 80.97	64.88 / 80.05	66.21 / 79.65	64.20 / 80.93	67.56 / 78.43	
VPT + DSGF	63.53 / 81.10	65.79 / 80.30	67.68 / 79.53	71.42 / 78.62	69.54 / 79.52	63.15 / 81.17	
LPT	74.08 / 74.13	75.89 / 72.8	77.78 / 71.45	82.03 / 69.94	79.00 / 71.97	74.46 / 71.83	
LPT + Ensemble	71.59 / 75.01	72.56 / 74.43	73.32 / 73.76	74.07 / 73.22	73.54 / 74.13	74.46 / 71.83	
16-shot		FPR@95 ↓ / AUROC ↑ (%)					
	Energy	Entropy	Variance	MSP	Max-Logits	k-NN	
FFT	72.80 / 76.84	73.37 / 75.87	75.43 / 74.71	78.07 / 73.89	75.74 / 75.88	73.99 / 76.69	
FFT + Ensemble	68.00 / 78.30	69.01 / 77.63	70.26 / 76.73	71.98 / 76.14	69.07 / 78.08	69.96 / 77.10	
FFT + DSGF	68.87 / 78.78	71.70 / 76.93	74.92 / 75.58	78.07 / 74.63	74.25 / 77.25	70.87 / 77.12	
VAT	68.14 / 79.64	69.21 / 77.35	72.41 / 75.62	74.81 / 74.73	69.47 / 78.99	67.21 / 78.54	
VAT + Ensemble	63.83 / 80.60	66.46 / 78.98	68.77 / 77.42	70.87 / 76.81	64.92 / 80.32	69.32 / 76.22	
VAT + DSGF	63.59 / 80.42	69.28 / 78.00	72.37 / 76.51	74.84 / 75.55	69.01 / 79.27	63.74 / 79.70	
VPT	60.58 / 82.28	64.12 / 80.43	66.80 / 78.93	69.68 / 78.09	65.84 / 81.05	64.96 / 81.19	
VPT + Ensemble	59.32 / 83.05	61.90 / 81.77	63.52 / 80.52	65.83 / 79.93	61.83 / 82.30	64.33 / 79.85	
VPT + DSGF	61.44 / 82.23	63.78 / 81.15	65.75 / 80.26	68.93 / 79.41	66.67 / 80.98	60.34 / 82.32	
LPT	73.16 / 74.81	75.94 / 72.83	78.84 / 71.17	82.24 / 69.69	78.82 / 72.37	74.44 / 72.07	
LPT + Ensemble	70.01 / 75.94	71.11 / 74.85	72.26 / 74.02	74.33 / 73.20	72.52 / 74.85	74.44 / 72.07	
All-shot		FPR@95 ↓ / AUROC ↑ (%)					
	Energy	Entropy	Variance	MSP	Max-Logits	k-NN	
FFT	64.40 / 82.50	69.51 / 80.59	72.45 / 80.13	74.67 / 80.00	65.73 / 82.39	63.51 / 84.24	
FFT + Ensemble	60.29 / 84.23	65.64 / 80.17	69.21 / 79.59	70.63 / 79.15	60.71 / 84.14	59.98 / 84.19	
FFT + DSGF	62.13 / 83.84	65.07 / 82.07	68.09 / 81.45	70.93 / 81.27	62.88 / 83.67	60.10 / 84.25	
VAT	53.70 / 84.76	60.52 / 81.70	64.27 / 80.11	66.53 / 79.34	56.94 / 84.21	59.23 / 83.73	
VAT + Ensemble	53.93 / 85.64	57.86 / 83.42	60.93 / 81.86	63.48 / 81.34	54.54 / 85.38	61.95 / 81.54	
VAT + DSGF	54.00 / 85.07	60.87 / 81.75	63.58 / 80.27	65.65 / 79.54	57.06 / 84.42	60.16 / 83.87	
VPT	53.93 / 84.92	59.37 / 82.27	63.07 / 80.59	64.84 / 79.85	58.06 / 83.99	55.07 / 85.20	
VPT + Ensemble	52.44 / 85.92	56.66 / 84.03	59.93 / 82.47	61.56 / 81.94	55.28 / 85.19	58.66 / 83.31	
VPT + DSGF	53.79 / 84.88	56.43 / 83.88	59.14 / 82.85	61.78 / 82.05	58.11 / 83.86	53.11 / 85.02	
LPT	72.13 / 76.61	76.01 / 74.69	78.57 / 73.41	81.40 / 72.54	78.27 / 74.96	74.62 / 74.02	
LPT + Ensemble	68.27 / 78.77	70.52 / 77.26	72.67 / 76.41	73.66 / 75.94	71.32 / 77.84	74.62 / 74.02	

TABLE A.17
HYPER-PARAMETERS SETTING FOR FOUR ID DATASETS ON DIFFERENT SETTINGS

	Fine-tuning Stage			DSGF Stage		
	Imagenet-1k			CIFAR-100		
	Learning Rate	Weight Decay	Batch Size	Learning Rate	Weight Decay	Batch Size
FFT	0.0001	0.01	64	0.01 / 0.01 / 0.1 / 0.1 / 0.001	0.0001 / 0.0001 / 0.0001 / 0 / 0	32
VAT	0.01 / 0.001 / 0.001 / 0.001 / 0.001	0.001	128	0.1	0	32
VPT	2.5 / 1.25 / 1.25 / 2.5 / 1.25	0.001	128	0.1 / 0.1 / 0.1 / 0.1 / 0.01	0.001 / 0.001 / 0.001 / 0.001 / 0	32
LPT	2.5	0.0001	512	-	-	-
	FOOD-101			Oxford-PETS		
	Learning Rate	Weight Decay	Batch Size	Learning Rate	Weight Decay	Batch Size
FFT	0.001 / 0.001 / 0.0001 / 0.0001 / 0.0001	0.01	64	0.1	0	32
VAT	0.01	0.01	128	0.1	0	32
VPT	3.75 / 3.75 / 2.5 / 2.5 / 1.25	0.001	128	0.1	0.01 / 0.01 / 0.01 / 0.01 / 0.001	32
LPT	2.5	0.0001	512	-	-	-
	Oxford-PETS			CIFAR-100		
	Learning Rate	Weight Decay	Batch Size	Learning Rate	Weight Decay	Batch Size
FFT	0.0001	0.01	64	0.1	0	32
VAT	0.01	0.01	128	0.1	0	32
VPT	3.75 / 2.5 / 2.5 / 2.5 / 1.25	0.001	128	0.1	0.1 / 0.1 / 0.1 / 0.1 / 0.01	32
LPT	2.5	0.0001	512	-	-	-

* / * / * / * / * The five values correspond to the settings of 2 / 4 / 8 / 16 / All shot respectively. A single value applies to 2 / 4 / 8 / 16 / All shot settings.