

Deep Multi Class-wise Clothing Attributes Recognition for the Elderly Care Robot Environment

RO-MAN 2020 Workshop on Social HRI of Human Care Service Robots

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What we do?

We develop robot care services where robots interact with the elderly in a home. This study is focusing appearance recognition of the elderly. Clothes are important factors in judging appearance status of them with living context.

- clothes and accessories reflect various values as culture, age, social status, lifestyle, and gender.
- daily care monitoring : What kind of clothes , change of clothes over the season, weather condition, fashion style, outing, etc

➡ The robot needs to know what kinds of clothes and various detailed attributes of clothes.



Multi-attribute based clothing classification?

Classification



Person

Classification + Localization



Person

Object Detection



Person, Person

Object Detection + Multi-attributes classification



Person: brown long autumn shirt, black long pants

Person: white hat, white long autumn jumper, black long pants, long stick

Predicts various sub-attributes of clothes worn by a person as well as clothing types

Clothing Dataset for this study

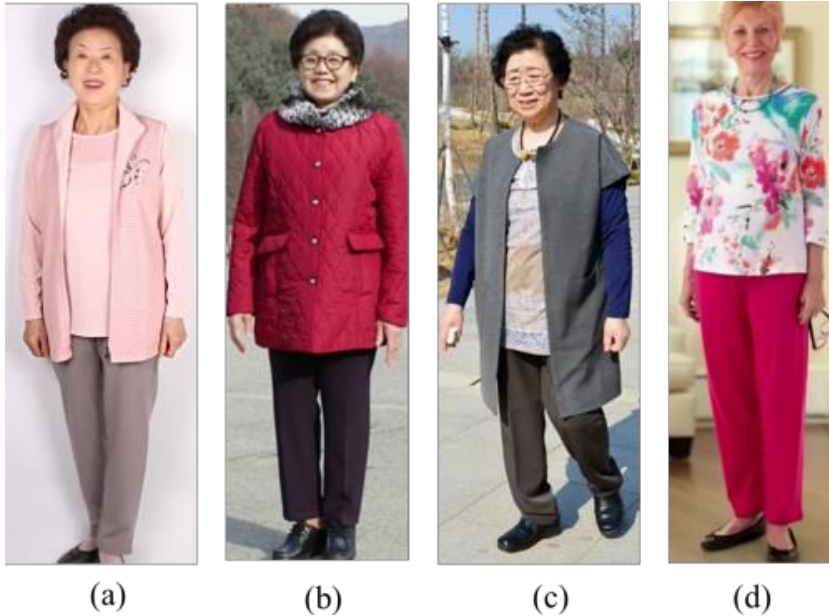


Image Gathering:

- photos from TV dramas and contents where many elderly people appeared
- photos of elderly models were gathered from the elderly clothes stores

TABLE I. 13 MULTI-ATTRIBUTES DEFINITION OF TOPS & BOTTOMS CLOTHING

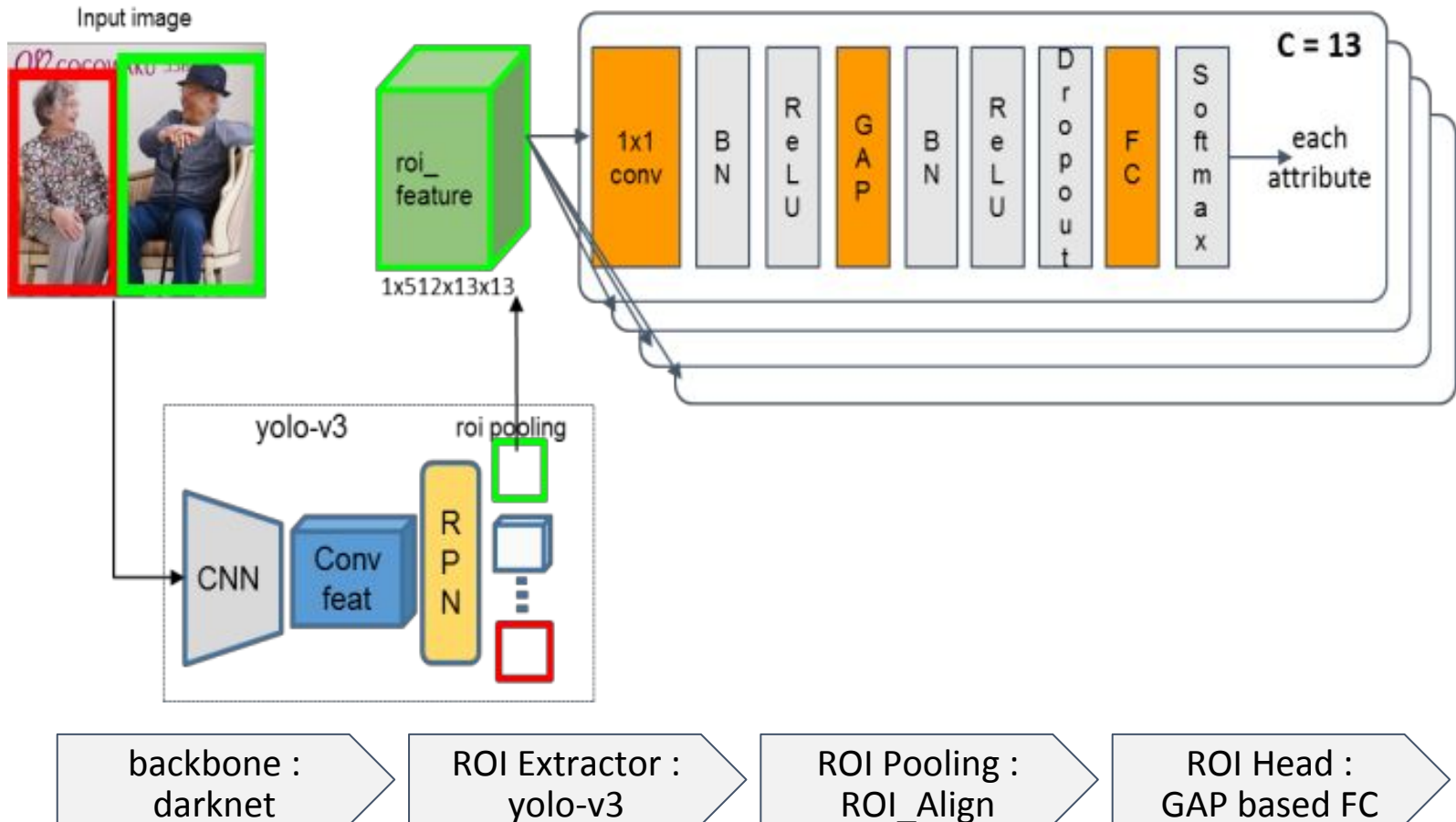
Attributes	Values
color_t ¹	white, black, gray, pink, red, green, blue, brown, navy, beige, yellow, purple, orange, mixed color
pattern_t	no_pattern, checker, dotted, floral, striped, custom pattern
gender_t	man, woman
season_t	spring, summer, autumn, winter
class_t	shirt, jumper, jacket, vest, parka, coat, dress
sleeves_t	short sleeves, long sleeves, no sleeves
color_b ²	white, black, gray, pink, red, green, blue, brown, navy, beige, yellow, purple, orange, mixed color
pattern_b	no_pattern, checker, dotted, floral, striped, custom pattern
gender_b	man, woman
season_b	spring, summer, autumn, winter
class_b	pants, skirt
sleeves_b	short, long
Leg_pose	standing, sitting, lying

1. _t: tops attribute, 2. _b: bottoms attribute

Ground Truth definition :

2 clothing type classes and 11 sub-attribute classes is combined to 13 multi-attributes definition

Clothing multi-attributes classification model



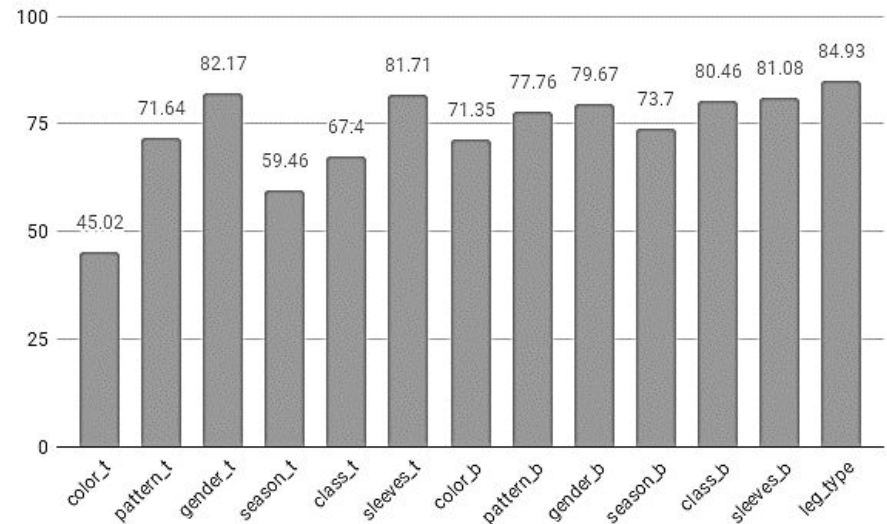
Experiment results : Evaluation

Evaluation Test 1 : typical class classification

- Evaluation metric : each attribute mA (average of Accuracy)

- dataset : 40,000 human instances

- training : 60%, validation 10%, test 30%



Evaluation Test 2 : Caption generation

- Evaluation metric : BLEU, METEOR, ROUGE_L

- generate caption to combine 13 attributes sequentially and compare GT caption with it

(ex: Pink floral woman shirt with long sleeves and beige woman summer pants)



	BLEU_1	BLEU_2	BLEU_3	BLEU_4	METEOR	ROUGE_L
Caption (LSTM)	61.4	50.4	40.4	33.2	35	64.4
ours	67.2	57.2	45.5	34.2	45.2	69.1

Experiment results : Test examples



Detected person ROI



Top-bottom clothes prediction results
by each attribute within the ROI