

CLIENT	Theodore P. Cummings, Esq. The Law Offices of Theodore P. Cummings, LLC 1600 Scripps Center 312 Walnut Street Cincinnati, OH 45202
CASE	2010-00379 FLOW - Forecasted Lane Opening Watchdog
REQUEST DATE	April 7, 2010
REQUEST	Patent Search
POINTS OF FOCUS	<p>Publications or communications that describe, disclose or teach, in general, as stated in client's search request of April 7, 2010 the following...</p> <p>A mathematical predictive system uses a communications multi-network and real-time location tracking of customers through the communications multi-network to predict the upcoming customer traffic flow (FLOW) to each department in a retail store....</p> <p>In exemplary embodiments, the system uses shopper profiles that include the individual shopper's average shopping speed and length of time spent in the store in combination with the knowledge of how many other shoppers are in the store, the specific location of the shopper in the store, the time of day, the number of employees on staff and other factors to accurately predict when the shopper will reach certain locations in the store...</p> <p>In some embodiments, an influential message (e.g. alert that there is high traffic in Aisle 5, alert that there is a spill in Aisle 8, in-store directions to complementary goods, discounts offered in the deli department) is transmitted through a communications multi-network to a customer's handheld wireless device to encourage her to alter her FLOW through the retail store to avoid high traffic areas...</p> <p>System could be used outside of the retail environment such as an amusement park.</p> <p>Communications multi-network: at least one mesh communication network and at least one star communication network connected to a logic engine that organizes, routes and manages data to be communicated on the different communication networks that make up the multi-network...</p>
RESULTS	<p>This search located five (5) Tier One patent references, eleven (11) Tier Two patent references and seven (7) Non-patent references that either speak directly or indirectly to the points of focus of which the following may be of interest...</p> <p>US20080154673A1 LOAD-BALANCING STORE TRAFFIC</p> <p>Determining activity patterns in retail spaces through video analysis</p> <p>US20040249848A1 Method and apparatus for intelligent and automatic alert management using multimedia database system</p> <p>US20100013931A1 SYSTEM AND METHOD FOR CAPTURING, STORING, ANALYZING AND DISPLAYING DATA RELATING TO THE MOVEMENTS OF OBJECTS</p>
NOTES	<ol style="list-style-type: none">1. <i>Tier One references teach or speak to many of the elements listed in the points of focus and may touch on novelty.</i>2. <i>Tier Two references teach or speak to a few of the elements listed in the points of focus and, when combined, may touch on obviousness.</i>3. <i>Legal Status is bold and italicized if other than pending or active.</i>
DISCLAIMER	<p><i>This search represents a thorough and continuous effort to locate the most appropriate references given the information provided by the client and the budget placed on this project. This is not a guarantee that every potential reference has been located. Furthermore, the information contained herein has been obtained from data sources believed to be reliable. Gilman Research Services, LLC disclaims all warranties as to the accuracy, completeness or adequacy of such information. No opinion, unless clearly stated, regarding freedom to operate, patentability or otherwise of the invention is expressed or implied other than the comments stated herein.</i></p>

RESOURCES

PATENT LITERATURE	
<i>USPTO</i>	US Full Text, US Published Patent Applications
Class/Subclass	
<i>Lexis-Nexis</i>	US Full Text, US Published Patent Applications, PCT Applications, Abstracts of Japan
<i>Delphion</i>	US Full Text, US Published Patent Applications, PCT Applications, Abstracts of Japan
NONPATENT LITERATURE	
<i>Lexis-Nexis</i>	General News, Industry News, Encyclopedia of Associations, Company News, Information Week
<i>Dialog</i>	Dissertation Abstracts (35), Conference Paper Index (77), Inside Conferences (65), New Product Announcements (621)
<i>Internet Search Engines</i>	Google, Google Scholar, Google Books, Taeus, All The Web, Open Directory Project
<i>e-Resources</i>	IBM Technical Disclosure Bulletin, IP.com, Research Disclosure, Social Science Research Network Electronic Library, IEEE Xplore, Internet Archive's – Wayback Machine, ACM Digital Library, Cite Seer, IST Scientific Literature Digital Library, MIT Technology Review, Geek.com, HalfBakery.com, Shouldexist.com, SlashDot, IE-Compendex Plus, Technology Review, Advanced Imaging, Chain Store Age, Retail Touchpoints, Retail Surveillance, Retail Customer Experience, Integrated Solutions for Retailers, Supermarket News,
<i>Usenet Newsgroups, Forums, BLOGS</i>	Google Newsgroups, Yahoo Groups, Eng-Tips Forum
<i>Company Sites</i>	IBM, NCR, Panasonic, Sony, LG, IntelliVid Corp, Verint Systems Inc
<i>Inventors, Individuals of Interest</i>	Not Applicable
<i>Trade Groups, Assoc. & Conferences (Online)</i>	Journal of Marketing, British Food Journal, In-Store Marketing Institute,
<i>Academia, Journals (Online)</i>	Journal of the Academy of Marketing Science
<i>Hand Library Search, Hardcopy Text</i>	Not Applicable

SEARCH STRATEGY

SEARCH TERMS	Predictive	Shopper profile	Traffic
	Calculate	Algorithm	Anticipate
	Predictive analytics	Network	MESH
	Direct	Resource management	Speed
	Travel	Retail traffic analytics	video analysis technology
	Dynamic Object Tracking System		
SEARCH STRINGS	(surveillance and ((monitor! or record! or track! or captur!) w/5 (image! or digital or video! or feed)) and (shopper w/5 (traffic or flow or path or route))	((shopper w/5 (traffic or flow or path or route or intent!)) w/p (monitor! or record! or track! or captur!))	((shopper w/5 (traffic or flow or path or route or intent!)) w/p (monitor! or record! or track! or captur!)) and (predict! or analy! or infer! or forecast or plot!)

Patent References - Tier One

[US5712830A](#) 1998-01-27 Acoustically monitored shopper traffic surveillance and security system for shopping malls and retail space (en)

Inventors: Paul C. Ross, Morris Plains;
Alex Kononov, Bridgewater;
William Wayne Plumlee, Andover
Applicants/Assignees: Lucent Technologies Inc. , Murray Hill
Application/Filing Date:
1995-12-28

English Abstract:

Acoustic surveillance of objects and human traffic in spatial zones of a shopping mall and associated retail selling space is used to detect shopper traffic movement and from it, traffic data such as: shopper volume, shopper flow, crowding, and also unusual motion such as crowd surges that might connote an emergency situation. The apparatus uses phased arrays of acoustic transducers including arrays oriented in a vertical aspect which enables differentiation of non-shopping young children to arrive at more accurate headcount figures. Several specific types of detected movement defined as abnormal trigger an alert to a remote monitoring station. The alerts are automatically prioritized using rule-based criteria. Enhanced surveillance of the alert site by audio links as well as site alert history information are also provided.

[US20100013931A1](#) 2010-01-21 SYSTEM AND METHOD FOR CAPTURING, STORING, ANALYZING AND DISPLAYING DATA RELATING TO THE MOVEMENTS OF OBJECTS (en)

Inventors: Oren Golan, Or-Yehuda, State of Israel;
Boaz Dudovich, Rehovot, State of Israel;
Shahar Daliyot, Rehovot, State of Israel;
Itzik Horovitz, Holon, State of Israel;
Shmuel Kiro, Rehovot, State of Israel
Applicants/Assignees: VERINT SYSTEMS INC. , Melville, NEW YORK, United States of America
Application/Filing Date:
2009-07-16

English Abstract:

A system and method for the capture and storage of data relating to the movements of objects, in a specified area and enables this data to be displayed in a graphically meaningful and useful manner. Video data is collected and video metadata is generated relating to objects (persons) appearing in the video data and their movements over time. The movements of the objects are then analyzed to detect the movements within a region of interest. This detection of movement allows a user, such as a manager of a store, to make informed decisions as to the infrastructure and operation of the store. One detection method relates to the number of people that are present in a region of interest for a specified time period. A second detection method relates to the number of people that remain or dwell in a particular area for a particular time period. A third detection method determines the flow of people and the direction they take within a region of interest. A fourth detection method relates to the number of people that enter a certain area by crossing a virtual line, a tripwire.

[US20040249848A1](#) 2004-12-09 Method and apparatus for intelligent and automatic alert management using multimedia database system (en)

Inventors: Ingrid Birgitta Carlbom, Summit;
Gopal Sarma Pingali, Mohegan Lake
Applicants/Assignees: CARLBOM INGRID BIRGITTA ;
PINGALI GOPAL SARMA
Application/Filing Date:
2003-06-06

English Abstract:

Techniques for intelligent and automatic alert management. Such techniques may be realized in conjunction with a multimedia database system, such that interesting and important multimedia data associated with real time events may be captured, and alerts generated based on the captured data. In one aspect of the invention, a technique for generating at least one alert message may include the following steps/operations. Sensor data captured by one or more sensors is processed. Then, at least one alert message is automatically generated based on information obtained using at least a portion of the processed data and pertaining to a continual activity of one or more objects and/or one or more persons and to an associated previous activity of the same or different objects and/or persons. The at least one alert message may also be generated based on a varying degree of complexity of activity. The one or more sensors may be associated with a multimedia database system.

[US6633232B2](#) 2003-10-14 Method and apparatus for routing persons through one or more destinations based on a least-cost criterion (en)

Inventors: Miroslav Trajkovic, Ossining;
Srinivas Gutta, Buchanan;
Vasanth Philomin, Briarcliff Manor
Applicants/Assignees: Koninklijke Philips Electronics N.V. , Eindhoven, Kingdom of the Netherlands
Application/Filing Date:
2001-05-14

English Abstract:

A vision system that is capable of computing the crowd densities, shopper movement speed and direction, and queue lengths at different locations in a shopping center makes recommendations for least-cost path through a set of destinations. Well-known person-counting techniques may be employed. One type of output display is a map display with an overlay an optimal route through a shopping venue.

[US20080154673A1](#) 2008-06-26 LOAD-BALANCING STORE TRAFFIC (en)

Inventors: Michael Connolly, Seattle, WASHINGTON;
Lili Cheng, Bellevue, WASHINGTON;
David M. Chickering, Bellevue, WASHINGTON;
Gary W. Flake, Bellevue, WASHINGTON;
Alexander G. Gounares, Kirkland, WASHINGTON;
Eric J. Horvitz, Kirkland, WASHINGTON;
Kamal Jain, Bellevue, WASHINGTON;
Christopher A. Meek, Kirkland, WASHINGTON
Applicants/Assignees: MICROSOFT CORPORATION ,
Redmond, WASHINGTON
Application/Filing Date:
2007-09-27

English Abstract:

The claimed subject matter relates to an architecture that can identify relevant features or characteristics of one or more shoppers in the vicinity of a business establishment. In addition, the architecture can monitor resources both of the business establishment as well as other re-mote or disparate businesses. Based upon the shopper traffic data and the resource data, the architecture can determine or infer a traffic modifier (e.g., an advertisement or incentive) that can be transmitted to a display device that is typically in close proximity to the business establishment in order to modify behavior of the shopper as well as to adjust resources based upon inferred results of the modified behavior.

Patent References - Tier Two

[US20080159634A1](#) 2008-07-03 Method and system for automatically analyzing categories in a physical space based on the visual characterization of people (en)

Inventors: Rajeev Sharma, State College, PENNSYLVANIA;
Satish Mummareddy, Washington, DISTRICT OF COLUMBIA;
Priya Baboo, State College, PENNSYLVANIA;
Jeff Hershey, Norfolk, VIRGINIA ;
Namsoon Jung, State College, PENNSYLVANIA
Applicants/Assignees: SHARMA RAJEEV ;
MUMMAREDDY SATISH ;
BABOO PRIYA ;
HERSHEY JEFF ;
JUNG NAMSOON
Application/Filing Date:
2007-12-06

English Abstract:

The present invention is a method and system for automatically analyzing a category in a plurality of the categories in a physical space based on the visual characterization, such as behavior analysis or segmentation, of the persons with regard to the category. The present invention captures a plurality of input images of the persons in the category by a plurality of means for capturing images. The present invention processes the plurality of input images in order to understand the shopping behavior of the persons with the sub-categories of the category and analyzes the level of engagement and decision process at the sub-category level. The processes are based on a novel usage of a plurality of computer vision technologies to analyze the visual characterization of the persons from the plurality of input images. The physical space may be a retail space, and the persons may be customers in the retail space.

[US20080184245A1](#) 2008-07-31 METHOD AND SYSTEM FOR TASK-BASED VIDEO ANALYTICS PROCESSING (en)

Inventors: Richard ST-JEAN, Kanata, Canada
Applicants/Assignees: MARCH NETWORKS CORPORATION ,
Ottawa, Canada
Application/Filing Date:
2008-01-30

English Abstract:

A task-based video analytics system and method are provided, which can include dynamic allocation and sharing of video analytics resources. Video analytics tasks are created in response to trigger information, which can be based on stored business rules, events and/or data of interest. The tasks are forwarded to a video analytics task manager, which manages and distributes tasks to appropriate video analytics resources according to parameters such as scheduling, priority and/or events. Video from the appropriate video source, either a video stream or stored video, is only obtained after the video analytics task is received at the video analytics resource. Video analytics are performed on the video itself, not on video metadata. Data mining of non-video metadata can be used to identify stored video of interest. Configuration tuning can be used to modify a

business rule and validate whether the modified rule would affect previous correct data.

[US20020168084A1](#) 2002-11-14 Method and apparatus for assisting visitors in navigating retail and exhibition-like events using image-based crowd analysis (en)

Inventors: Miroslav Trajkovic, Ossining;
Srinivas Gutta, Buchanan;
Vasanth Philomin, Briarcliff Manor
Applicants/Assignees: Koninklijke Philips Electronics N.V.
Application/Filing Date:
2001-05-14

English Abstract:

A vision system that is capable of computing the crowd density at an exhibition-like event provides real-time information to visitors to allow them to avoid crowds or identify the most popular exhibits. Well-known counting techniques may be employed. One type of display that provides crowd information is a map display with an overlay showing density of visitors.

[US20080294476A1](#) 2008-11-27 METHODS AND APPARATUS TO MONITOR IN-STORE MEDIA AND CONSUMER TRAFFIC RELATED TO RETAIL ENVIRONMENTS (en)

Inventors: William J. Dupre, Downers Grove, ILLINOIS;
Matthew C. Cakora, Plainfield, ILLINOIS;
Daniel G. Brown, Buffalo Grove, ILLINOIS
Applicants/Assignees: DUPRE WILLIAM J ;
CAKORA MATTHEW C ;
BROWN DANIEL G
Application/Filing Date:
2008-04-25

English Abstract:

Methods and apparatus to monitor in-store media and consumer traffic related to retail environments are disclosed herein. In a disclosed example method to monitor a monitored establishment, a survey is presented to an auditor and a user-provided survey response is received indicative of a condition in a monitored establishment that affects an accuracy of shopper count information provided by the auditor. Instructions are displayed to the auditor to sequentially move to a plurality of predetermined locations in the monitored establishment and collect a shopper count corresponding to each of the predetermined locations. The example method also involves receiving and storing each of the plurality of shopper counts.

[US20080294475A1](#) 2008-11-27 SYSTEMS AND APPARATUS TO DETERMINE SHOPPER TRAFFIC IN RETAIL ENVIRONMENTS (en)

Inventors: Michael John Zenor, Deerfield, ILLINOIS;
William J. Dupre, Downers Grove, ILLINOIS;
Frank W. Piotrowski, Arlington Heights, ILLINOIS
Applicants/Assignees: ZENOR MICHAEL JOHN ;
DUPRE WILLIAM J ;
PIOTROWSKI FRANK W
Application/Filing Date:
2008-04-25

English Abstract:

Methods and apparatus to determine shopper traffic in retail environments are disclosed herein. In a disclosed example method of generating shopper traffic data, in-person-based count data and sensor-based count data are obtained. The in-person-based count data is indicative of a first quantity of shoppers within a first zone of a monitored establishment is obtained. The sensor-based count data is indicative of a second quantity of shoppers within the first zone of the monitored establishment. The example method also involves determining a relationship value indicative of a relationship between the in-person-based count data, the sensor-based count data, and first sales data associated with the first zone of the monitored establishment.

[US20080294487A1](#) 2008-11-27 METHODS AND APPARATUS TO MONITOR IN-STORE MEDIA AND CONSUMER TRAFFIC RELATED TO RETAIL ENVIRONMENTS (en)

Inventors: Kamal Nasser, Palm Harbor, FLORIDA
Applicants/Assignees: NASSER KAMAL
Application/Filing Date:
2008-04-25

English Abstract:

Methods and apparatus to monitor in-store media and consumer traffic related to retail environments are disclosed herein. In a disclosed example method to monitor presentations of media in a monitored establishment, a floor layout map of a monitored establishment is displayed a medium profile associated with a medium presented at a location on the floor layout map is presented in response to receiving a user selection of the location on the floor layout map. The example method also involves storing a media type classification code, a media characteristic identifier code, and location information indicative of the location on the floor layout map in association with the medium profile.

[US7606728B2](#) 2009-10-20 Shopping environment analysis system and method with normalization (en)

Inventors: Herb Sorensen, Corbett, OREGON
Applicants/Assignees: Sorensen Associates Inc. , Troutdale, OREGON
Application/Filing Date:
2003-09-19

English Abstract:

A system and method are provided for analyzing a shopping environment. The method typically includes tracking a plurality of paths of a plurality of persons in the shopping environment, and recording corresponding path data. The method further may include normalizing path data for each path by use of a predetermined normalization function, and calculating a predetermined statistical measure of the normalized shopping data. The method also may include producing output based upon the predetermined statistical measure.

[US20080204224A1](#) 2008-08-28 Path tracking system, terminal device, fixed communication device, and path management device (en)

Inventors: Takashi Yuba, Shinagawa, Japan;
Shigemi Kurashima, Shinagawa, Japan;
Masahiro Yanagi, Shinagawa, Japan;
Takashi Arita, Shinagawa, Japan
Applicants/Assignees: FUJITSU COMPONENT LIMITED , Tokyo, Japan
Application/Filing Date:
2007-07-31

English Abstract:

A shopping path tracking system is disclosed that comprises a terminal device, a fixed communication device, and a path management device. The fixed communication device wirelessly communicates with the terminal device, calculates a response time of the terminal device, and reports the calculated response time to the path management device. The path management device detects a position of the terminal device based on the response time reported from the fixed communication device, stores the detected position, and detects a travel path of the terminal device by tracking the stored positions.

[US20080306756A1](#) 2008-12-11 SHOPPER VIEW TRACKING AND ANALYSIS SYSTEM AND METHOD (en)

Inventors: Herb Sorensen, Troutdale, OREGON;
Marcus Hannon Geroux, Gresham, OREGON;
David Albers, Gresham, OREGON
Applicants/Assignees: SORENSEN ASSOCIATES INC , Troutdale, OREGON
Application/Filing Date:
2008-06-06

English Abstract:

Devices, systems, and methods for tracking a view of a shopper are disclosed. The system may include camera coupled with a head of a shopper, and configured to capture one or more images in a field of view of the camera as captured image data. The shopper view tracking system may also include an analysis computing device configured to receive the captured image data, and an analysis program configured to determine an estimated shopper field of view having a boundary that is calculated to represent a probability of a person in a data sample having an actual measured focal point that occurs within the boundary, and to display the estimated shopper field of view superimposed on the one or more images in the captured image data. The analysis program further may be configured to generate an output including statistical measures based on the estimated field of view.

[US20070055563A1](#) 2007-03-08 System and methods for tracking consumers in a store environment (en)

Inventors: Ronald Gary Godsey, Baltimore, MARYLAND;
Marshall P. Haine, Reisterstown, MARYLAND;
Mary Elizabeth Scheid, Rotterdam, Kingdom of the Netherlands
Applicants/Assignees: GODSEY RONALD G ;
HAINE MARSHALL P ;
SCHEID MARY E
Application/Filing Date:
2006-11-09

English Abstract:
A virtual store environment is provided.

[US20090326807A1](#) 2009-12-31 METHODS AND APPARATUS TO MONITOR SHOPPERS IN A RETAIL ENVIRONMENT (en)

Inventors: Arun Ramaswamy, Tampa, FLORIDA;
Rafael E. Alonso, Tampa, FLORIDA
Application/Filing Date:
2008-06-30

English Abstract:
Methods and apparatus to monitor shoppers in a retail environment are disclosed herein. In a disclosed example method, a first signal is transmitted via a first device in a first direction to a second device and a second signal is transmitted via the first device in a second direction to a third device associated with a shopper. A direction of travel of the third device is determined based on the first signal and a path of travel of the third device through a monitored establishment is determined based on the second signal.

Non-patent References

The P.R.I.S.M. Project: Measuring In-Store Reach

The audience for in-store marketing can now be measured.

<http://www.instoremarketer.org/?q=node/5779>

A consortium of manufacturers and retailers spearheaded by the In-Store Marketing Institute has created a tool for measuring in-store consumer reach at the category level. The model was verified by research conducted at four leading retailers in spring 2006.

The measurement model predicts consumer reach by category or area of the store, by retail format, and by day of the week, delivering unprecedented insight into the store as a marketing channel.

The model could prove to be a watershed event for the marketing world, because it allows the store to be compared alongside television, radio and other forms of mass media for its ability to deliver consumer reach. In effect, it could do for the store what the measurement of gross ratings points (GRP) did for television.

While in-store marketing has long been an element of the consumer marketing mix, its potential value as a brand-building vehicle has never been objectively assessed, largely because there hasn't been a way to accurately measure the total reach of a campaign conducted at retail. By establishing a common metric that can be understood by both brand marketers and retailers, this model can eliminate that obstacle.

P.R.I.S.M. Update: Phase II Begins

http://www.instoremarketer.org/files/2007_5_1_wishart.html

The second phase of research will expand the initial project in several key ways:

- It will collect data from as many as 200 stores representing more than one dozen top food, drug and mass-market retailers, including A&P, Albertsons, Kroger, Meijer, Rite Aid, Safeway, Walgreens, Wal-Mart and Winn-Dixie. The first study examined 10 stores, two each from Albertsons, Kroger and Walgreens and four from Wal-Mart.
- It will broaden the scope beyond the 64 product categories tracked in the initial study by "covering the entire store. We'll be able to accommodate just about every category," Wishart said.
- It will make the formula more precise by adding to the data used in the calculation. Factored into the equation will be specific characteristics related to the geographic area, store and department and/or category in question, among other variables.
- It will collect data over 26 weeks, compared with four weeks in the initial study. "It will be continuous in a few stores so we can understand some of the subtleties of seasonality, and then we'll be pulsing in and out of the rest of the stores in three- and four-week intervals," he said.

P.R.I.S.M.'s Promise Approaching Reality

<http://www.instoremarketer.org/article/p-r-i-s-m-s-promise-br-approaching-reality/6687>

Data collected through the P.R.I.S.M. project may quite literally transform the retail environment, and should have a major impact on the future of marketing to consumers.

The Pioneering Research for an In-Store Metric project has achieved its primary objective to measure retail traffic at the category level. Under the direction of The Nielsen Company, the initiative now also has moved beyond traffic counts by incorporating store communication audits to derive estimates for consumer reach.

In other words, the in-store "audience" for marketing communications can now be quantified, which makes retail a measured medium similar to TV, radio, print and online. "This metric will allow everyone gathered in this room to truly begin to treat and discuss the physical store as a marketing medium," David Calhoun, The Nielsen Company's chief executive officer, told an audience of more than 1,000 gathered for a special panel discussion on P.R.I.S.M. at the In-Store Marketing Expo in Chicago on Sept. 27.

Analyzing Preliminary P.R.I.S.M. Data

<http://www.instoremarketer.org/article/analyzing-PRISM-data>

OMD, Clorox execs offer preview of P.R.I.S.M. data
By Peter Breen

Using such data, a brand marketer could conclude that the chain with the higher traffic count may warrant more of an outlay for media and merchandising, but that the periods in which to execute programs at each wouldn't differ, Hess suggested.

Traffic in specific sections of the stores varied widely, with the checkout area garnering the highest numbers and the greeting cards/party supplies department receiving significantly fewer visits, according to the data. But while overall traffic counts varied across chains and even across stores within the same chain, the demographic makeup of shoppers visiting each store area was remarkably similar, Hess noted. (Nielsen is attaining demographic profiles by "superimposing" information from its HomeScan consumer panel onto the P.R.I.S.M. data, Garry noted.)

Determining activity patterns in retail spaces through video analysis

Girgensohn, A. and Shipman, F. and Wilcox, L.
Proceeding of the 16th ACM international conference on Multimedia
pages=889–892
year=2008
organization=ACM

ABSTRACT

Retail establishments want to know about traffic flow and patterns of activity in order to better arrange and staff their business. A large number of fixed video cameras are commonly installed at these locations. While they can be used to observe activity in the retail environment, assigning personnel to this is too time consuming to be valuable for retail analysis. We have developed video processing and visualization techniques that generate presentations appropriate for examining traffic flow and changes in activity at different times of the day. Taking the results of video tracking software as input, our system aggregates activity in different regions of the area being analyzed, determines the average speed of moving objects in the region, and segments time based on significant changes in the quantity and/or location of activity. Visualizations present the results as heat maps to show activity and object counts and average velocities overlaid on the map of the space.

motion tracking, camera coordination, activity classification, and event detection. In this paper, we focus on motion tracking and show how one can use observed motion to learn patterns of activity in a site. Motion segmentation is based on an adaptive background subtraction method that models each pixel as a mixture of Gaussians and uses an online approximation to update the model. The Gaussian distributions are then evaluated to determine which are most likely to result from a background process. This yields a stable, real-time outdoor tracker that reliably deals with lighting changes, repetitive motions from clutter, and long-term scene changes. While a tracking system is unaware of the identity of any object it tracks, the identity remains the same for the entire tracking sequence. Our system leverages this information by accumulating joint co-occurrences of the representations within a sequence. These joint co-occurrence statistics are then used to create a hierarchical binary-tree classification of the representations. This method is useful for classifying sequences, as well as individual instances of activities in a site

[DOTS: support for effective video surveillance](#)

Girgensohn, Andreas and Kimber, Don and Vaughan, Jim and Yang, Tao and Shipman, Frank and Turner, Thea and Rieffel, Eleanor and Wilcox, Lynn and Chen, Francine and Dunnigan, Tony
MULTIMEDIA '07: Proceedings of the 15th international conference on Multimedia
year 2007
isbn 978-1-59593-702-5
pages 423–432

ABSTRACT

DOTS (Dynamic Object Tracking System) is an indoor, real-time, multi-camera surveillance system, deployed in a real office setting. DOTS combines video analysis and user interface components to enable security personnel to effectively monitor views of interest and to perform tasks such as tracking a person. The video analysis component performs feature-level foreground segmentation with reliable results even under complex conditions. It incorporates an efficient greedy-search approach for tracking multiple people through occlusion and combines results from individual cameras into multi-camera trajectories. The user interface draws the users' attention to important events that are indexed for easy reference at a later time. Different views within the user interface provide spatial information for easier navigation. Our system, with over twenty video cameras installed in hallways and other public spaces in our office building, has been in constant use for almost a year.

[Learning patterns of activity using real-time tracking](#)

Chris Stauffer, W. Eric L. Grimson
IEEE Transactions on Pattern Analysis and Machine Intelligence, v.22 n.8, p.747-757, August 2000

Abstract

Our goal is to develop a visual monitoring system that passively observes moving objects in a site and learns patterns of activity from those observations. For extended sites, the system will require multiple cameras. Thus, key elements of the system are