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Winter 11-1-2022

Computer Vision based Analysis of Crowd Behavior for Efficient Video Surveillance in Public Places

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Recommended Citation

Pai, Abhilash K., "Computer Vision based Analysis of Crowd Behavior for Efficient Video Surveillance in Public Places" (2022). *Technical Collection*. 37.
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Details of Research Projects Undertaken by Dr. Abhilash K. Pai

Jul. 2015 – Jan. 2022 **Ph. D. Scholar (Computer Vision), Manipal Institute of Technology (MIT), Manipal Academy of Higher Education (MAHE), Manipal, India.**

Thesis title: **Motion Pattern Segmentation for Crowded Scene Analysis**

The primary aim of the research was to improve the efficiency of the mid-level crowded scene analysis technique known as motion pattern segmentation.

- *Project 1:* **Motion estimation in crowded scenes** [MATLAB]

The crowd motion estimation accuracy of the pixel-domain optical flow vectors, obtained by fully decoding the input video and explicitly performing motion estimation, were compared with the compressed-domain motion vectors, by partially decoding of the video to get the motion data) **[Experimental work in progress]**

- *Project 2:* **Compressed-Domain Motion Pattern Segmentation** **[**MATLAB]

Motion Vector Fields, representing the crowd motion patterns, were initially extracted from H.264/AVC coded input video bitstream. The refined motion vector fields were segmented using a graph-based integrated path-similarity approach, which captures both global and local traits of the crowd motion **[Dataset creation for final testing of the proposed framework under process].**

- *Project 3:* **Pixel-Domain Motion Pattern Segmentation** **[Code] [Paper link] [**MATLAB]

Trajectories, representing the crowd motion patterns, were initially computed from the input video using the KLT tracker. Spatial and angular information obtained from the trajectories was used as an input to an improvised density-based clustering algorithm to cluster the trajectories. **[Project completed, working on Future Work]**

Sep. 2015 - Feb. 2016 **Guest Scientist, Institute of Micro Electronic Systems, Leibniz Universität, Hannover, Germany.**

Project title: **Disparity map estimation based on extraction of image features** **[C++,** MATLAB]

Contributed to the ADAS-based project. Performed experiments using the SIFT, DAISY descriptor for the computation of dense disparity map from stereo images captured using a wide-baseline camera **[Project completed].**

Jan. 2021 - May. 2021 **Student Internship Project Mentor, Manipal Institute of Technology, Manipal Academy of Higher Education, Manipal, India.**

Project title: **Classification of Crowded Scenes based on Motion Patterns** **[Paper link]** [Python]

A novel and robust feature vector called as Histogram of Angular Deviations (obtained from the KLT trajectories) was proposed. Machine learning models such as SVM, Weighted k-Nearest Neighbours were used to build the crowd classification model. A novel crowd structuredness index was introduced. **[Project completed].**

Dec. 2016 - Jul. 2017 **Ph.D. Course Work Project, Manipal Institute of Technology, Manipal Academy of Higher Education, Manipal, India.**

Project title: **Crowd density estimation using texture features** **[Paper link] [**MATLAB]

A novel and robust feature vector called LBPG was proposed. LBPG was obtained by combining two texture features, namely Local Binary Pattern (Uniform) and Gabor Feature. The SVM-based machine learning technique was used to build a crowd density estimation model. **[Project completed].**

Oct. 2021 - Dec. 2021 **Collaborative Research Work with Department of Atomic and Molecular Physics, Manipal Academy of Higher Education, Manipal, India.**

Project 1: **Laser induced fluorescence of cervical tissues: An in-vitro study for the diagnosis of cervical cancer from cervicitis.** **[Paper link] [**MATLAB]

Contributed to the project by using various supervised machine learning techniques including SVM to classify the Fluorescence Spectroscopy-based signals (obtained from Tissue samples of the patients) as Malignant and Non-Malignant. **[Project completed].**

Project 2: **Raman spectroscopic study of tissue and blood plasma to differentiate malignant from cervicitis** **[Paper link] [**MATLAB]

Contributed to the project by using a Principal Component Analysis (PCA) based technique to reduce the feature dimensions of the input Raman Spectroscopic Signals. The PCA-reduced features were used to train an SVM based classifier to classify the Raman Spectra obtained from the Tissue and Plasma samples of various subjects as Malignant or Cervicitis. **[Project completed].**
