Person Search in a Scene by Jointly Modeling People Commonness and Person Uniqueness

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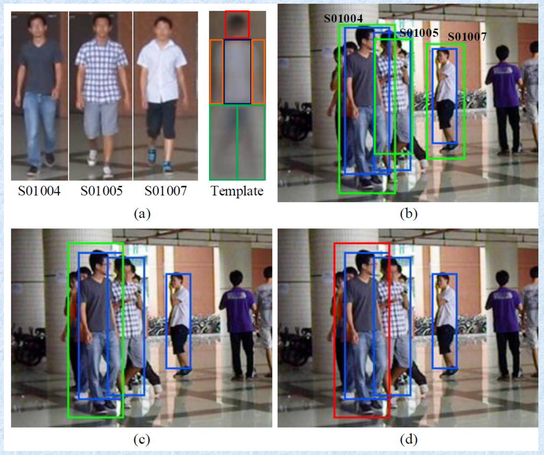
Motivation



Person search: Searching a specific person in a scene using body appearance

	Pros	Cons
Face	accurate	often not visible
Body	mostly visible	large variations; partial occlusions

Related work: People detection/tracking + person re-identification (usually sequential)

Problems:

- Person re-id relies heavily on the preceding people detection results;
- Person search is essentially a *verification* problem while many person re-id algorithms follow a *classification* framework

Proposal

Philosophy:

- People detection algorithms use the most common features, *commonness*, shared by all human bodies to distinguish them from other objects;
- Person re-id algorithms need the most distinctive features, *uniqueness*, that are unique to a certain person to discriminate him/her against other people.

Solution: Jointly solving detection and identification

Given a query image Iq and a scene Is, we want to find the possible location L of the queried person, by verifying every sliding window, using an additional set of images of people, T. The *joint* MAP problem is:

$$P(L \mid Iq, Is, T) \propto P(L \mid Is, T)\, \mathrm{P}(L \mid Iq, Is)$$
$$\propto exp(-D_{com}(L, Is, T)) \cdot exp(-D_{uniq}(L, Iq, Is))$$

GMM Encoded Commonness:

$D_{com}(.)$ measures the deviation of the contents in the current sliding window from the common people appearance, modeled by a GMM trained from T

Fisher Vector Encoded Uniqueness:

$D_{uniq}(.)$ measures the distance between the query and the current window, in terms of the unique appearances, modeled by Fisher vectors

Experiments

Datasets:

Dataset	ID #	Query #	Scene #	Target #	Scene Res.
CAMPUS	74	370	214	1519	640×360
EPFL	30	70	80	294	360×288

Results:

Method	CAMPUS			EPFL
	All	S1	S2	
Our Full	16.28%	19.96%	27.55%	30.15%
Our Uniq	13.59%	17.65%	24.47%	27.87%
Detect+ID Jnt	12.15%	16.54%	24.12%	29.72%
Detect+ID Seq	11.51%	15.82%	23.96%	29.54%