Re-identifying people across multiple cameras

Saurav Sthapit, Prof. John Thompson, Dr. James R. Hopgood, Dr. Neil M. Robertson (HWU)

Introduction

Person re-identification refers to **associating people across camera views** at different locations and times. It can have huge impact on surveillance and security because doing it manually is not only **tedious and costly** but most often too late. Re-identifying people on a distributed system has numerous benefits such as:

- Multi-Camera Target tracking.
- Widening the search for targets and identifying them.
- Cameras can be deployed and scaled up in number easily.
- In a military context, cameras can be embedded within soldier's uniform to monitor targets without raising suspicion.

Camera 1

Camera 2

Flowchart

Person re-identification generally starts with person detection from one or more images in each camera. Each image is then subject to feature extraction and signature generation. Features are extracted from overlapping patches of an image and consist of **colour histogram**, **textures**, and **shape descriptors**. These signatures are compared with each other to find if the images belong to the same person or not.

Figure 2: General person re-identification workflow

Challenges

Different people may appear similar and the same person may look different in different views.

- Non Overlapping views
- Occlusion
- Colour constancy
- Network
- Pose
- Limited Computational Capability
- Limited Energy

Figure 1: Time and energy taken to send data over the network

Simulation Results

Results show that Saliency has superior results in Rank 1 which is desirable, comparably much more expensive than KISSME. SDALF has shortest feature length before dimensionality reduction. KISSME looks better solution for distributed system but has to be trained.

Algorithm	Feature Length (After PCA)	Time (Sec)	Rank-1 Score
SDALF	5359	11981	19.1
KISSME	22154/(34)	260.05	18.03
Unsupervised Saliency	201600	11737.9	27.22

Table 1: Comparison of the algorithms

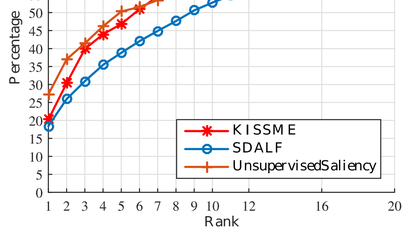
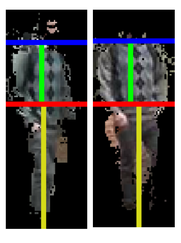


Figure 3: Performance of the algorithms

Person Re-idenification Methods

- Symmetry-Driven Accumulation of Local Features (SDALF)
  - Unsupervised method
  - Uses Colour Histograms, Maximally Stable Colour Region (MSCR) and Textures



- Keep It Simple and Straightforward MEtric (KISSME)

Supervised method

Uses Colour Histograms and Textures

- Unsupervised Saliency Matching
  - Uses Colour Histograms and Scale Invariant Feature Transform (SIFT) features.
  - Compares visual similarity and salience scores.

Future Directions

Our goal is to develop a reliable distributed algorithm capable of running on existing distributed systems such as a network of smartphone devices. Our next step is to build a **simulator** to simulate the **computation** and **communication** between sensors and see the time and energy consumption. It will allow us to test different strategies based on our priorities such as minimizing the **delay** or maximising the **network lifetime** etc. This will help us in developing algorithms which can coordinate with neighbours better.

Contact Information

Saurav Sthapit

s.sthapit@ed.ac.uk

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