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硕士学位论文

视频监控中人体及人群行为分析系统的设计与实现

The Design and Implementation of Human  
Activity and Crowd Behavior Analysis System  
in Video Surveillance

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## 摘要

近年来，视频监控系统广泛应用在人们日常生活的多个领域中，如企业与居家安防、刑侦、银行监控、医院和交通流量监控等。但是，现有的监控系统只是事后取证的手段，缺乏智能化的事件发现和报警。人体行为和人群行为监控是视频监控的核心，智能化行为判定能够为人们提供及时可靠的实时信息，对异常事件做出快速反应。因而，视频监控中人体人群行为分析具有重要的现实意义。本文主要完成视频监控中人体行为和人群行为的分析，主要工作如下：

(1) 人体行为主要针对于人体运动行为，运动行为获取运用了前景检测和目标跟踪算法。在深入研究了VIBE算法和帧间差分算法之后，本文提出了改进后的前景检测算法。在此基础上，使用直方图匹配优化的压缩感知跟踪算法，取得较好跟踪效果。最后，根据人体运动行为模型，完成人体运动行为判定。

(2) 人群行为分析主要针对人群密度估计和人群异常事件判定。本文提出了基于样本前景像素权重值的人群密度估计算法。通过样本视频进行前景像素权重值计算，结合SVM线性分类器完成密度估计。对人群异常事件判定，提出了基于网格粒子社会力和方向熵变化率的判定算法。通过光流场计算社会力和方向熵变化率，与样本变化率阈值进行比较，得到人群异常事件判定的结果。

(3) 依据本文提出的人体行为和人群行为的判定算法，完成了人体人群行为分析系统。在UMN和厦大视频数据库上进行了测试实验，实验表明本系统能够对针对性场景下的人体和人群行为进行分析并判定。为应对海量视频监控数据，提出了系统的云部署概念，并设计了相应的通信数据格式。

**关键词：**智能监控；人体行为分析；人群密度估计；人群异常判定

## Abstract

In recent years, video surveillance systems are used in the areas of people's daily life, such as enterprises and home security, criminal investigation, monitoring banks, hospitals and traffic monitoring. However, the existing monitoring system is only used to obtain evidence after the accident, lacking intelligent event detection and alarm. Human activity and crowd monitoring is the core of video surveillance, intelligent behavior determination can provide timely and reliable real-time information to make a quick response to abnormal events. Therefore, the analysis of human activity in video surveillance has important practical significance. We mainly complete the analysis of human activity and crowd behavior in video surveillance, the details as follows:

(1) Human activity is mainly aimed at the human body motion behavior, the main algorithms of the movement behavior is the foreground detection and target tracking. After deeply studying VIBE algorithm and inter frame difference algorithm, we propose an improved foreground detection algorithm. Based on this, using the histogram matching optimization of compressed sensing tracking algorithm to achieve better tracking results. Finally, the behavior model is used to determine the motion.

(2) Crowd behavior analysis aims at population density estimation and the determination of abnormal events. In our paper, we propose a population density estimation algorithm based on the foreground pixel weight value of the sample. The sample weight is calculated by sample video, and the density estimation is done using the SVM linear classifier. In our paper, we propose a decision algorithm based on the change rate of the social force and the direction entropy of the grid. By calculating the change rate of the social force and the direction of the optical flow field, compared with the sample rate threshold, the result of the abnormal event is obtained.

(3) Basing on the algorithms of human activity and human behavior, we develop the analysis system of human activity and crowd behavior. Experimental tests were carried out on the UMN and Xiamen video database. The experiments show that the system can analyze and determine human activity and abnormal crowd behavior in public place. In order to meet the demand of massive video data, the system's cloud deployment architecture is putting forward, the communication data format is designed at the same time.

**Keywords:** Intelligent monitoring Human activity analysis Crowd density estimation Abnormal event determination

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