

DeepFace: Deep Learning Model based Criminal Identifications System for Law Enforcement Department

Abstract

Criminal record generally contains all the information both personal and criminal with the photograph of the person. In order to recognize Criminal, identification of some sort is required, designated by eyewitnesses. In most cases the resolution or/and quality of the recorded image sections is unsatisfactory and is difficult to recognize the face. Recognition can be achieved in various different ways like DNA, eyes, finger print, etc. One of the ways is face identification. Since facial recognition technology is powered by artificial intelligence, it can provide excellent results in identifying criminals. Even considering that most people, when committing an illicit activity, try to hide their identity: hiding their faces or covering their faces with scarves, masks, etc. In such cases, AI uses deep learning methods to identify the individual. In this project, proposed an DeepFace an automatic criminal identification system for Police Department to enhance and upgrade the criminal distinguishing into a more effective and efficient approach using Convolutional neural network algorithms. In our proposed methodology, a database is created by storing both full and sliced images of the criminals along with all the personal and criminal details. The captured images of the person get compared with the criminal data Law Enforcement Agencies have in their database. The CNN involves mapping the face with some facial points, allowing the true identity of the individual to be revealed. Using technology, this idea will add plus point in the current system while bringing criminals spotting to a whole new level by automating tasks. Law enforcement receive alerts when an individual claimed by the authorities is identified by our technology, speeding up their arrest and preventing new crimes. Customize notifications and alarms based on a variety of detection or recognition events and program automated security response workflows and SMS and email notifications.

Software specification

Server Side : Python 3.7.4(64-bit) or (32-bit)

Client Side : HTML, CSS, Bootstrap

IDE : Flask 1.1.1

Back end : MySQL 5.

Server : Wampserver 2i

DL DLL : TensorFlow, Pandas, SiKit Learn

1. Graph-Based Local Feature Adaptation for Cross-Domain Person Re-Identification

Author: Jun Wang

Year:2022

Doi: 10.1109/ACCESS.2022.3140311

Problems Identified

The performance of cross-domain person re-identification has been greatly improved in recent years. However, there are still two problems in existing cross-domain person re-identification methods. First, most of them conduct domain adaptation on features that contain background noise. Second, they ignore the correlation between different features, including intra-domain and inter-domain.

Paper Objective

To overcome these problems, we propose a novel Graph-based Local Feature Adaptation (GLFA) framework for cross-domain person re-identification, which promotes domain adaptation by correlating intra-domain and inter-domain semantic local features with graph convolutional network.

Methodology

The author proposes a novel GLFA framework for unsupervised domain adaptive person re-identification, which conducts adaptation on semantic local features. Compared with previous methods, the features learned by our framework are more fine-grained and domain invariant. Then construct two graphs to correlate semantic local features within each domain and across different domains, respectively. And two stacked GCNs are built to propagate local feature information through these two graphs, thereby facilitating the knowledge transfer from source to target domain. To our best knowledge, this is the first work that applies GCN to unsupervised domain adaptive person re-identification. Then design a local feature distribution alignment loss based on Maximum Mean Discrepancy (MMD) distance. It enables the corresponding local feature distributions between two domains are well aligned.

Findings

Experimental results on six cross-domain pairs prove the superiority of our method. However, the

training of our model is slightly complex, which may affect the generalization of our method in other fields. Furthermore, our work utilizes the parsing model to extract semantic local features, which may not be feasible in other person re-identification scenarios due to the lack of corresponding parsing models, such as Visible-Infrared Person Re-Identification (VI-ReID).

2. Gait Recognition and Re-Identification Based on Regional LSTM for 2-Second Walks.

Author: Piya Limcharoen; Nirattaya Khamsemanan

Year:2021

Doi: 10.1109/ACCESS.2021.3102936

Problems Identified

Law enforcement and different authorities need a new efficient way to track and re-identify a person of interest via different cameras. Usually, the person of interest is not known and the original video may be short and have poor quality.

Paper Objective

In this paper, the author proposes a new technique based on a new regional-LSTM learning model that can use a 2-second walk to recognize and re-identify an unknown person.

Methodology

In this work, we propose a new gait recognition and re-identification technique that is unsupervised, resists the view-point issue, and only requires a 2-second walk input. We propose a new unsupervised gait recognition technique based on a new learning model, called the regional-LSTM learning model. The regional-LSTM learning model is a representation function that maps gait features into an embedded space so that the similarity of intra-class is small and the similarity of inter-class is large. The proposed technique focuses on sequential movements of each region of the body by creating an LSTM model for each region. It then combines the outputs from all regions to create a gait-embedded vector for an entire body. By doing these different regions are assigned

different weights to reflect different degrees of uniqueness in the regions. An output of the regional-LSTM learning model is an embedded vector in Euclidean space.

Findings

This demonstrates that the proposed regional LSTM model is efficient and useful in tracking and re-identifying a person of interest. This implies that the proposed regional LSTM technique is suitable for assisting authorities in tracking and re-identifying a person of interest, especially the identity of an unknown.

3. Multi-Stream Refining Network for Person Re-Identification

Author: Xu Wang; Yan Huang

Year:2021

Doi: 10.1109/ACCESS.2020.3048119

Problems Identified

Viewpoint change, pose variation and background clutter have adverse impacts on similarity evaluation for person re-identification. Because of its distinction and reliability, person saliency has been applied to model person appearance characteristics. However, such valuable information is not fully exploited to compute similarities of person images with existing deep methods.

Paper Objective

To this end, the author presents a novel multi-stream refining based deep multi-task learning scheme that aggregates multi-stage salient embedding features in the network to boost the retrieval performance.

Methodology

The author designs a multi-stream refining model to gradually enhance the focus on salient channels from multiple stages and fully exploit their available discriminant information in deep feature space. A hierarchical multi-task learning framework is proposed to learn more discriminant

features from a multi-stream structure, which can systematically integrate the advantages of multiple loss tasks by sharing the information of lower stage subnets step by step.

Findings

Extensive experiments on three public datasets validate the state-of-the-art performance of the proposed MRNet and ablation studies illustrate the effectiveness of our proposed method. However, the proposed MRNet is time consuming due to deep architecture. Besides, the proposed method is just a stage of person Re-ID system since the pedestrian images are given. As a result, when facing real-world data, the proposed model may become vulnerable. Therefore, a network with pruning strategies for pedestrian detection and person Re-ID will be explored for future work. In fact, existing person Re-ID datasets are built-in ideal condition.

4. Adversarial Erasing Attention for Person Re-Identification in Camera Networks Under Complex Environments

Author: Shuang Liu; Xiaolong Hao

Year:2020

Doi: 10.1109/ACCESS.2020.3048119

Problems Identified

Person re-identification (Re-ID) in camera networks under complex environments has achieved promising performance using deep feature representations. However, most approaches usually ignore to learn features from non-salient parts of pedestrian, which results in an incomplete pedestrian representation.

Paper Objective

In this paper, we propose a novel person Re-ID method named Adversarial Erasing Attention (AEA) to mine discriminative completed features using an adversarial way.

Methodology

Specifically, the proposed AEA consists of the basic network and the complementary network. On the one hand, original pedestrian images are used to train the basic network in order to extract global and local deep features. On the other hand, to learn features complementary to the basic network, we propose the adversarial erasing operation, that locates non-salient areas with the help of attention map, to generate erased pedestrian images. Then, we utilize them to train the complementary network and adopt the dynamic strategy to match the dynamic status of AEA in the learning process. Hence, the diversity of training samples is enriched and the complementary network could discover new clues when learning deep features. Finally, we combine the features learned from the basic and complementary networks to represent the pedestrian image.

Findings

In order to generate effective erased pedestrian images, presented the adversarial erasing operation to locate salient areas on the attention map, and adopted the dynamic strategy to match the dynamic status of AEA. Because of the diversity of training samples, i.e., original and erased pedestrian images, the generalization ability of AEA is improved.

5. A Novel Method for Person Re-Identification: Conditional Translated Network Based on GANs

Author: Rui Sun; Weiming Lu

Year:2020

Doi: 10.1109/ACCESS.2019.2962301

Problems Identified

The main challenge of person re-identification (re-id) lies in the strikingly discrepancy between different camera views, including illumination, background and human pose. Existing person re-id methods rely mostly on implicit solutions, such as seeking robust features or designing discriminative distance metrics. Compared to these methods, human solutions are more straightforward. That is, imagine the appearance of the target person under different camera views before matching target person. The key idea is that human can intuitively implement viewpoint

transfer, noting the association of the target person under different camera views but the machine failed.

Paper Objective

In this paper, we attempt to imitate such human behavior that transfer person image to certain camera views before matching. In practice, we propose a conditional transfer network (cTransNet) that conditionally implement viewpoint transfer, which transfers image to the viewpoint with the biggest domain gap through a variant of Generative Adversarial Networks (GANs).

Methodology

In this paper, we resort to imitating such human behavior to improve the performance of person re-id. During implementation, we split the entire workflow into two stages. In the first stage, we propose a modified StarGAN to learn the style for each camera view, then we measure the domain gap for the style of each camera viewpoint, finally we translate the image to the camera viewpoint with the largest domain gap. In the second stage, we fuse the feature of translated image with original feature. After that, we perform similarity matching based on the cosine distance.

Findings

In addition, cTransNet can be implemented in other important person re-identification tasks, such as one view learning and domain adaptation. In the future work, we will improve the generality of our approach to deal with the increasing scale of cameras by multi-domain image-to-image translation methods, such as TraVeLGAN.