

# Appendix for “Do Different Deep Metric Learning Losses Lead to Similar Learned Features?”

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## A. Full Results Tables of the Quantitative Pixel Level Analysis

Tables 1 and 2 show the full correlation tables for our quantitative analysis. Tables 3 to 5 show the Jensen-Shannon Divergence tables.

	Contrastive	Triplet	NTXent	Margin	Ranking Margin/class	FastAP	SNR Con.	MS	MS+Miner	Classification ProxyNCA	N. Softmax	CosFace	ArcFace	SoftTriple	None
Ranking	Contrastive	84±6	86±5	86±5	85±5	85±5	86±5	86±5	87±5	85±5	86±5	85±5	85±5	86±5	74±11
	Triplet	84±6	85±6	84±6	85±6	84±6	84±6	84±6	84±6	83±6	84±6	82±7	82±7	84±6	75±10
	NTXent	86±5	85±6	85±6	85±5	85±6	85±5	86±5	86±5	85±5	86±5	84±6	84±6	85±5	74±10
	Margin	86±5	84±6	85±6	85±6	85±6	85±6	85±5	85±6	84±6	85±6	84±6	83±6	84±6	74±10
	Margin/class	85±5	85±6	85±5	85±6	84±6	84±6	85±5	85±5	84±5	85±5	84±6	83±6	84±6	75±10
	FastAP	85±5	84±6	85±6	85±6	84±6	85±6	85±5	85±5	85±5	85±5	84±6	84±6	85±5	73±11
	SNR Con.	86±5	84±6	85±5	85±6	84±6	85±6	86±5	85±5	84±5	86±5	84±6	84±6	85±5	74±10
Classif.	MS	86±5	84±6	86±5	85±5	85±5	85±5	86±5	86±5	85±5	86±5	85±6	85±6	86±5	74±10
	MS+Miner	87±5	84±6	86±5	85±6	85±5	85±5	86±5	86±5	85±5	86±5	85±6	85±5	86±5	73±11
	ProxyNCA	85±5	83±6	85±5	84±6	84±5	85±5	85±5	85±5		87±4	85±5	85±5	86±5	74±10
	N. Softmax	86±5	84±6	85±6	85±5	85±5	86±5	86±5	86±5	87±4	86±5	86±5	87±4	87±4	74±11
	CosFace	85±5	82±7	84±6	84±6	84±6	84±6	84±6	85±6	85±5	86±5	86±5	85±5	87±4	73±11
	ArcFace	85±5	82±7	84±6	83±6	83±6	84±6	84±5	85±5	85±5	86±5	85±5	86±4	86±4	73±11
	SoftTriple	86±5	84±6	85±5	84±6	84±6	85±5	85±5	86±5	86±5	86±5	87±4	87±4	86±4	74±11
	None	74±11	75±10	74±10	74±10	75±10	73±11	74±10	73±11	74±10	74±11	73±11	73±11	73±11	74±11

Table 1. Correlations between all loss functions on the Cars196 dataset. All values are in percent. Larger values have darker cells.

	Contrastive	Triplet	NTXent	Margin	Ranking Margin/class	FastAP	SNR Con.	MS	MS+Miner	Classification ProxyNCA	N. Softmax	CosFace	ArcFace	SoftTriple	None
Ranking	Contrastive	88±7	89±6	89±6	89±5	89±6	89±5	89±5	89±5	88±6	89±6	89±6	89±6	89±5	86±6
	Triplet	88±7	89±5	89±6	89±6	89±6	89±5	89±5	89±5	88±6	89±5	88±7	88±6	88±6	86±6
	NTXent	89±6	89±5	89±5	90±5	89±5	90±5	90±4	90±5	89±5	90±5	88±6	89±5	89±5	86±6
	Margin	89±6	89±6	89±5	90±5	90±5	90±5	90±5	90±5	89±5	89±5	88±6	89±6	89±6	86±6
	Margin/class	89±5	89±6	90±5	90±5	90±5	90±5	90±5	90±5	89±6	89±5	88±6	89±5	89±5	86±6
	FastAP	89±6	89±6	90±5	90±5	90±5	90±5	90±5	90±5	89±5	90±5	89±6	90±5	90±5	86±6
	SNR Con.	89±5	89±5	89±5	90±5	90±5	90±5	90±4	90±4	89±5	90±5	90±5	89±5	89±5	87±6
Classif.	MS	89±5	89±5	90±5	90±5	90±5	90±5	90±4	90±4	89±5	90±5	90±5	89±5	89±5	87±5
	MS+Miner	89±5	89±5	90±4	90±5	90±5	90±5	90±4	90±4	89±5	90±5	90±5	90±5	90±5	86±6
	ProxyNCA	88±6	88±6	89±5	89±5	89±6	89±5	89±5	89±5		89±5	88±6	89±5	89±5	87±5
	N. Softmax	89±6	89±5	90±5	89±5	89±5	90±5	90±4	90±5	89±5	90±5	90±5	90±5	90±5	86±6
	CosFace	89±6	88±7	88±6	88±6	88±6	89±6	89±5	89±5	88±6	89±6	90±5	90±5	90±5	86±6
	ArcFace	89±6	88±6	89±5	89±6	89±5	90±5	89±5	89±5	89±5	90±5	90±5	90±5	90±5	86±6
	SoftTriple	89±5	88±6	89±5	89±6	89±5	90±5	89±5	89±5	89±5	90±5	90±5	90±5	90±5	86±6
	None	86±6	86±6	86±6	86±6	86±6	86±6	87±6	87±5	86±6	87±5	86±6	86±6	86±6	86±6

Table 2. Correlations between all loss functions on the CUB200 dataset. All values are in percent. Larger values have darker cells.

	Contrastive	Triplet	NTXent	Margin	Ranking Margin/class	FastAP	SNR Con.	MS	MS+Miner	ProxyNCA	N. Softmax	Classification CosFace	ArcFace	SoftTriple	None
Ranking	Contrastive	2±0	2±0	2±0	2±0	2±0	2±0	2±0	2±0	3±1	3±0	3±1	3±1	3±1	4±1
	Triplet	2±0	2±0	2±0	2±0	2±0	2±0	2±0	2±0	3±1	3±0	3±1	3±1	3±1	3±1
	NTXent	2±0	2±0	2±0	2±0	2±0	2±0	2±0	2±0	2±0	2±0	3±0	3±0	2±0	3±1
	Margin	2±0	2±0	2±0	2±0	2±0	2±0	2±0	2±0	3±0	3±0	3±1	3±1	3±1	3±1
	Margin/class	2±0	2±0	2±0	2±0	2±0	2±0	2±0	2±0	3±0	3±0	3±1	3±1	3±1	3±1
	FastAP	2±0	2±0	2±0	2±0	2±0	2±0	2±0	2±0	3±1	3±0	3±1	3±1	3±1	3±1
	SNR Con.	2±0	2±0	2±0	2±0	2±0	2±0	2±0	2±0	3±1	3±1	3±1	3±1	3±1	4±1
Classif.	MS	2±0	2±0	2±0	2±0	2±0	2±0	2±0	2±0	3±0	2±0	3±0	3±0	3±0	3±1
	MS+Miner	2±0	2±0	2±0	2±0	2±0	2±0	2±0	2±0	2±0	2±0	3±0	3±0	3±0	3±1
	ProxyNCA	3±1	3±1	2±0	3±0	3±0	3±1	3±1	3±0	2±0	2±0	2±0	2±0	2±0	3±1
	N. Softmax	3±0	3±0	2±0	3±0	3±0	3±1	2±0	2±0	2±0	2±0	2±0	2±0	2±0	3±1
	CosFace	3±1	3±1	3±0	3±1	3±1	3±1	3±0	3±0	2±0	2±0	2±0	2±0	3±0	
	ArcFace	3±1	3±1	3±0	3±1	3±1	3±1	3±1	3±0	2±0	2±0	2±0	2±0	3±1	
	SoftTriple	3±1	3±1	2±0	3±1	3±1	3±1	3±1	3±0	2±0	2±0	2±0	2±0	3±0	
None		4±1	3±1	3±1	3±1	3±1	3±1	4±1	3±1	3±1	3±1	3±1	3±1	3±1	

Table 3. Jensen-Shannon Divergence between all loss functions on the SOP dataset. All values are in percent.

	Contrastive	Triplet	NTXent	Margin	Ranking Margin/class	FastAP	SNR Con.	MS	MS+Miner	ProxyNCA	N. Softmax	Classification CosFace	ArcFace	SoftTriple	None
Ranking	Contrastive	2±0	1±0	2±0	2±0	2±0	2±0	1±0	1±0	2±0	2±0	2±0	2±0	2±0	3±1
	Triplet	2±0	2±0	2±0	2±0	2±0	2±0	2±0	2±0	2±0	2±0	2±0	2±0	2±0	3±1
	NTXent	1±0	2±0	2±0	1±0	2±0	1±0	1±0	2±0	2±0	1±0	2±0	2±0	2±0	3±1
	Margin	2±0	2±0	2±0	2±0	2±0	2±0	2±0	2±0	2±0	2±0	2±0	2±0	2±0	3±1
	Margin/class	2±0	2±0	1±0	2±0	2±0	2±0	2±0	2±0	2±0	2±0	2±0	2±0	2±0	3±1
	FastAP	2±0	2±0	2±0	2±0	2±0	2±0	2±0	2±0	2±0	2±0	2±0	2±0	2±0	4±1
	SNR Con.	2±0	2±0	1±0	2±0	2±0	2±0	2±0	1±0	2±0	1±0	2±0	2±0	2±0	3±1
Classif.	MS	1±0	2±0	1±0	2±0	2±0	2±0	2±0	1±0	1±0	1±0	2±0	2±0	2±0	3±1
	MS+Miner	1±0	2±0	2±0	2±0	2±0	2±0	2±0	1±0	2±0	1±0	2±0	2±0	1±0	3±1
	ProxyNCA	2±0	2±0	2±0	2±0	2±0	2±0	1±0	2±0	1±0	1±0	1±0	2±0	1±0	3±1
	N. Softmax	2±0	2±0	1±0	2±0	2±0	2±0	1±0	1±0	1±0	1±0	1±0	2±0	1±0	3±1
	CosFace	2±0	2±0	2±0	2±0	2±0	2±0	2±0	2±0	1±0	1±0	1±0	2±0	1±0	3±1
	ArcFace	2±0	2±0	2±0	2±0	2±0	2±0	2±0	2±0	2±0	2±0	2±0	2±0	1±0	3±1
	SoftTriple	2±0	2±0	2±0	2±0	2±0	2±0	2±0	2±0	1±0	1±0	1±0	1±0	1±0	3±1
None		3±1	3±1	3±1	3±1	3±1	4±1	3±1	3±1	3±1	3±1	3±1	3±1	3±1	

Table 4. Jensen-Shannon Divergence between all loss functions on the Cars196 dataset. All values are in percent.

	Contrastive	Triplet	NTXent	Margin	Ranking Margin/class	FastAP	SNR Con.	MS	MS+Miner	ProxyNCA	N. Softmax	Classification CosFace	ArcFace	SoftTriple	None
Ranking	Contrastive	2±0	2±0	2±0	2±0	2±0	2±0	1±0	2±0	2±0	2±0	2±0	2±0	2±0	2±0
	Triplet	2±0	1±0	1±0	1±0	2±0	2±0	1±0	1±0	1±0	1±0	1±0	2±0	2±0	2±0
	NTXent	2±0	1±0	1±0	1±0	1±0	1±0	1±0	1±0	1±0	1±0	1±0	1±0	2±0	2±0
	Margin	2±0	1±0	1±0	1±0	2±0	1±0	1±0	1±0	1±0	1±0	1±0	2±0	2±0	2±0
	Margin/class	2±0	1±0	1±0	1±0	1±0	1±0	1±0	1±0	1±0	1±0	1±0	1±0	2±0	2±0
	FastAP	2±0	2±0	1±0	2±0	1±0	1±0	1±0	1±0	2±0	1±0	2±0	2±0	2±0	2±1
	SNR Con.	2±0	2±0	1±0	1±0	1±0	1±0	1±0	1±0	1±0	1±0	2±0	2±0	1±0	2±0
Classif.	MS	1±0	1±0	1±0	1±0	1±0	1±0	1±0	1±0	1±0	1±0	1±0	1±0	1±0	2±0
	MS+Miner	2±0	1±0	1±0	1±0	1±0	1±0	1±0	1±0	1±0	1±0	1±0	1±0	1±0	2±0
	ProxyNCA	2±0	1±0	1±0	1±0	1±0	2±0	1±0	1±0	1±0	1±0	2±0	1±0	1±0	2±0
	N. Softmax	2±0	1±0	1±0	1±0	1±0	1±0	1±0	1±0	1±0	1±0	2±0	1±0	1±0	2±0
	CosFace	2±0	2±0	2±0	2±0	2±0	2±0	2±0	2±0	2±0	2±0	2±0	1±0	1±0	2±0
	ArcFace	2±0	2±0	1±0	2±0	1±0	2±0	1±0	1±0	1±0	1±0	1±0	1±0	1±0	2±0
	SoftTriple	2±0	2±0	2±0	2±0	2±0	2±0	2±0	1±0	1±0	1±0	1±0	1±0	1±0	2±0
None		2±0	2±0	2±0	2±0	2±0	2±1	2±0	2±0	2±0	2±0	2±0	2±0	2±0	2±0

Table 5. Jensen-Shannon Divergence between all loss functions on the CUB200 dataset. All values are in percent.

## B. Examples of the Qualitative Pixel Level Analysis

Figures 1 to 9 show saliency maps for example images from all three datasets Cars196, CUB200, and SOP.

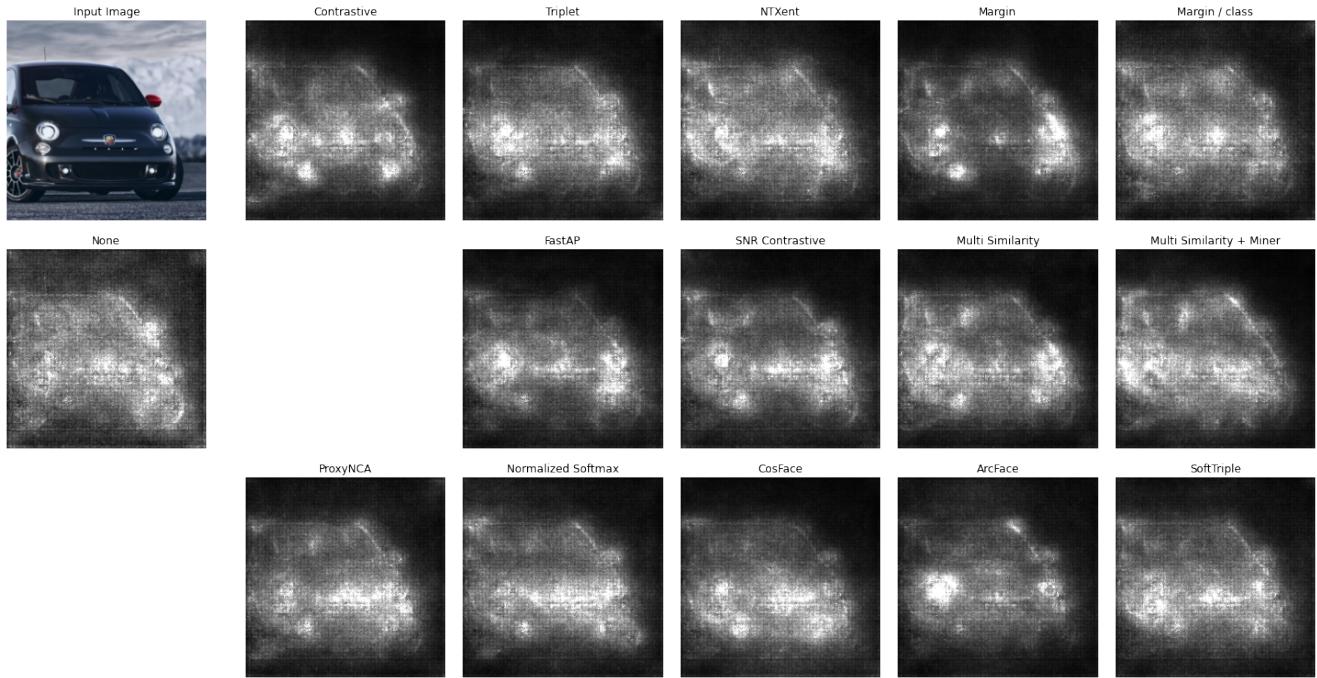


Figure 1. Saliency maps of a sample image from Cars196.

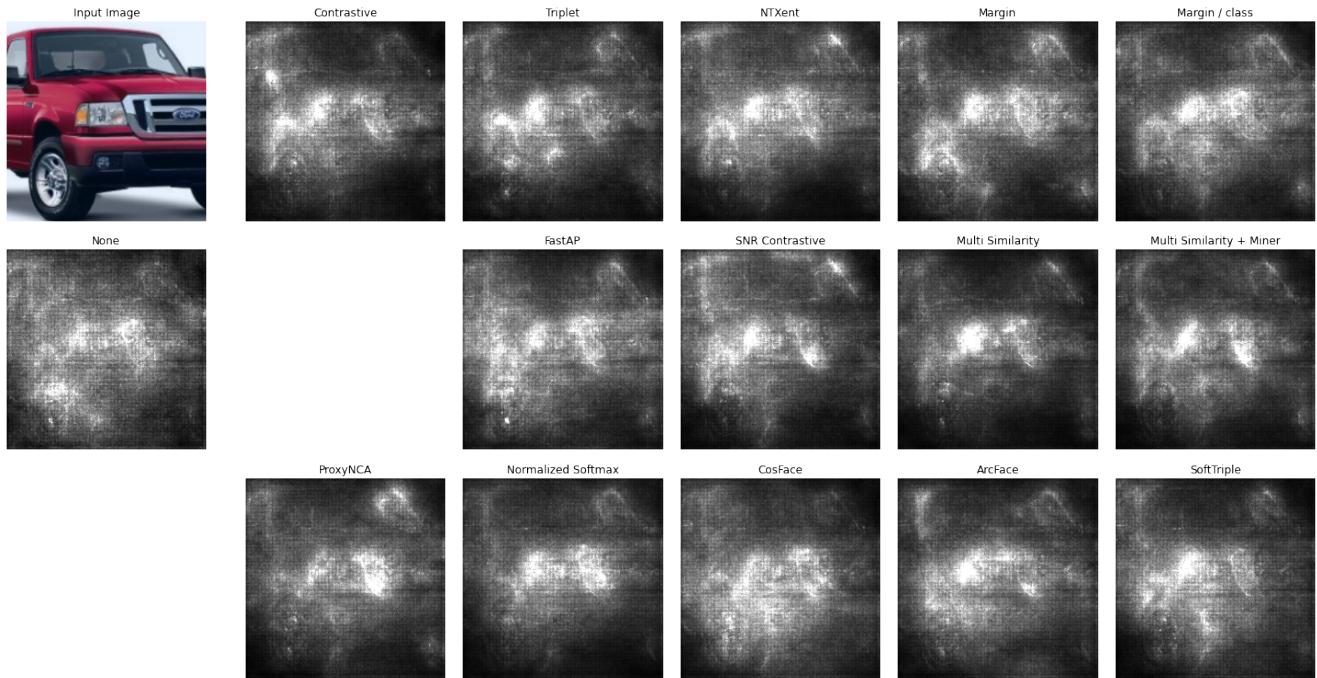


Figure 2. Saliency maps of a sample image from Cars196.

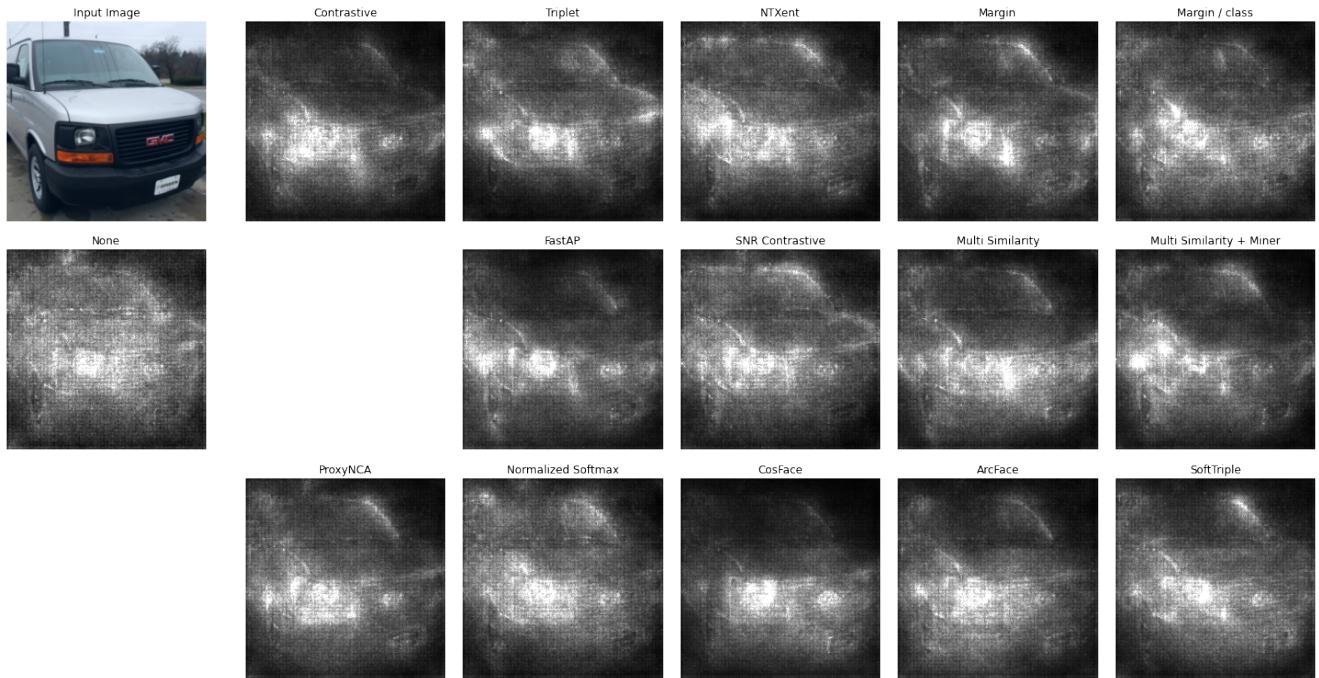


Figure 3. Saliency maps of a sample image from Cars196.

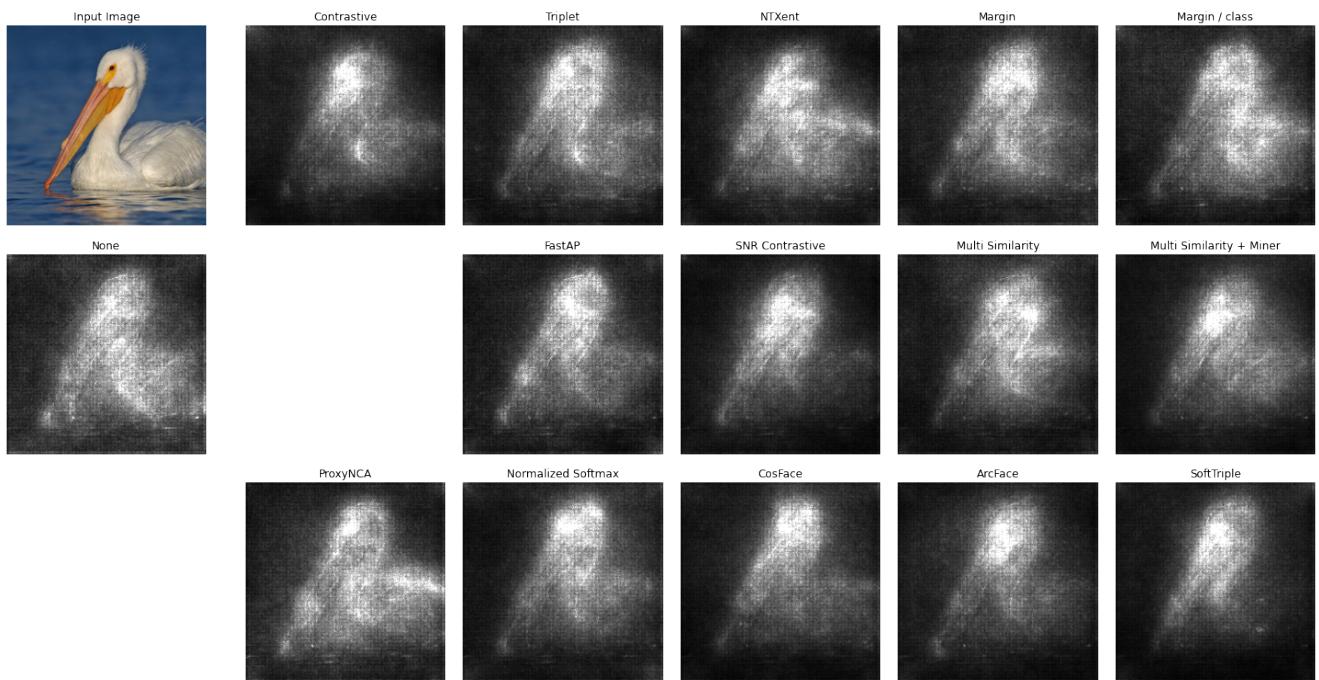


Figure 4. Saliency maps of a sample image from CUB200.

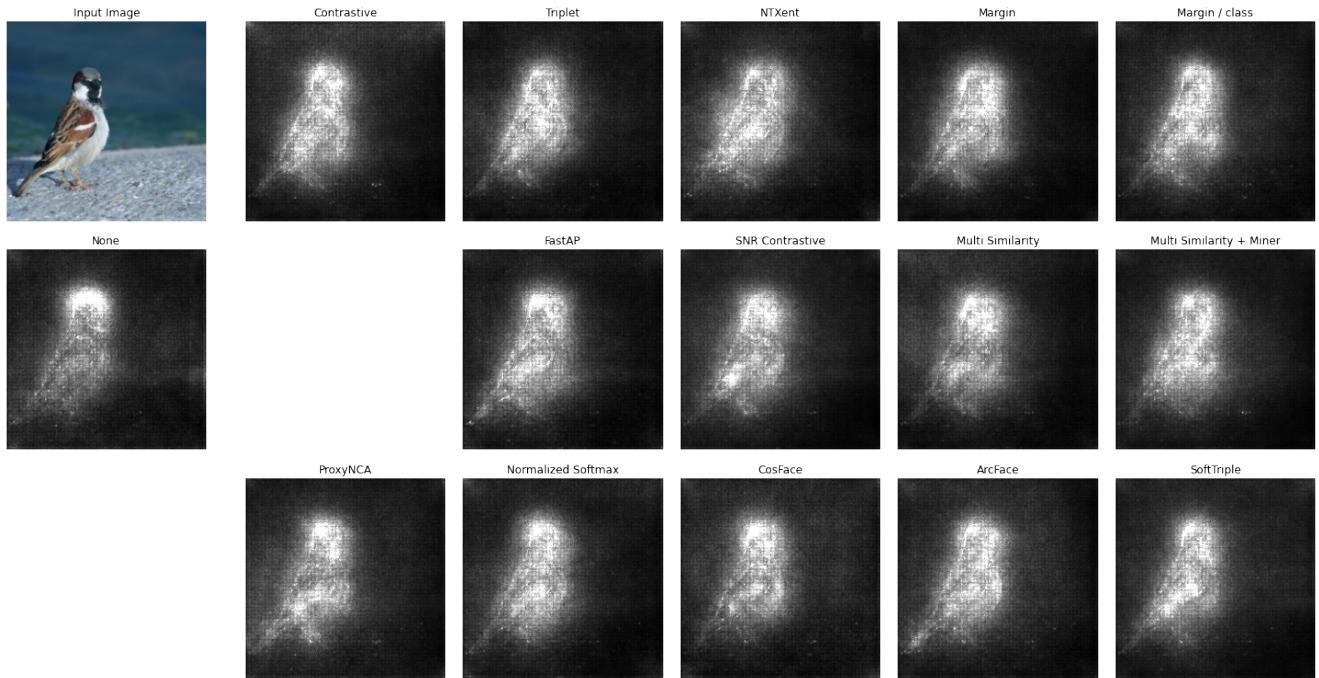


Figure 5. Saliency maps of a sample image from CUB200.

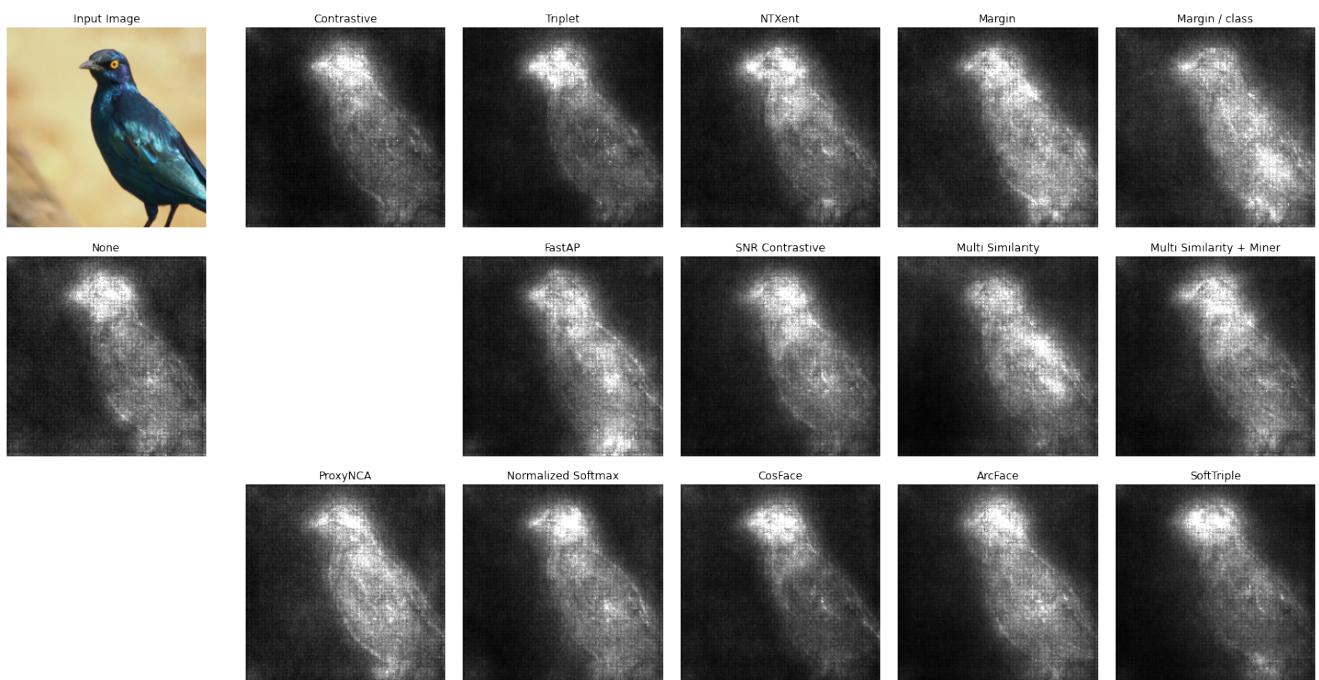


Figure 6. Saliency maps of a sample image from CUB200.

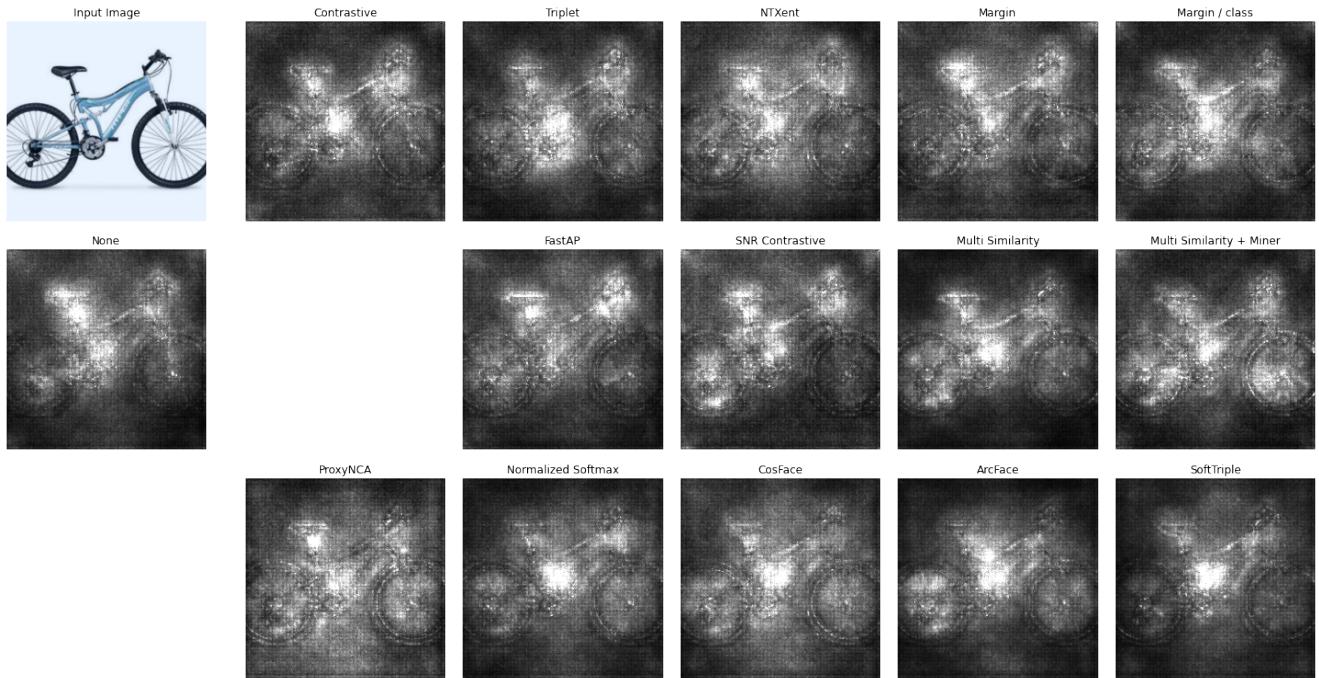


Figure 7. Saliency maps of a sample image from SOP.

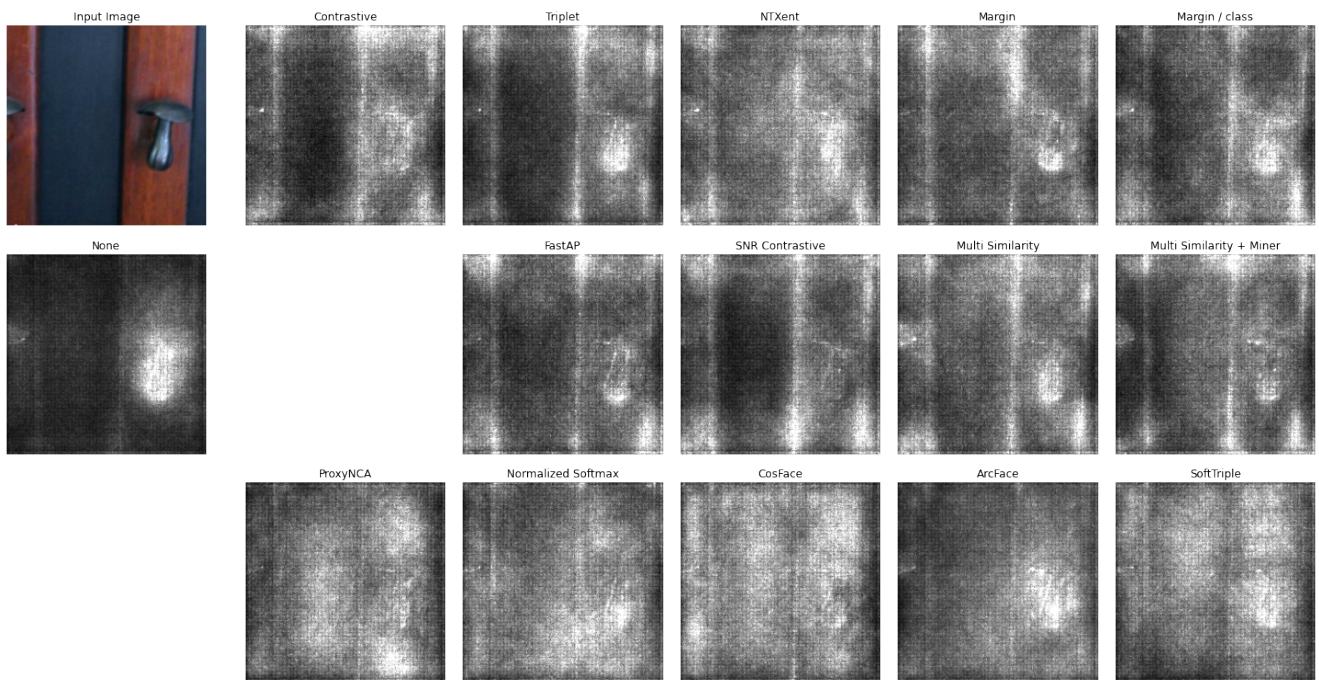


Figure 8. Saliency maps of a sample image from SOP.

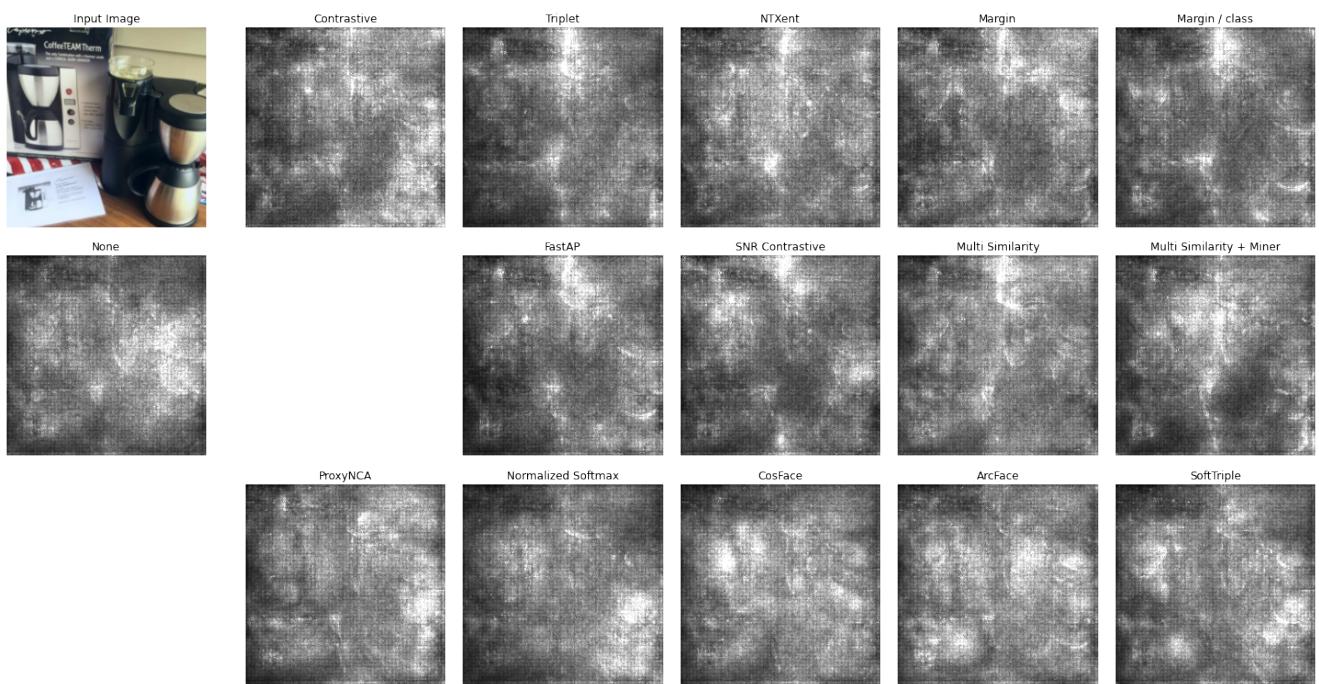


Figure 9. Saliency maps of a sample image from SOP.