Person Re-identification with Spatial Multi-granularity Feature Exploration for Social Risk Situational Assessment

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Abstract: Recently, the “human-oriented” concept of security development has become a consensus among all countries. This depends mainly on intelligent surveillance systems that can support person re-identification (Re-ID) technology to empower social risk situational assessment applications. However, existing Re-ID methods mainly focus on single and fixed convolutional operations for feature extraction, ignoring the multi-dimensional spatial association of the human body, which limits the performance of Re-ID. Human cognition when identifying people does not solely rely on visual cues of the individual in sight, but also on his/her behavioral and gestural characteristics. To solve this issue and inspired by the aforementioned cognitive mechanism of the human brain, this study developed a spatial multi-granularity feature exploration (SMGFE) model for person Re-ID. The proposed SMGFE model comprises two main steps: (i) a multi-granularity feature exploration strategy and (ii) a human spatial association scheme. The former mainly includes coarse (original person images), medium (multi-regional divided person images), and fine-tuned (keypoints of the human body) level features, which form the multigranularity feature representation. An undirected graph model was then developed to construct multi-dimensional spatial relations for each person. Finally, the unified optimization strategy was applied to train the framework to achieve promising accuracy. We evaluated the proposed algorithm on frequently used and benchmark person Re-ID datasets (Market-1501 and DukeMTMC-reID). The cumulative match curve (CMC) and mean average precision (mAP), which are the common measuring criteria for most person Re-ID methods reported to date, were used to verify the experimental results. Experiments show that our proposed algorithm achieved unrivaled performance levels. In addition, based on the spatial multi-granularity feature exploration strategy, the time efficiency of the proposed method for detecting specific instances can reach O(n), making it suitable for deployment in low-resource terminals for security risk assessment, including

Android/iOS analysis servers, urban safety risk surveillance systems, and warning platforms for situational awareness.