A Domain-based Approach to Social Relation Recognition

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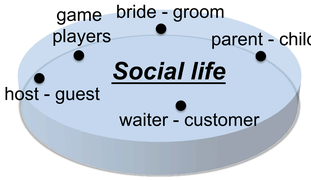
Motivations

- Understand social relations in daily life photos
- Provide coverage of all social life

In related works:
Ramanathan et al. CVPR13 "*Social role discovery in human events*."
Shu et al. CVPR15 "*Joint Inference of Groups, Events and Human Roles in Aerial Videos*"



In our work:

Attachment: Proximity maintenance during late infancy with specific others in the service of safety

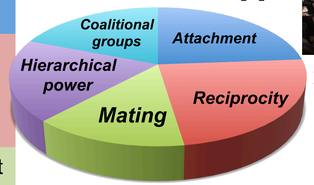
Reciprocity: Maximize joint outcomes for functional equal, require a long-term accounting of the relative benefits and costs

Mating: Select & maintain & protect access to the sexual mate

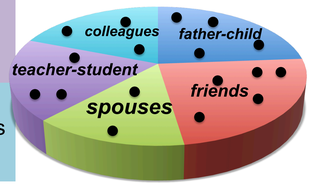
Hierarchical power: Between individuals with unequal control, resources or resource-holding

Coalitional groups: Identification and defense of the lines that divides "us" and "them" in group coalitions

Social domain level [1]



Social relation level



Contributions

- The first domain-based approach that partitions human social life
  5 social relations [1] → *16 social relations*
- The first daily life photo dataset with the hierarchical labeling of social domains and relations
  26,915 person pairs on PIPA dataset [2]
- Semantic attribute models of person appearance and behavior for the interpretable recognition of social domains and relations
  5 head attribute models + 5 body attribute models

5 social domains → 16 social relations

Attachment (d0)

father – child (r0) | mother – child (r1) | grandpa - grandchild (r2) | grandma - grandchild (r3)

Reciprocity (d1)

friends (r4) | siblings (r5) | classmates (r6)

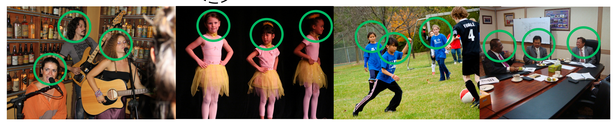
Mating (d2)

lovers / spouses (r7)

Hierarchical power (d3)

presenter – audience (r8) | teacher – student (r9) | trainer – trainee (r10) | leader – subordinate (r11)

Coalitional groups (d4)



band members (r12) | dance team members (r13) | sport team members (r14) | colleagues (r15)

Semantic attribute models

Revisit domain definitions:

e.g. Attachment domain characterized by proximity maintenance within a protective relationship, e.g. kinship between parents and children. Human attributes such as age difference, proximity and the activity of seeking protection are social cues which can be visually recognizable.

Attributes: age, proximity, activity

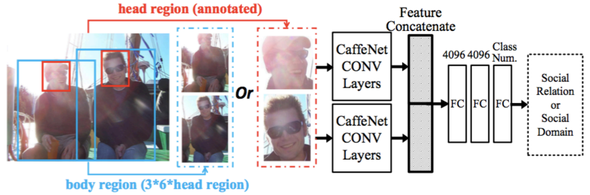
	SEMANTIC ATTRIBUTES	*(DATASET)*
Age	6 classes: senior, young, …	(PIPA, head regions)
Gender	2 classes: female, male	(PIPA, head regions)
Appearance	32 classes: arched eyebrows, …(CelebA Face)	
Pose	5 classes: frontal, left, right, …	(IMFDB)
Emotion	7 classes: anger, happiness, …	(IMFDB)
Age	6 classes: senior, young, …	(PIPA, body regions)
Gender	2 classes: female, male	(PIPA, body regions)
Clothing	8 classes: has t-shirt, has shorts, …(Berkeley P.A.)	
Proximity (pairwise)	7 classes: hold from behind, …	(Immediacy)
Activity	504 classes: adjusting, smiling, …	(ImSitu.)

Build semantic attribute models:
- Feature extraction from 10 attribute models
- Feature concatenation (add location & scale)
- Classifier training, e.g. linear SVM

Advantages:
- Semantic attributes lend themselves for the model interpretability.
- Bridge the gap between social psychology theory and computational models.
- Allow to leverage other large-scale datasets annotated with such attributes.

Baseline vs. Semantic attribute models

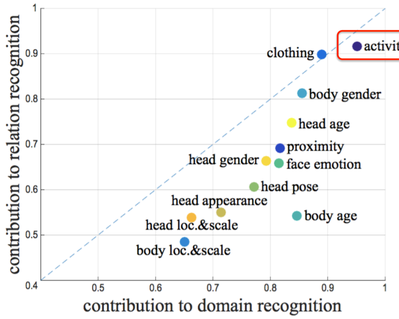
Baseline end-to-end recognition model



Accuracies of social relation recognition, social domain recognition, social domain generalization testing

MODEL	RELATION	DOMAIN	GENERALIZATION
END-TO-END SCRATCH	34.4%	41.9%	–
END-TO-END FINETUNED	46.2%	59.0%	18.5%
PRE-TRAINED, SVM	35.9%	53.3%	27.7%
FINETUNED, SVM	48.6%	63.2%	27.1%
HEAD ATTRIBUTES, SVM	44.8%	59.4%	21.5%
BODY ATTRIBUTES, SVM	57.2%	67.7%	32.8%
ALL ATTRIBUTES, SVM	57.2%	67.8%	33.3%

Go into semantic attributes



top activities

father – child (r0)
- grinning
- giggling
- carrying
- admiring
- hugging

band members (r12)
- singing
- whirling
- dancing
- performing
- twirling

[1] Bugental, D.B.: Acquisition of the Algorithms of Social Life: A Domain-Based Approach. Psychological Bulletin,2000.
[2] Zhang, N., Paluri, M., Taigman, Y., Fergus, R. and Bourdev, L.: Beyond frontal faces: Improving person recognition using multiple cues. CVPR 2015.

code & data