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Person ReID in Different Environment Settings Using Deep Learning Methods

by

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Certificate of Original Authorship

I, Ziyue Zhang declare that this thesis, is submitted in fulfilment of the requirements for the award of Doctor of Philosophy, in the Faculty of Engineering and IT at the University of Technology Sydney.

This thesis is wholly my own work unless otherwise referenced or acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis.

This document has not been submitted for qualifications at any other academic institution.

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ABSTRACT

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Person Re-identification (Person ReID) is an essential research area in vision-based human image retrieval. It is a technology where the system can automatically identify the same person appearing in different camera views. Most existing works in this area focus on settings where the environment is either kept the same or has tiny fluctuation. However, it is well-known that no matter how small, the degree of environment changes may affect the robustness of a ReID algorithm significantly. Many real-world applications are required to detect the same person at a drastically different place and time, making large environment changes an unavoidable yet under-addressed problem.

Hence, we want to address the problem where environment settings are different, such as illuminations, resolutions, modalities and clothing. Specifically, this thesis proposes a series of methods for environment change person ReID, summarized as follows:

1. We proposed a Two-Stream Model which can solve the illumination adaptive person ReID problem. It can separate ReID features from lighting features to enhance ReID performance. We construct two augmented datasets by synthetically changing a set of predefined lighting conditions in two of the most popular ReID benchmarks: Market1501 and DukeMTMC-ReID. Experiments demonstrate that our algorithm outperforms other state-of-the-art works and is particularly potent in handling images under extremely low light.

2. We proposed a Teacher-Student GAN model to solve the cross-modality person ReID problem. It adopts different domains and guides the ReID backbone. Unlike other GAN-based models, the proposed model only needs the backbone module at the test stage, making it more efficient and resource-saving. To showcase our model's capability, we did extensive experiments on the newly-released SYSU-MM01 and RegDB ReID benchmark and achieved superior performance to the state-of-the-art methods.

3. We propose a novel two-stream network that can solve the cross-resolution person ReID problem. It contains a lightweight resolution association ReID feature transformation (RAFT) module and a self-weighted attention (SWA) ReID module to evaluate features under different resolutions. Comprehensive experiments on five benchmarks show the validity of our method.

4. We design a novel unsupervised model, Syn-Person-Cluster ReID, to solve the unlabeled clothing change person ReID problem. We develop a purely unsupervised pipeline equipped with synthetic augmentation on person images and feature restriction for the same person. Extensive experiments on clothing change ReID datasets show the out-performance of our methods.

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List of Publications

Journal Papers

J-1. **Zhang Z.**, Jiang S., Huang C., Li Y., Xu R. Y. D. (2021). RGB-IR cross-modality person ReID based on teacher-student GAN model, Pattern Recognition Letters, 150, 155-161.

J-2. **Zhang Z.**, Jiang S., Huang C., Xu R. Y. D., Unsupervised clothing change adaptive person ReID, IEEE Signal Processing Letters

Conference Papers

C-1. **Zhang Z.**, Xu, R. Y. D., Jiang S., **Li Y.**, Huang C., Deng C., Illumination Adaptive Person ReID based on Teacher-Student Model and Adversarial Training, accepted by ICIP, 2020.

C-2. **Zhang Z.**, Jiang S., Huang C., Xu R. Y. D., Resolution-Invariant Person Reid Based On Feature Transformation And Self-Weighted Attention, 2021 IEEE International Conference on Image Processing (ICIP), 2021.

C-3. Huang C., Jiang S., Li Y., **Zhang Z.**, Traish J., Deng C., Ferguson S., Xu R. Y. D., End-to-end Dynamic Matching Network for Multi-view Multi-person 3d Pose Estimation, accepted by ECCV, 2020.

C-4. Li Y., Li K., Jiang S., **Zhang Z.**, Huang C., Xu R. Y. D., Geometry-driven self-supervised method for 3D human pose estimation, In Proceedings of the AAAI Conference on Artificial Intelligence 2020.

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