Dimensionality Reduction Using Discriminative Autoencoders for Remote Sensing Image Retrieval

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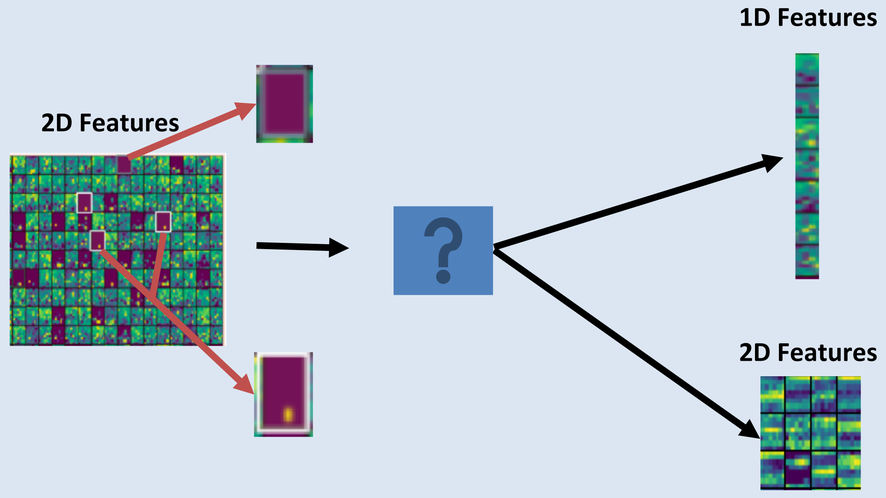
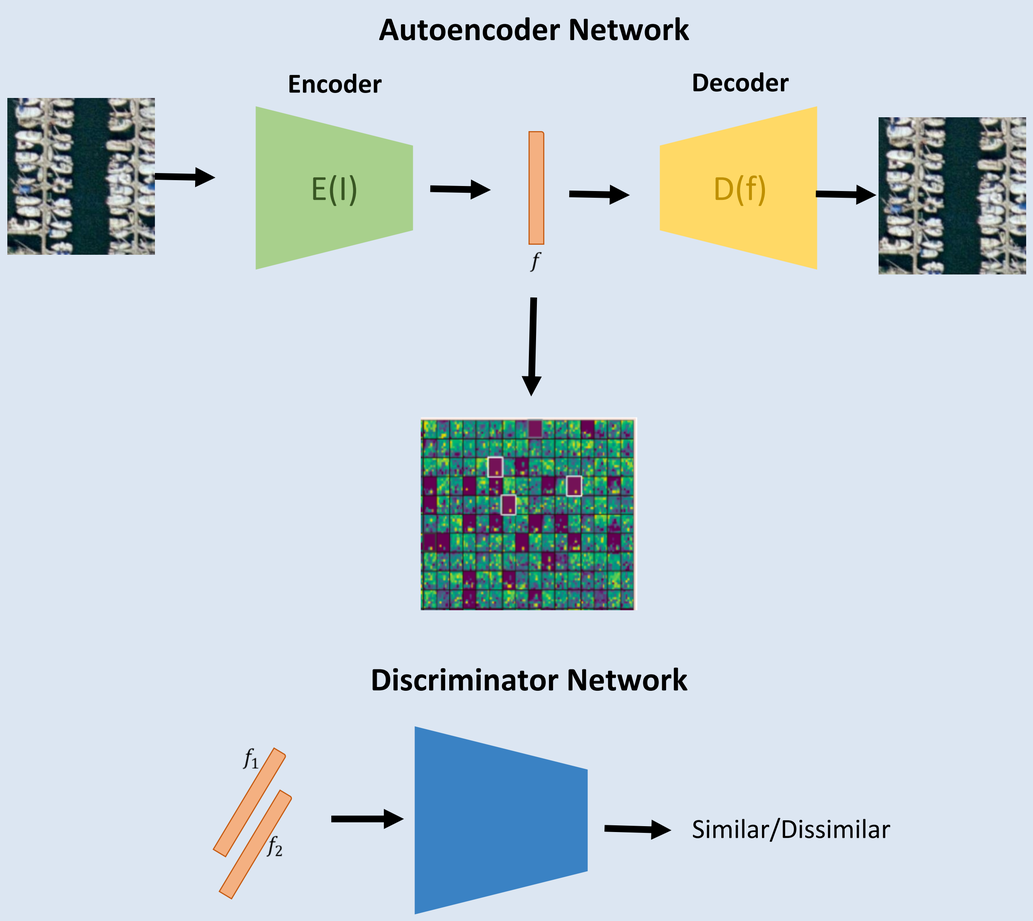
1 Motivation

- Lack of annotated data for Remote Sensing Images.
- Feature extraction using deep unsupervised methods results in large feature size as some filters could be redundant.
- Current feature reduction schemes aggregate learned visual descriptors leading to loss of information

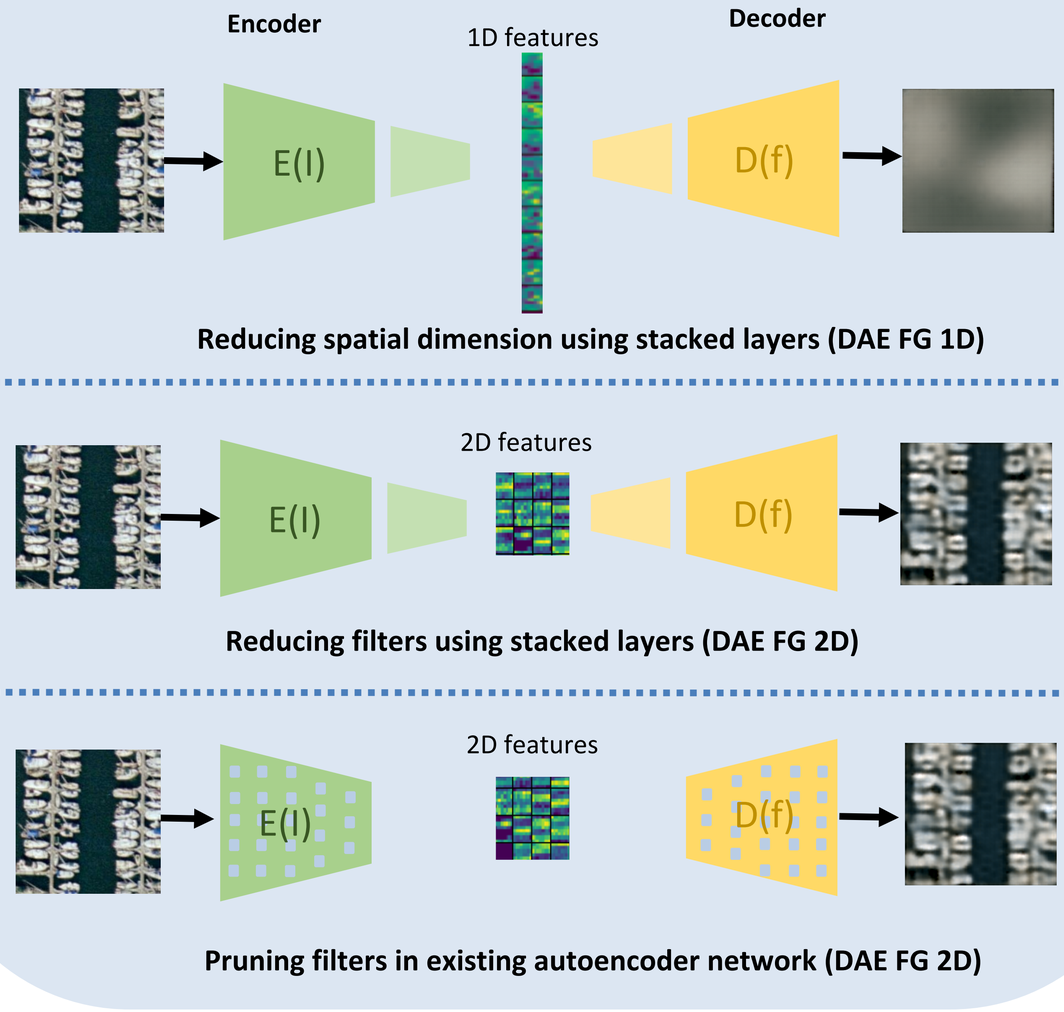
How to reduce features redundancy?



2 Discriminative Autoencoder (DAE CG)



3 Dimensionality Reduction



4 Results

$$mAP = \frac{1}{Q}\sum_{q=1}^{Q} AP(q)$$

$$NMRR = \frac{Rank_{mean}(q) - 0.5\,[1 + G(q)]}{1.25\,K(q) - 0.5\,[1 + G(q)}$$

$$ANMRR = \frac{1}{Q}\sum_{q=1}^{Q} NMRR$$

Q = Set of queries
G(q) = Set of relevant images

Feature Type	Features	Feature Size	ANMRR	mAP	P@5	P@50	P@100
Hand Crafted	LPB RGB [13]	54	0.751	18.0	58.7	28.1	19.6
	Dense SIFT VLAD [14]	25600	0.649	28.0	74.9	38.2	28.1
	Dense SIFT FV [13]	40960	0.639	29.2	75.3	39.1	28.5
Deep Supervised	NetVLAD [15]	4060	0.406	51.4	83.00	61.6	49.0
	SatResNet [13]	2048	0.239	69.9	92.1	77.2	64.4
Deep Unsupervised	DAE CG	32768	0.09	81.2	100	99.2	87.4
	DAE CG PCA	1063	0.591	24.7	59.6	45.5	39.9
	DAE FG 1D	**1024**	0.495	38.0	63.1	54.0	49.6
	DAE FG 2D	1280	0.417	43.9	66.7	63.6	57.2

Table:1 Comparative evaluation of our proposed approach on LandUse dataset

Feature Type	Features	Feature Size	ANMRR	mAP	P@5	P@50	P@100
Hand Crafted	LPB RGB [13]	54	0.664	25.0	50.3	26.3	19.4
	Dense SIFT VLAD [14]	25600	0.649	28.0	74.9	4.20	28.1
	Dense SIFT FV [13]	40960	0.552	35.9	71.3	36.2	25.0
Deep Supervised	NetVLAD [15]	4060	0.371	56.4	82.5	64.4	52.2
	SatResNet [13]	2048	0.207	74.2	92.1	80.9	68.0
Deep Unsupervised	DAE CG	32768	0.06	96.6	100	94.3	52.0
	DAE CG PCA	1063	0.473	17.9	65.0	52.1	37.2
	DAE FG 1D	**804**	0.495	17.1	54.2	51.2	30.4
	DAE FG 2D	1280	0.5	17.6	60.8	50.7	29.9

Table:2 Comparative evaluation of our proposed approach on SatScene dataset

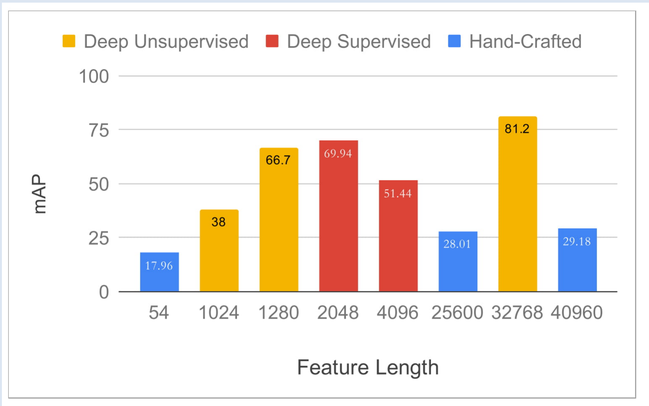


Fig.1 Quantitative Evaluation: Comparison between mAP scores of various methods for LandUse dataset.

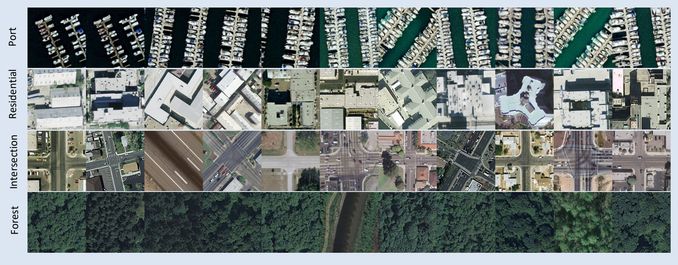


Fig.2 Qualitative Evaluation: Left most is query image and the remaining are top retrieved images.

[1] Tharani, Mohbat, Numan Khurshid, and Murtaza Taj. "Unsupervised Deep Features for Remote Sensing Image Matching via Discriminator Network." arXiv preprint arXiv:1810.06470 (2018).

Additional info.: http://cvlab.lums.edu.pk/iciap2019