APPLICATION FOR UNITED STATES PATENT

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TITLE: VIDEO SURVEILLANCE SYSTEM EMPLOYING VIDEO PRIMITIVES

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VIDEO SURVEILLANCE SYSTEM EMPLOYING VIDEO PRIMITIVES

CROSS-REFERENCE TO RELATED APPLICATIONS

[1] This application claims the priority of U.S. Patent Application No. 09/694,712 filed October 24, 2000, which is incorporated herein by reference.

BACKGROUND OF THE INVENTION

Field of the Invention

[2] The invention relates to a system for automatic video surveillance employing video primitives.

References

[3] For the convenience of the reader, the references referred to herein are listed below. In the specification, the numerals within brackets refer to respective references. The listed references are incorporated herein by reference.

[4] The following references describe moving target detection:

[5] {1} A. Lipton, H. Fujiyoshi and R. S. Patil, "Moving Target Detection and Classification from Real-Time Video," Proceedings of IEEE WACV '98, Princeton, NJ, 1998, pp. 8-14.

[6] {2} W.E.L. Grimson, et al., "Using Adaptive Tracking to Classify and Monitor Activities in a Site", CVPR, pp. 22-29, June 1998.

[7] {3} A.J. Lipton, H. Fujiyoshi, R.S. Patil, "Moving Target Classification and Tracking from Real-time Video," IUW, pp. 129-136, 1998.

[8] {4} T.J. Olson and F.Z. Brill, "Moving Object Detection and Event Recognition Algorithm for Smart Cameras," IUW, pp. 159-175, May 1997.

[9] The following references describe detecting and tracking humans:

[10] {5} A. J. Lipton, "Local Application of Optical Flow to Analyse Rigid Versus Non-Rigid Motion," International Conference on Computer Vision, Corfu, Greece, September 1999.

[11] {6} F. Bartolini, V. Cappellini, and A. Mecocci, "Counting people getting in and out of a bus by real-time image-sequence processing," IVC, 12(1):36-41, January 1994.

[12] {7} M. Rossi and A. Bozzoli, "Tracking and counting moving people," ICIP94, pp. 212-216, 1994.

[13] {8} C.R. Wren, A. Azarbayejani, T. Darrell, and A. Pentland, "Pfinder: Real-time tracking of the human body," Vismod, 1995.

[14] {9} L. Khoudour, L. Duvieubourg, J.P. Deparis, "Real-Time Pedestrian Counting by Active Linear Cameras," JEI, 5(4):452-459, October 1996.

[15] {10} S. Ioffe, D.A. Forsyth, "Probabilistic Methods for Finding People," IJCV, 43(1):45-68, June 2001.

[16] {11} M. Isard and J. MacCormick, "BraMBLe: A Bayesian Multiple-Blob Tracker," ICCV, 2001.

[17] The following references describe blob analysis:

[18] {12} D.M. Gavrila, "The Visual Analysis of Human Movement: A Survey," CVIU, 73(1):82-98, January 1999.

[19] {13} Niels Haering and Niels da Vitoria Lobo, "Visual Event Detection," Video Computing Series, Editor Mubarak Shah, 2001.

[20] The following references describe blob analysis for trucks, cars, and people:

[21] {14} Collins, Lipton, Kanade, Fujiyoshi, Duggins, Tsin, Tolliver, Enomoto, and Hasegawa, "A System for Video Surveillance and Monitoring: VSAM Final Report," Technical Report CMU-RI-TR-00-12, Robotics Institute, Carnegie Mellon University, May 2000.

[22] {15} Lipton, Fujiyoshi, and Patil, "Moving Target Classification and Tracking from Real-time Video," 98 Darpa IUW, Nov. 20-23, 1998.

[23] The following reference describes analyzing a single-person blob and its contours:

[24] {16} C.R. Wren, A. Azarbayejani, T. Darrell, and A.P. Pentland. "Pfinder: Real-Time Tracking of the Human Body," PAMI, vol 19, pp. 780-784, 1997.

[25] The following reference describes internal motion of blobs, including any motion-based segmentation:

[26] {17} M. Allmen and C. Dyer, "Long--Range Spatiotemporal Motion Understanding Using Spatiotemporal Flow Curves," Proc. IEEE CVPR, Lahaina, Maui, Hawaii, pp. 303-309, 1991.

[27] {18} L. Wixson, "Detecting Salient Motion by Accumulating Directionally Consistent Flow", IEEE Trans. Pattern Anal. Mach. Intell., vol. 22, pp. 774-781, Aug, 2000.

Background of the Invention

[28] Video surveillance of public spaces has become extremely widespread and accepted by the general public. Unfortunately, conventional video surveillance systems produce such prodigious volumes of data that an intractable problem results in the analysis of video surveillance data.

[29] A need exists to reduce the amount of video surveillance data so analysis of the video surveillance data can be conducted.

[30] A need exists to filter video surveillance data to identify desired portions of the video surveillance data.

SUMMARY OF THE INVENTION

[31] An object of the invention is to reduce the amount of video surveillance data so analysis of the video surveillance data can be conducted.

[32] An object of the invention is to filter video surveillance data to identify desired portions of the video surveillance data.

[33] An object of the invention is to produce a real time alarm based on an automatic detection of an event from video surveillance data.

[34] An object of the invention is to integrate data from surveillance sensors other than video for improved searching capabilities.

[35] An object of the invention is to integrate data from surveillance sensors other than video for improved event detection capabilities

[36] The invention includes an article of manufacture, a method, a system, and an apparatus for video surveillance.

[37] The article of manufacture of the invention includes a computer-readable medium comprising software for a video surveillance system, comprising code segments for operating the video surveillance system based on video primitives.

[38] The article of manufacture of the invention includes a computer-readable medium comprising software for a video surveillance system, comprising code segments for accessing

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