A Deep Cascade Network for Unaligned Face Attribute Classification

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Introduction

Face Attribute Classification

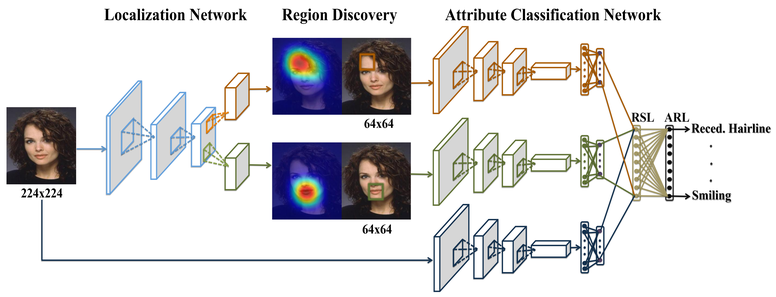
- Predict different face properties
- Useful for face verification

Limitations

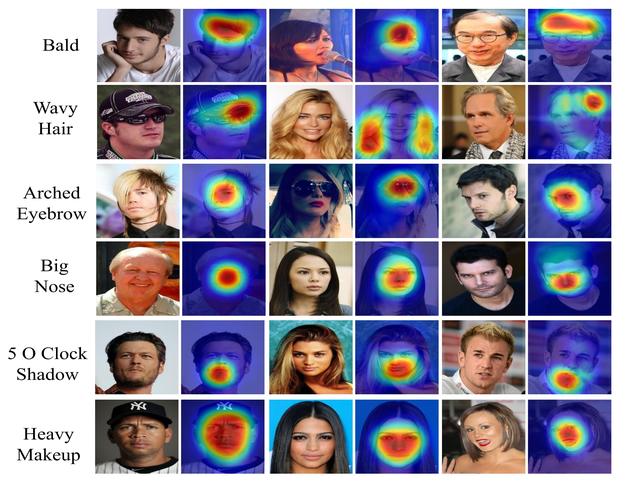
- Depends heavily on face alignment
- Doesn't consider the spatial relationship

Proposed Model

- The localization network is responsible to detect the attribute relevant face regions. It is trained in a weakly-supervised manner with attributes labels.
- The classification network is consisted of one global and several parts subnets.

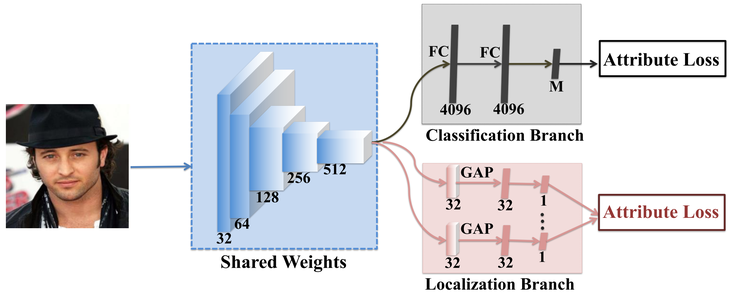


Face Region Localization Results

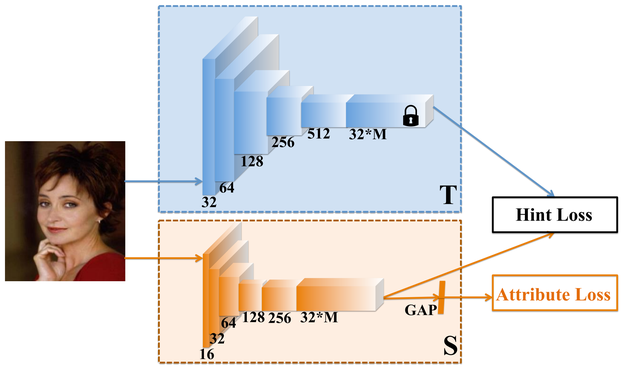


Approaches

Multi-Net Learning

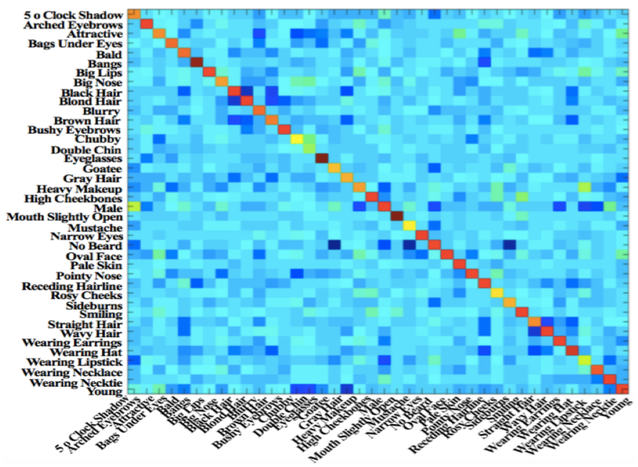


Hint-based Model Compression



Visualization

Attribute Correlation Visualization



Experiments

Multi-Net Learning Results

Table 1: Average classification accuracy on uCelebA dataset.

Methods	Classif. Branch	Loc. Branch
Without MNL	-	91.01
MNL	91.05	**91.07**

Table 2: Fine-grained classification accuracy on CUB-200 dataset.

Methods	Classif. Branch	Loc. Branch
Without MNL on full image	-	67.40
MNL on full image	72.10	**71.66**
Without MNL on crop	-	71.90
MNL on crop	75.76	**76.03**

Hint-based Model Compression Results

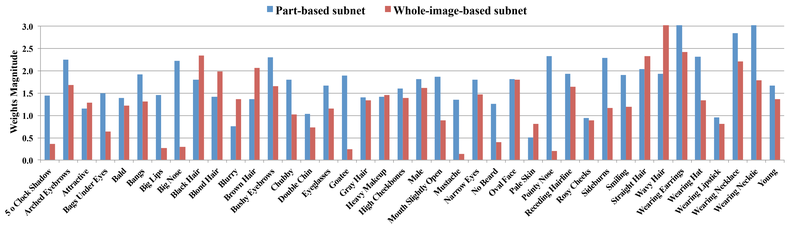
Table 3: Comparison of average accuracy and compactness between different compressed models on uCelebA dataset.

Layer	TNet	SNet1	SNet2	SNet3
Conv1	3x3x32(2)	3x3x32	3x3x32	3x3x16
Pool1	2x2x32	2x2x32	2x2x32	2x2x16
Conv2	3x3x64(2)	3x3x64	3x3x64	3x3x32
Pool2	2x2x64	2x2x64	2x2x64	2x2x32
Conv3	3x3x128(3)	3x3x128	3x3x128	3x3x64
Pool3	2x2x128	2x2x128	2x2x128	2x2x64
Conv4	3x3x256(3)	3x3x256	3x3x256	3x3x128
Pool4	2x2x256	2x2x256	2x2x256	2x2x128
Conv5	3x3x512(3)	3x3x512	3x3x512	1x1x1280
Conv6	3x3x1280	3x3x1280	1x1x1280	n/a
Classifier	GAP FC40	GAP FC40	GAP FC40	GAP FC40
Accuracy	91.07	91.02	90.89	90.60
Param.	19M	6M	2M	0.27M

Table 4: Comparison of average accuracy and compactness on the aligned CelebA dataset.

Method	Accuracy	Param.
SOMP (Lu et al. 2017)-thin-32	89.96	0.22M
SOMP (Lu et al. 2017)-branch-32	90.74	1.49M
Low Rank (Denton et al. 2014)	90.88	4.52M
SNet3	**90.89**	**0.27M**

Region Selection Layer Visualization



Classification Results on Unaligned CelebA

		5 o Clock Shadow	Arched Eyebrows	Attractive	Bags Under Eyes	Bald	Bangs	Big Lips	Big Nose	Black Hair	Blond Hair	Blurry	Brown Hair	Bushy Eyebrows	Chubby	Double Chin	Eyeglasses	Goatee	Gray Hair	Heavy Makeup	High Cheekbones	Male
uCelebA	LNets+ANet [25]	91.00	79.00	81.00	79.00	98.00	95.00	68.00	78.00	88.00	95.00	84.00	80.00	90.00	91.00	92.00	99.00	95.00	97.00	90.00	87.00	98.00
	Part-only	93.90	81.86	81.88	84.07	98.72	95.71	70.63	83.48	87.97	95.16	95.83	87.53	91.73	95.05	95.92	99.46	97.19	97.93	90.26	86.20	96.65
	Whole-only	93.95	81.43	82.06	84.11	98.57	95.45	70.66	82.91	89.08	95.52	96.01	88.63	92.32	95.12	95.98	99.40	96.90	98.07	90.67	86.57	97.10
	PaW	**94.64**	**83.01**	**82.86**	**84.58**	**98.93**	**95.93**	**71.46**	**83.63**	**89.84**	**95.85**	**96.11**	**88.50**	**92.62**	**95.46**	**96.26**	**99.59**	**97.38**	**98.21**	**91.53**	**87.44**	**98.39**

		Mouth Slightly Open	Mustache	Narrow Eyes	No Beard	Oval Face	Pale Skin	Pointy Nose	Receding Hairline	Rosy Cheeks	Sideburns	Smiling	Straight Hair	Wavy Hair	Wearing Earrings	Wearing Hat	Wearing Lipstick	Wearing Necklace	Wearing Necktie	Young	Average
uCelebA	LNets+ANet [25]	92.00	95.00	81.00	95.00	66.00	91.00	72.00	89.00	90.00	96.00	92.00	73.00	80.00	82.00	99.00	93.00	71.00	93.00	87.00	87.30
	Part-only	93.55	96.63	86.96	95.71	73.03	96.86	76.40	92.87	94.77	97.63	91.98	82.53	81.29	89.07	98.75	92.96	87.13	96.69	86.51	90.46
	Whole-only	93.24	96.59	87.19	95.40	74.48	96.85	76.06	92.95	94.83	97.50	91.61	82.18	82.63	89.13	98.50	93.58	87.14	96.77	87.14	90.60
	PaW	**94.05**	**96.90**	**87.56**	**96.22**	**75.03**	**97.08**	**77.35**	**93.44**	**95.07**	**97.64**	**92.73**	**83.52**	**84.07**	**89.93**	**99.02**	**94.24**	**87.70**	**96.85**	**88.59**	**91.23**

Acknowledgement

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