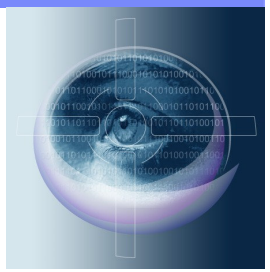


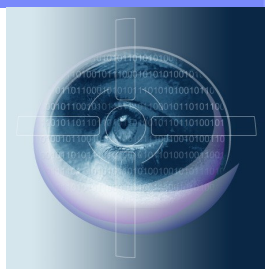
# Applications and Commercial Systems for Video Surveillance

*Instructor: YingLi Tian*

*IBM TJ Watson Research Center*

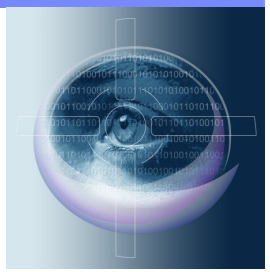
yltian@us.ibm.com

# Outline



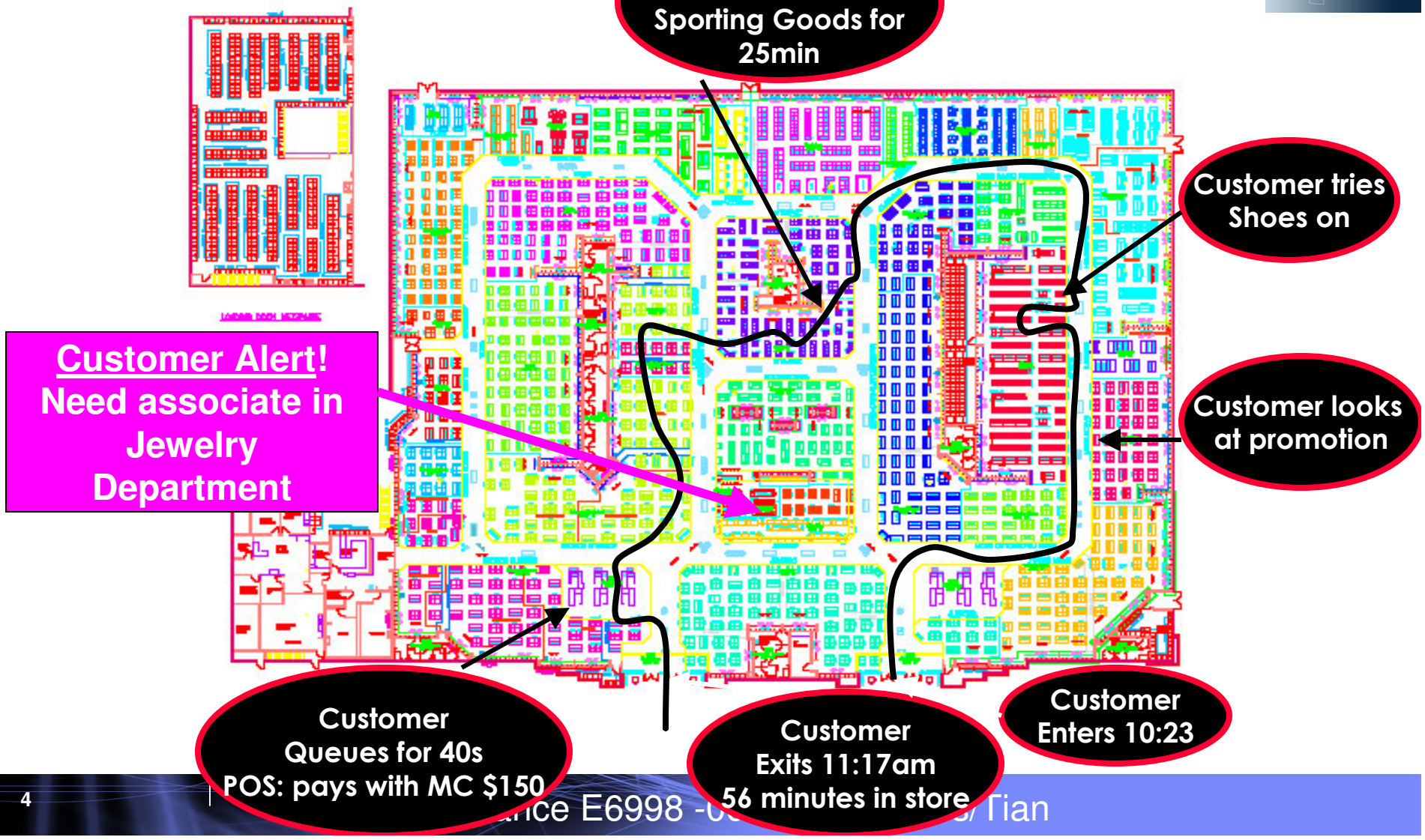
- Video Surveillance Applications
  - Retail Solutions
  - Public Sector
    - Airport
    - Seaport
    - Transportation
  - Finance
  - Other
    - Education
    - Health Care
    - Casino and Games
- Commercial Systems

# Video Surveillance Applications -- retail

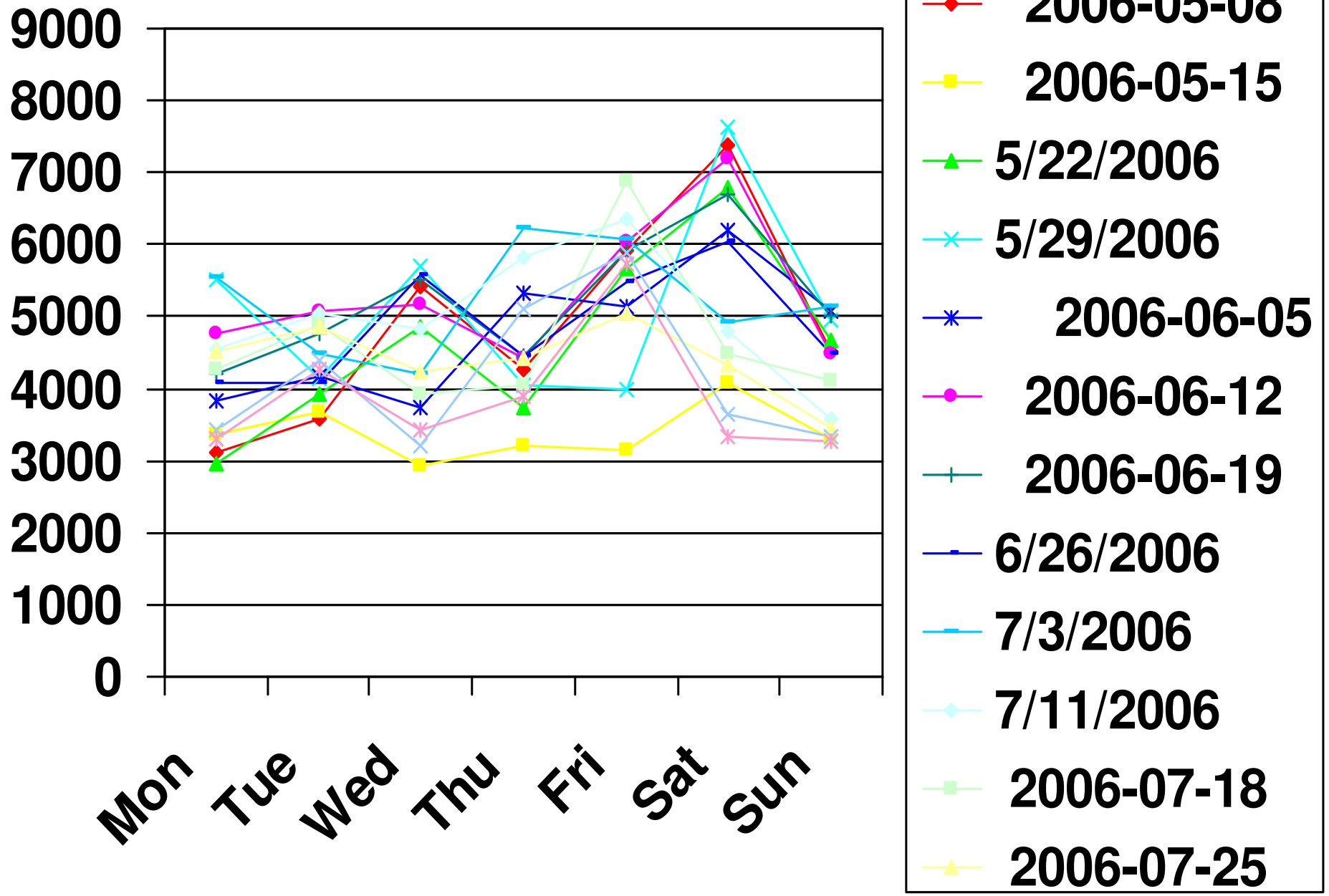


- People counting
- Return Fraud
- Display Effectiveness
- Line Management

# Throughout store tracking



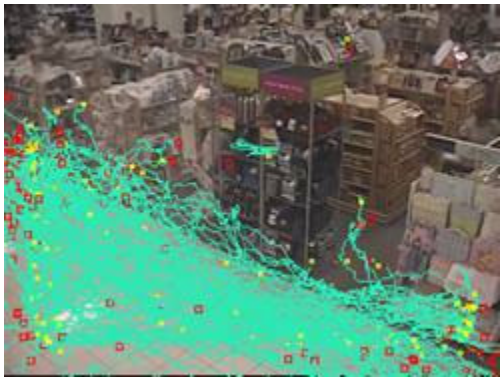
**Count of Entry Events May – August (Continuous operation for 100 days)**



# Display/Area Effectiveness (30 mins)

## Pain Point/Challenge

- Inability to identify customer interest of product display areas
- Inability to identify customer purchase behavior at product display areas
- Inability to Identify type of customer interested in product display areas



## Operational Opportunities

- System records number of customers that dwell at display
- System records dwell time of customers
- System builds history of hot areas in the store where customers migrate
- Product placement is allocated based on customer behavioral trends

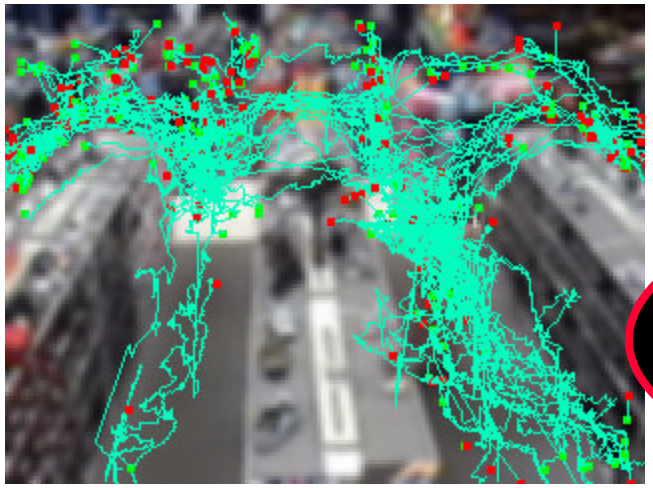
- **140 Customers passed by display in 30 minutes**
- **2 Customers paused in near the display**

**Benefits (grey)**

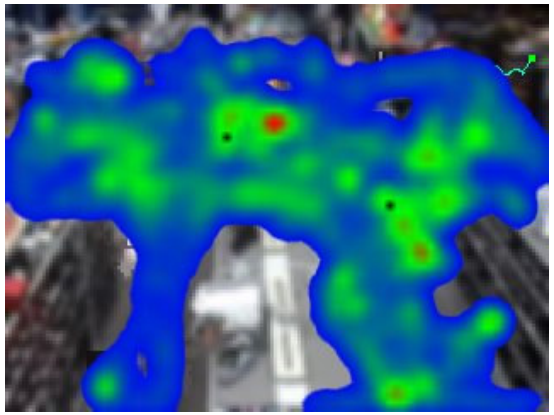
| | | | | |
|---|---|---|---|---|
| **Shrink** | **Costs (excl. Shrink Costs)** | **Revenue** | **Productivity** | **Customer Sat** |

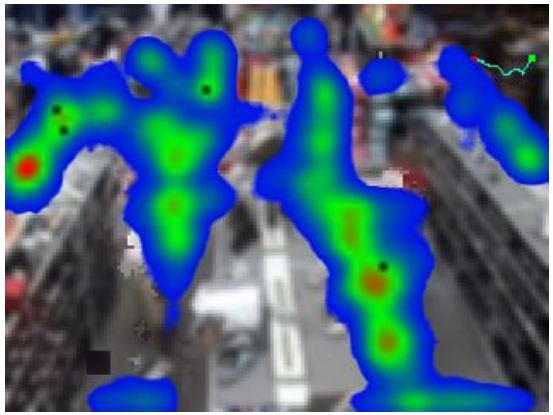
# Display effectiveness and store flow

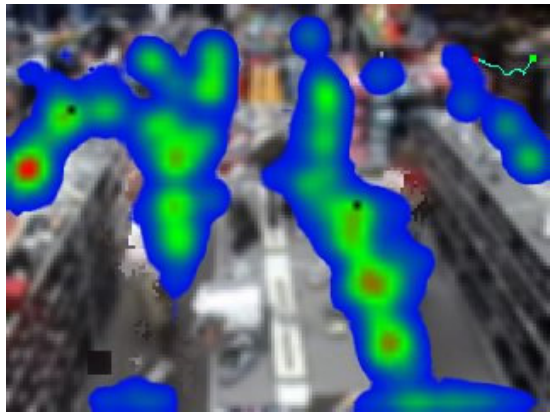
- Plot all tracks:
- Density
- Flow



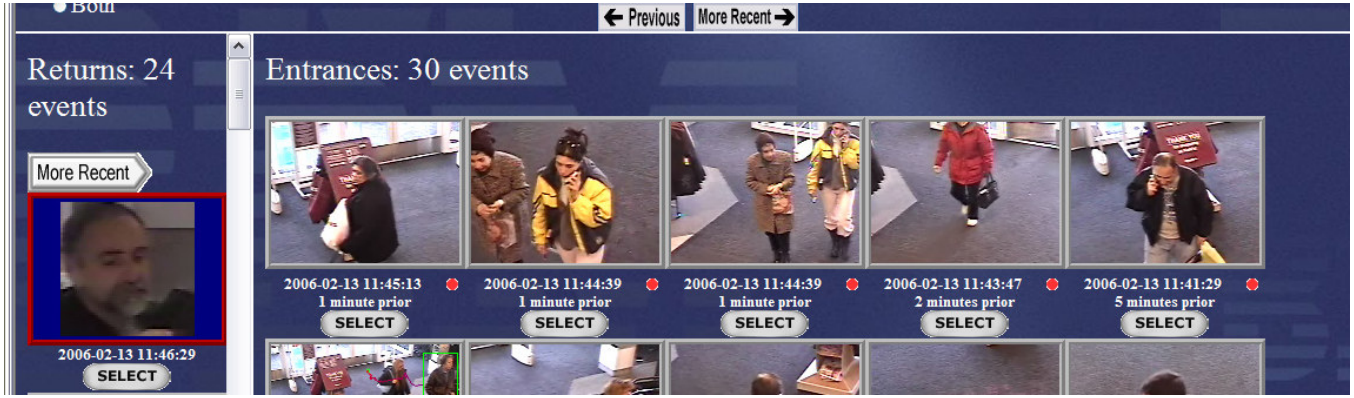
**Value:**
**Count customers at specific locations**
**Determine where customers stop/reach**
**See customer flows within store**







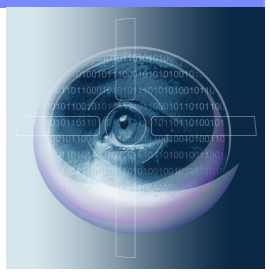
# Returns Fraud Investigation




**Video Clip at Entrance**

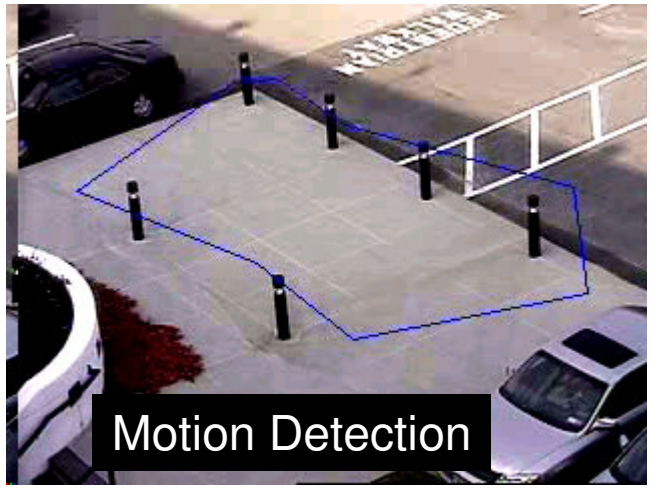
**Video Clip at Return Desk**

# Video Surveillance Applications – public sector



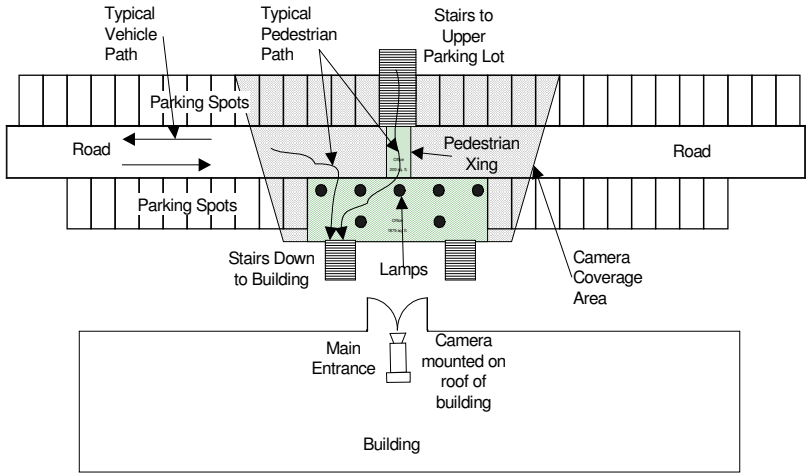
- Airport Security
- City Surveillance
- Urban Surveillance
- Subway systems

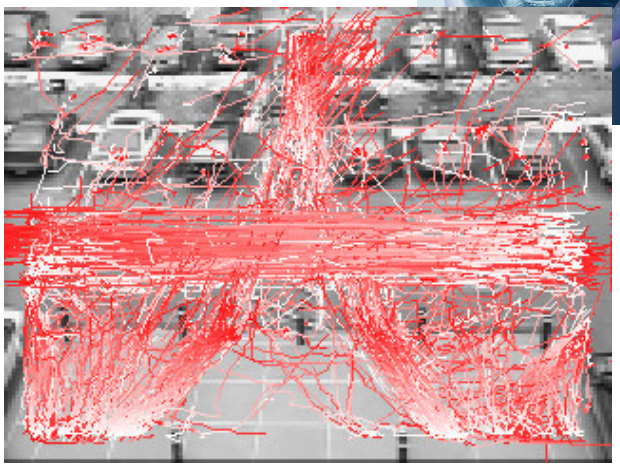
# Real-Time Alerts

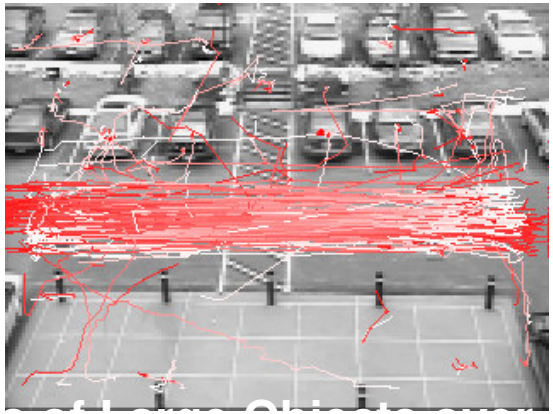


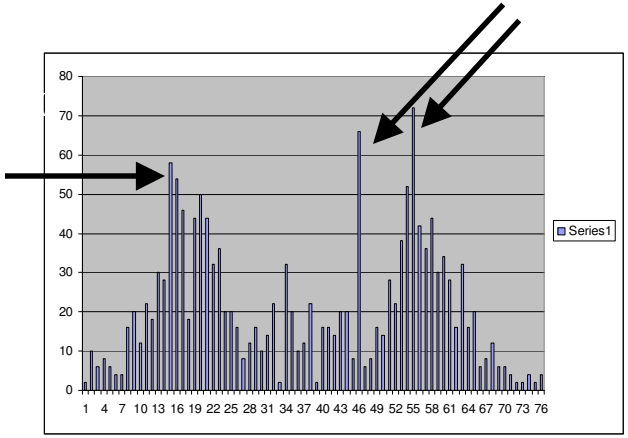



# Long Term Monitoring Results – Event Statistics (24 hours)

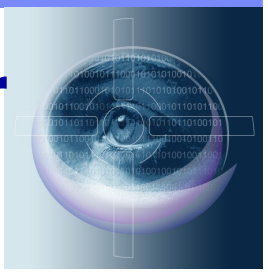






# Video Surveillance Applications – Other Sectors



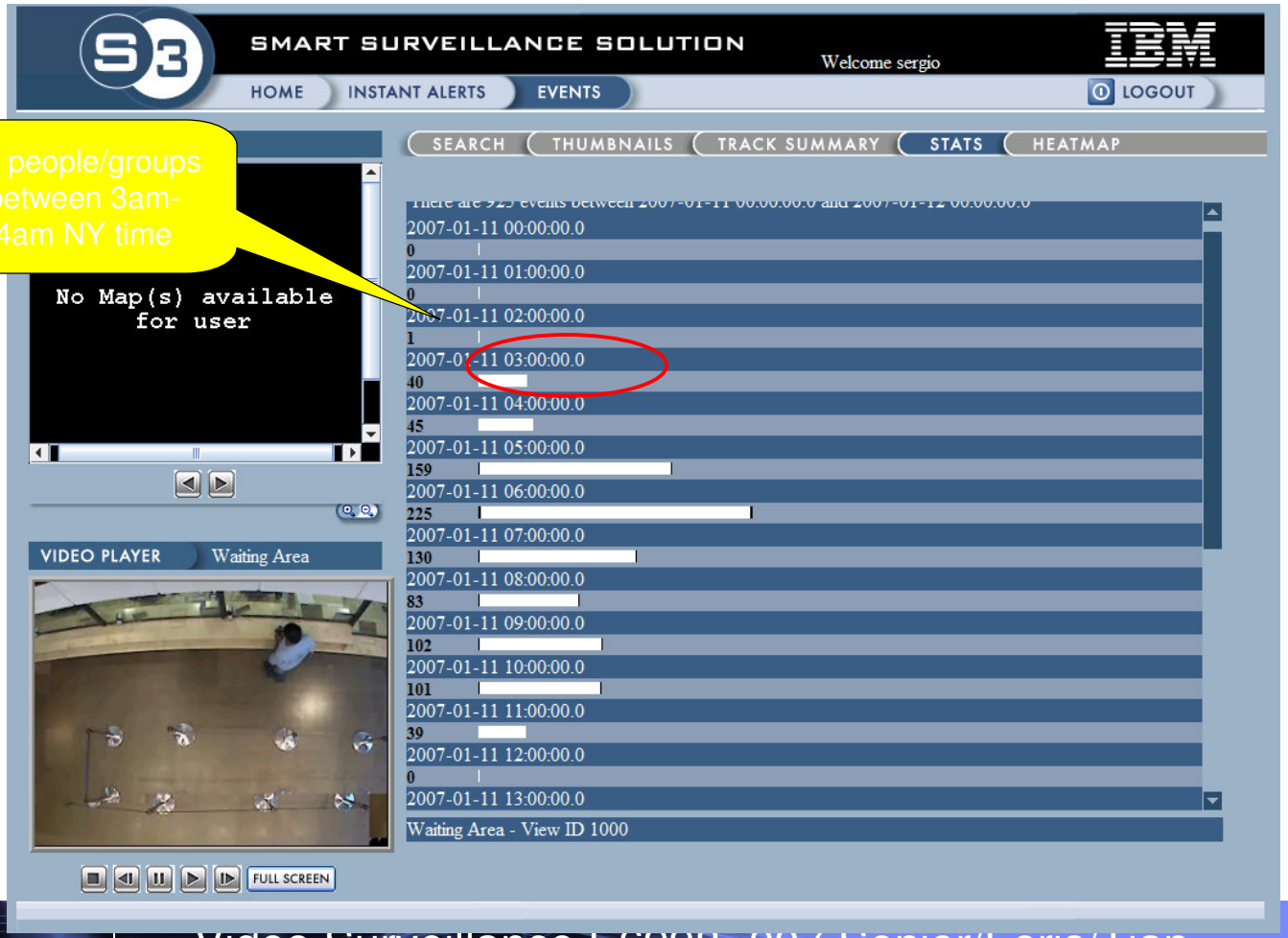
- Healthcare
- Financial Sector
  - Bank
  - ATM
- Casinos and Gaming
- Education

# Application at Bank and ATM

- Provide real time alerts on the following human behaviors patterns
  - a new device was fixed at the ATM's card reader
  - A client stands for more than a specific period of time in front of the ATM
  - A fake advertisement was fixed on the ATM
  - Two people goes to the ATM at the same time
  - The time that clients are spending on a line
  - How many clients are in a line
- Evolve these alerts as new threats and fraud behaviors are recognized.
- Use the S3 index to preemptively discover fraud behavior.
- Integrate video events with transactions at ATM

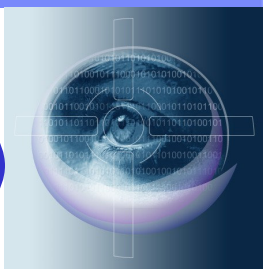
Displayed here are the key frames of the events where the S3 systems has identified a person or group or people in the camera field of view. Once you click on the event you should see the event played back in the screen on the bottom left side.

Here are the statistics of people or groups of people flowing through the lane in time. Please note there were 40 events (people or groups of people together) that were received from 3am to 4am NY time (6am-7am SP time). People flow from 6am to 7am was 40people/hr which means an average wait time of 1min and 30sec per person



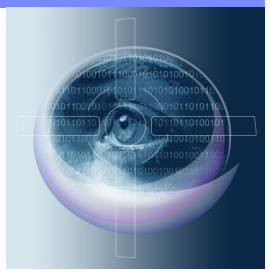
In Blue, you have all tracks of people and groups in the field of view using the sate search. In other words the trajectory of each individual person. Each track can be identified and the associated clip can be played as seen in player and the yellow track.

# Commercial Systems (Focus on Video Analytics)



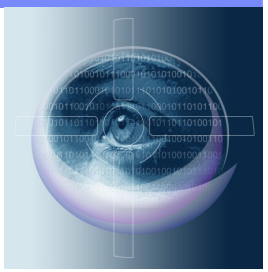
- IBM SSS
- Agent video intelligence (http://www.agentvi.com/)
- Cernium (http://www.cernium.com/index.asp)
- Honeywell (http://www.honeywellvideo.com/support/library/videos/IASindex.html)
- Genetec (http://www.genetec.com/)
- General Electric (http://www.gesecurity.com/portal/site/GESecurity)
- IntelliVision (http://www.intelli-vision.com/)
- iOmniscient (http://www.iomniscient.com)
- Object Video (http://www.objectvideo.com/)
- Sarnoff (http://www.sarnoff.com/products_services/imagers/index.asp)
- Siemens
- Vident (http://www.vident.com/products.html)
- Verint (http://verint.com/corporate/home.cfm)
- VideoIQ (http://www.videoiq.net/)
- VideoMining (http://www.videomining.com/)
- Virage (http://www.virage.com/content/securityandsurveillance/index.en.html)
- Vis-a-Pix (http://www.visapix.de/en/)

# Agent video intelligence -- 1



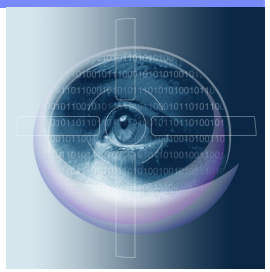
* Agent Vi video analytics software enhances security and loss prevention, alerting you to:
  - Loitering or intrusion in big-ticket, high-theft areas (DVD box sets, handheld games and players)
  - Pallet movement from stock room or movement within a secure zone
  - Suspicious directional movement, such as reaching over a jewelry or electronics countertop
  - Objects removed from store shelves or sensitive stockroom areas
  - Items left near fire exits or delivery docks
  - Tailgating into restricted access zones
  - Entrances/exits via fire doors or warehouse doors
  - Unauthorized activity during off hours
  - Vehicles parked at loading docks at any time
  - Alert to camera blocking )

# Agent video intelligence -- 2



* Agent Vi addresses public safety and liability issues, with alerts for:
  - Vehicles parked illegally in fire lanes
  - Blocked fire exits
  - Unattended or suspicious objects
  - Slip-and-fall detection to identify potential customer injuries, fraudulent claims and liability issues
* Agent Vi delivers superior business intelligence, reporting:
  - Restocking alerts for high-turnover merchandise
  - How much time customers spend in front of a display
  - The number of people passing through store entrances/exits and other areas of interest
  - Automatic PTZ tracking

# Cernium - 1



- entry into exit
- video quality
- Single Person
- Fast [Moving] Person, Lurking Person
- Lurking Person, Erratic Person, Multiple People, Converging People, Fallen Person, crowd forming, crowd dispersal etc.

# Cernium – ExitsEntry -- 2

[1] U.S. patent number 6,940,998

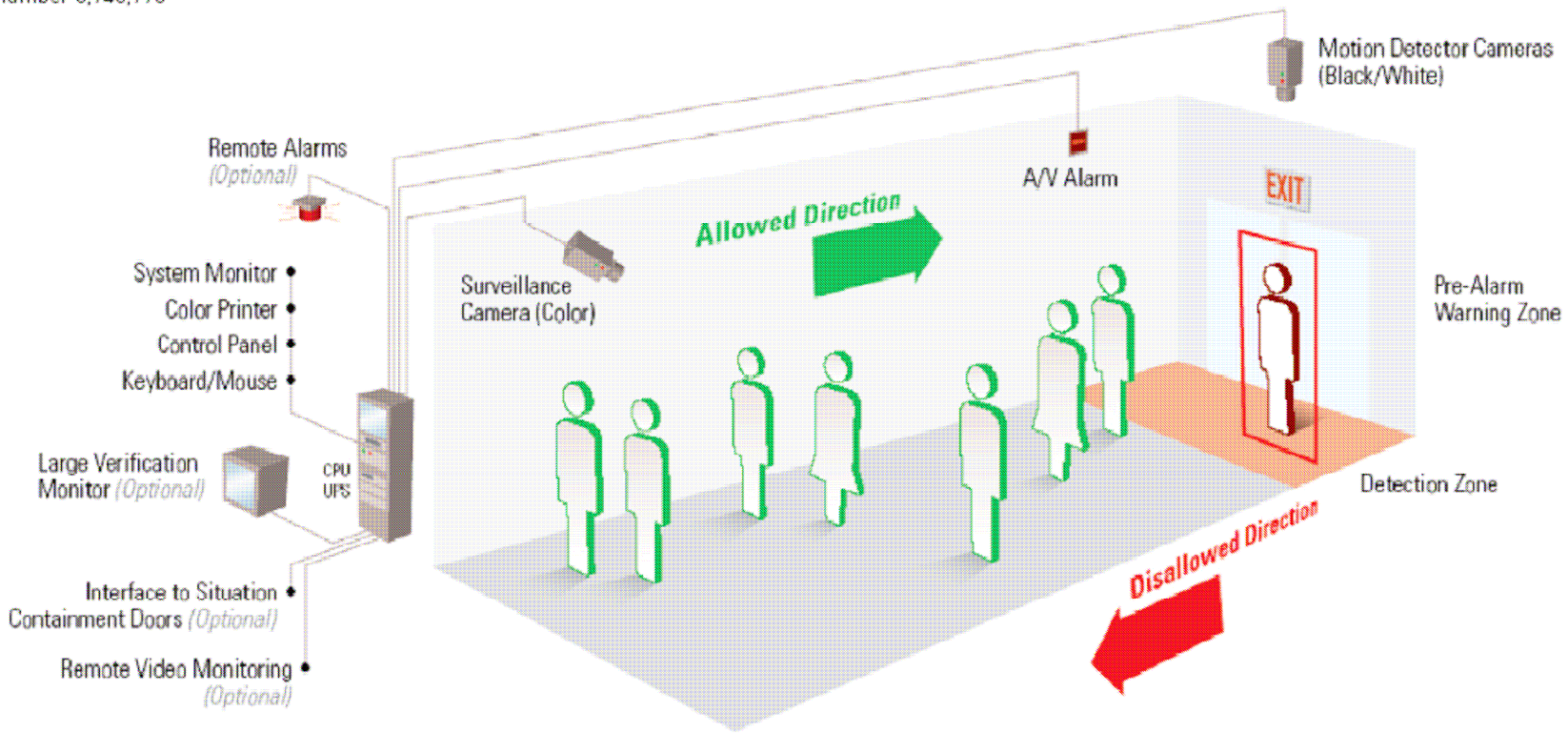
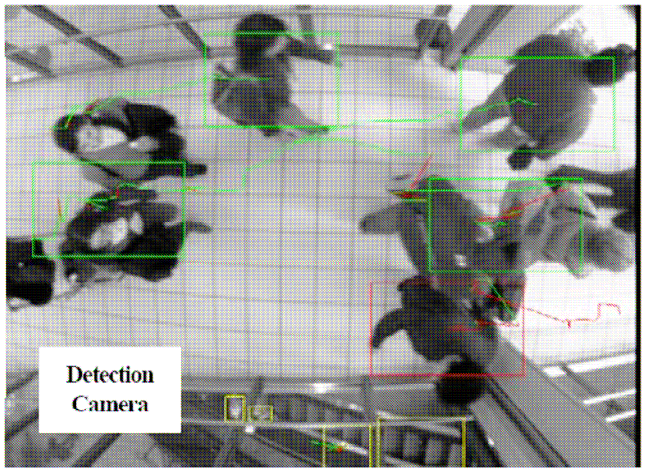


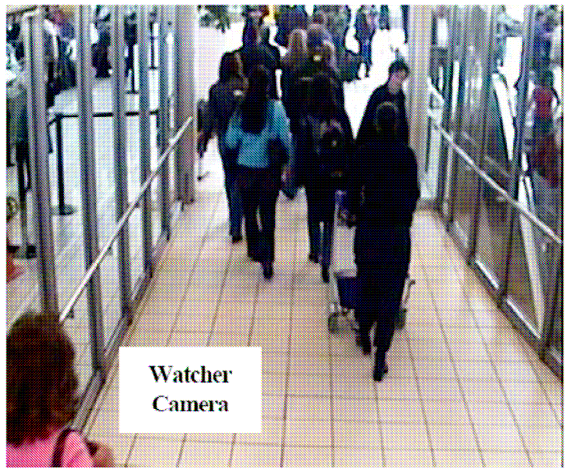

**Figure 1: ExitSentry Airport Exit Lane Monitoring Solution**
Applies powerful video analytics technology to immediately catch any individual attempting to enter an exit lane from the wrong direction

# Cernium – ExitsEntry Results -- 3

**Adult Entering Lane Incorrectly**

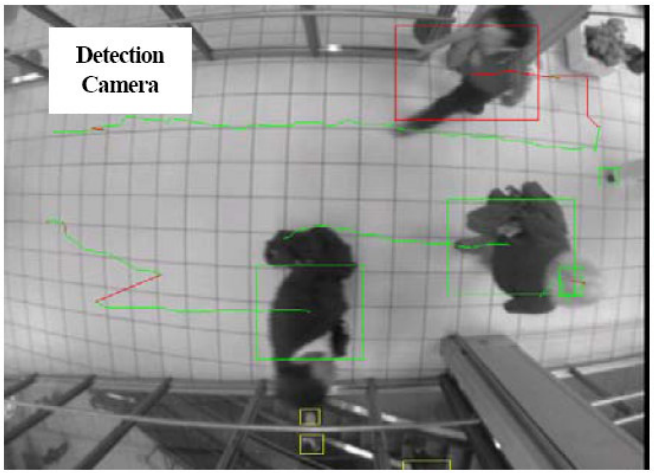
3/14/03
3:33pm



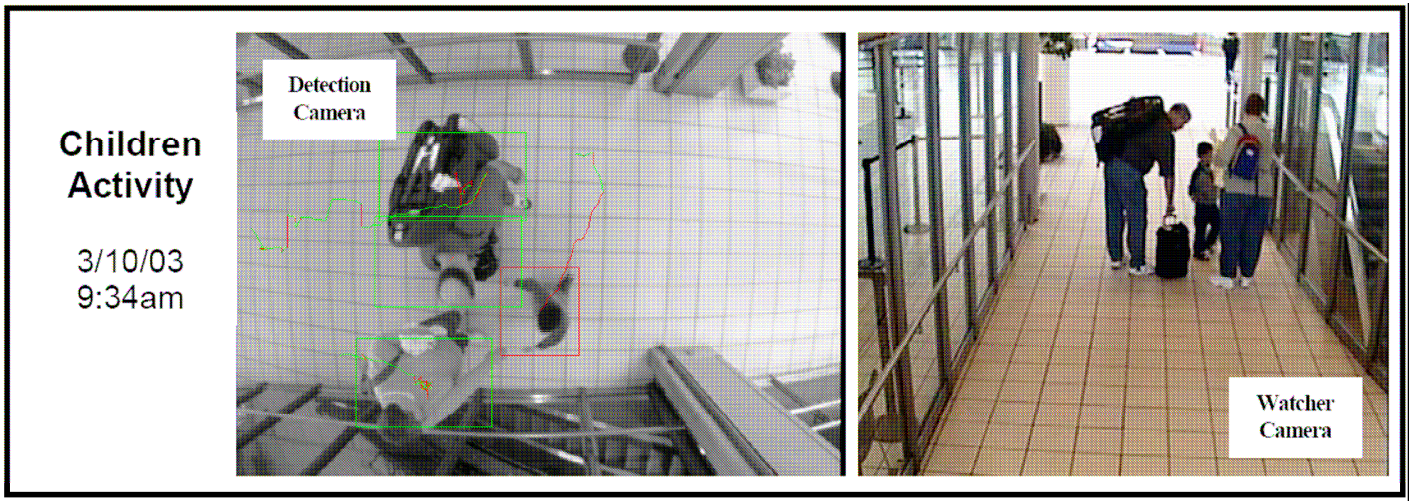




**Adult Stop & Reverse**

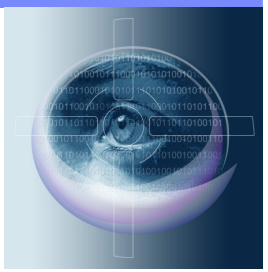
3/20/03
1:04pm




# Cernium – Child detection -- 4



# Honeywell Video Systems -- 1

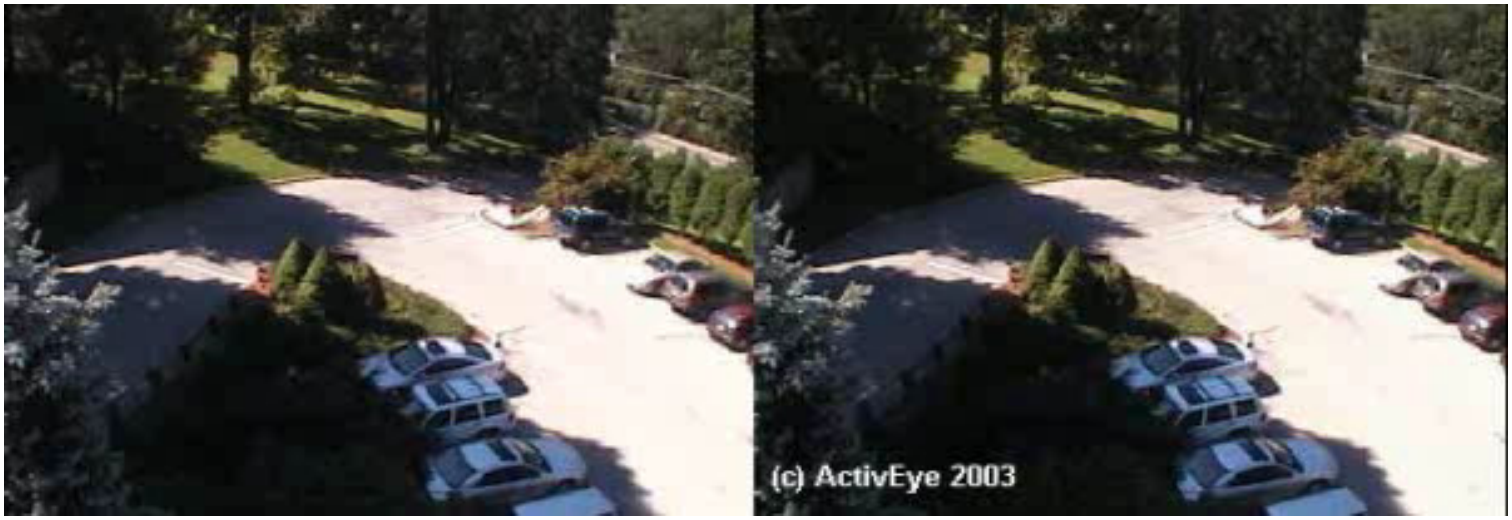


- Acquires ActivEye in Mar. 2007
- Traditional Video and Analytics
  - Lane Traffic Counts
  - Car Requiring Assistance
  - Vehicle Tracking
  - People Tracking Hallway
  - Possible Theft
  - Tracking People in Heavy Snow
  - Illegal U-turn
- Handling Environmental Noise

# Honeywell Video Systems -- 2


**Car request assistant**

# Honeywell Video Systems -- 3




**Illegal U-turn detection**

# Honeywell Video Systems -- 4


**Lane traffic count**

# Honeywell Video Systems -- 5


Person at Fence Line Entering Restricted Area

# Honeywell Video Systems -- 6

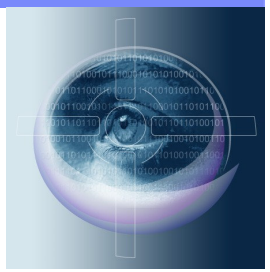

**Possible Theft**

# Honeywell Video Systems -- 7


**People Tracking**

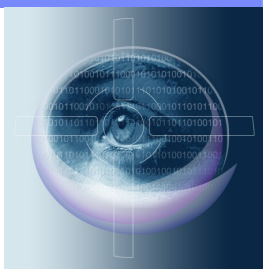

**Vehicle Tracking**

# Genetec



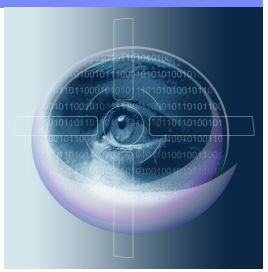
- Motion detection, real-time alerts on restricted zones, color, license plate recognition, …
- Searching, like: "Display all video sequences where a blue car with license plate X driving with speed higher than Y in the parking lot.
- object detection
- object left detection

# General Electric



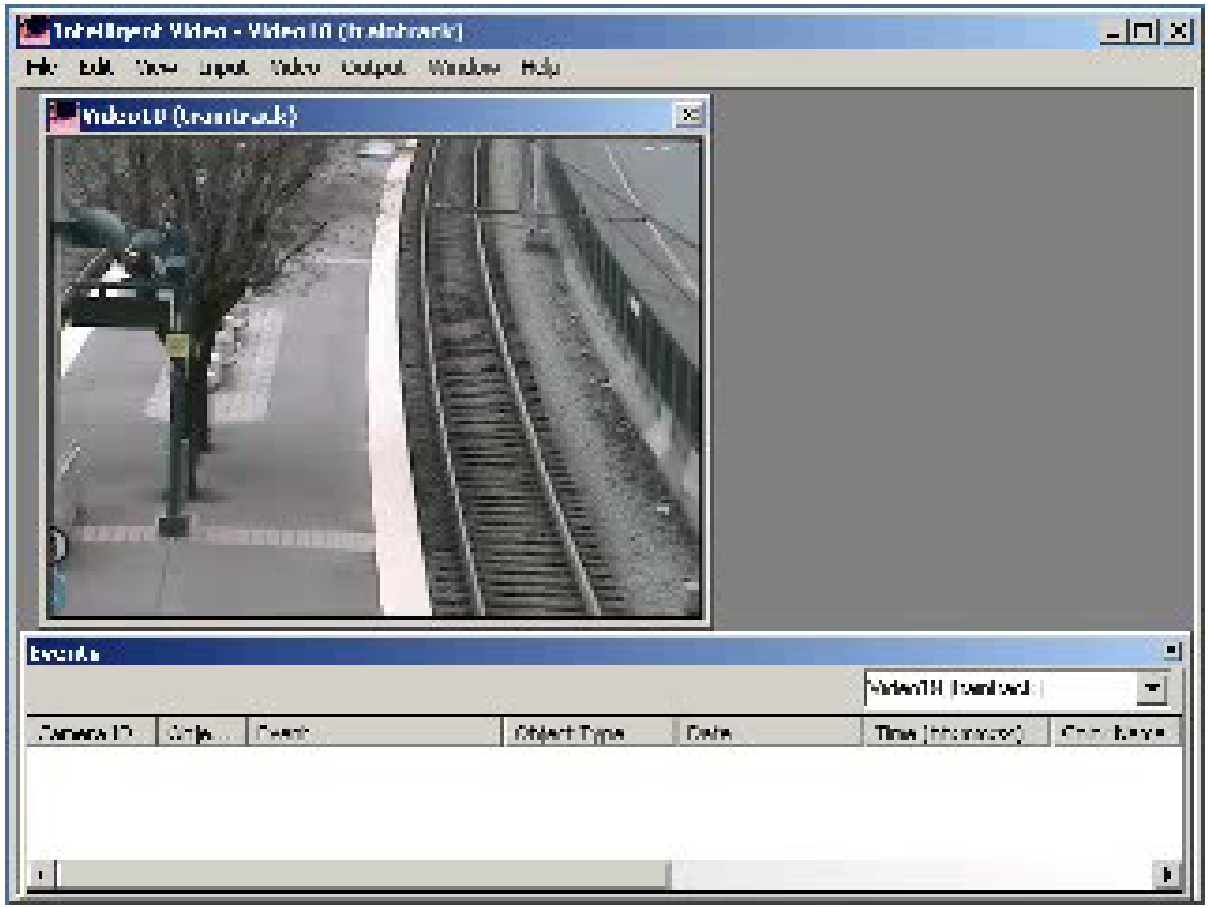
- Black frame, blur and camera displacement detection
- crowd management, forensics,left object/removed object, motion detection, people counting
- perimeter/intrusion detection, smoke detection, suspicious behavior detection, traffic law enforcement
- waiting line measure, wrong way movement detection

# IntelliVision -- 1



- Intrusion Detector
- Motion Detection
- Video Counter – count people, vehicle or other objects
- Object Left Detector
- Asset Protector (object removal)
- Auto Tracker – PTZ camera
- Intelli-Search

# IntelliVision -- 2



Intrusion Detector - Intrusion Detector provides automated perimeter monitoring and secure area protection.

# IntelliVision -- 3


Asset Protector - Asset Protector continuously monitors an area to detect removal of assets/valuable property from the scene.

# IntelliVision -- 4


Video Panorama - Video Panorama dynamically "stitches" and combines multiple camera views into one large panoramic view.

# IntelliVision -- 5


Face Recognizer - Face Recognizer detects, recognizes and records people's faces that appear in a camera's field of view.

# IntelliVision -- 6

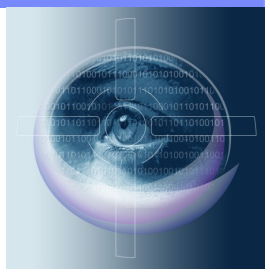


Video Counter - Video Counter is an intelligent video-based counting solution that processes video streams in real-time to count people, vehicles and other objects.

# IntelliVision -- 7

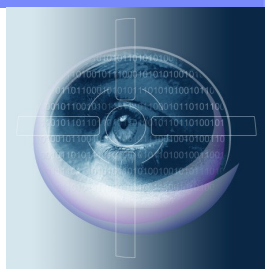

Video Stabilizer - Video Stabilizer is a robust and reliable solution to stabilize the video output from any camera.

# iOmniscient - 1



- Abandoned object detection
- Theft detection
- Counting
- Tracking
- Slip and fall detection
- Perimeter protection

# iOmniscient - 2



Demo1 Demo2

**Intrusion Detection**

Demo1 Demo2

**Counting**

Demo1

**Slip and Fall**

Demo1 Demo2

**Non-motion Detection**

Demo1

**Sensitive Night Motion Detection**

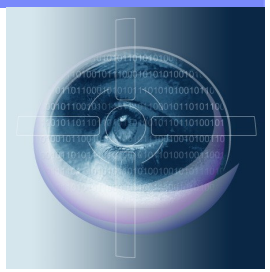
Demo1 Demo2

**Tracking and Classification**

Demo1

**LPR**

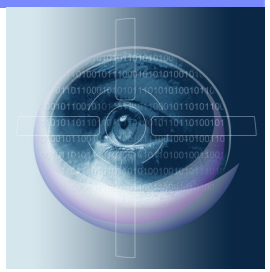
# ObjectVideo



- Unauthorized entry through restricted areas
- Gate monitoring for vehicle size, pedestrian use

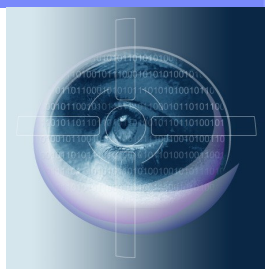
- People or vehicles loitering around facility perimeter
- Tailgating through secure access doorways
- People approaching doors after hours
- Delivery/loading area activity
- Suspicious objects left behind
- Objects appearing/thrown into the area
- Camera tampering

# Sarnoff



- Tracking (Single camera, PTZ, multiple cameras,moving camera, stereo)
- Mosaicking and blending technologies
- Supper Resolution
- Video to 3D model alignment
- V4V (vision for vehicles)

# Siemens -- 1



- In research:
- Object detection, tracking, and behavior analysis (tunnel monitoring)
- Face and Vehicle Detection
- Dual-camera monitoring

# Siemens -- 2

Bayesian Kernel Tracking.

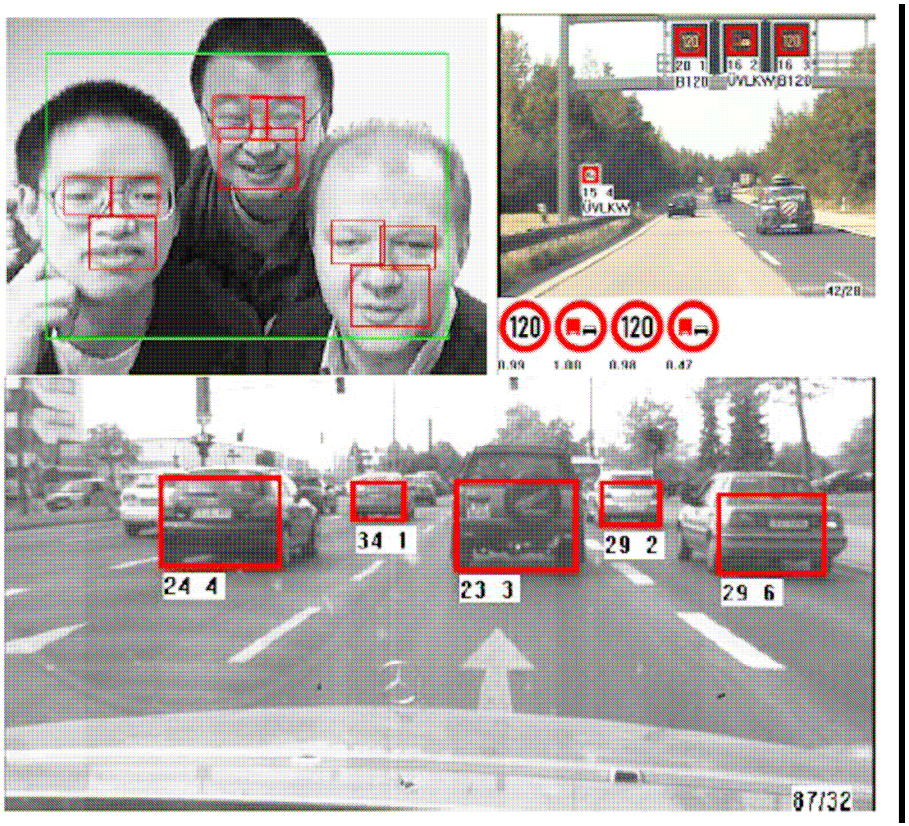
From paper “Real-time vision at Siemens Corporate Research” Ramesh, V.
Dept. of SCR Real-Time Vision, Siemens Corp. Res., Princeton, NJ, USA; **AVSS 2005.**

# Siemens -- 3

A dual-camera monitoring system

From paper “Real-time vision at Siemens Corporate Research” Ramesh, V.
Dept. of SCR Real-Time Vision, Siemens Corp. Res., Princeton, NJ, USA; **AVSS 2005.**

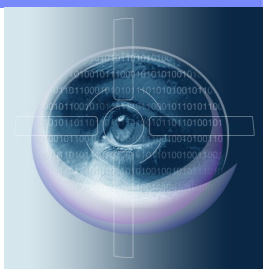
# Siemens -- 4




Face and Vehicle Detection

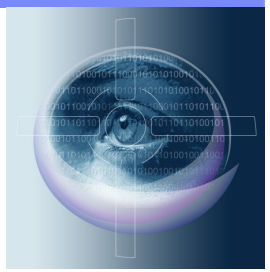
From paper “Real-time vision at Siemens Corporate Research” Ramesh, V.
Dept. of SCR Real-Time Vision, Siemens Corp. Res., Princeton, NJ, USA; **AVSS 2005.**

# Vidient -- **SmartCatch**



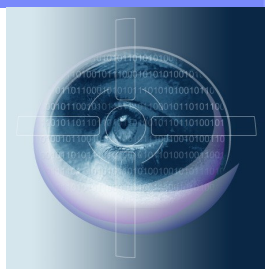
- Crowd size estimation
- Queue length and traffic speed computation.
- Detecting ppl in wrong traffic direction.
- Object tailgating (human/vehicle)
- Loitering near secured areas
- Intrusion detection for secured areas.
- Removed object detection
- detecting stopped vehicle near sensitive area.
- Turnstile violation detection.
- Unattended object detection
- People/Vehicle counting with traffic direction.
- PTZ tracking.

# Verint -- Nextiva



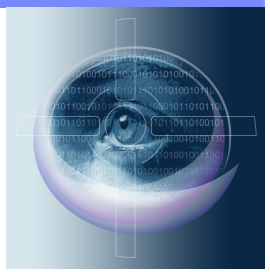
- customer counting
- return fraud detection
- link tlog data with video.
- Pattern analysis of customer behaviors.
- detect object blocking exits
- vehicle counting in parking lot
- Loitering detection and perimeter detection
- Tailgating
- scene stitching, panorama
- camera tampering.

# VideoIQ



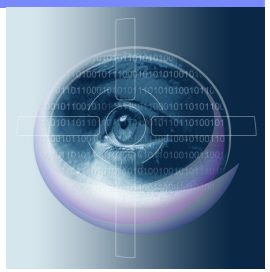
- Heat Map Generation (entire store)
- Face Capture
- Object Tracking
- Directional people counting

# VideoMining



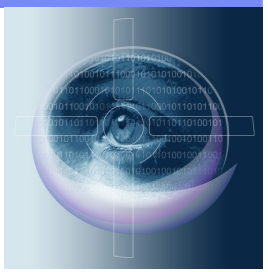
- Heat Map Generation (entire store)
- Face Capture
- Object Tracking
- Directional people counting

# Virage



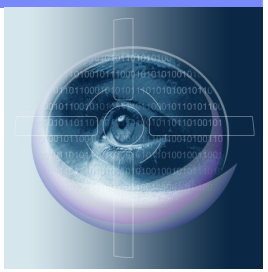
- Object Detection / Tracking
- Counting and behavior analysis
- License plate recognition
- Audio Recognition
- Point-of-Sale analysis (TLOG)

# Vis-a-Pix



- **Vis-a-Pix-IQ 100**
- People counting
- Object detection and tracking
- License plate detection
- Vehicle Detector, with linking to driver/owner information
- Detection with classification (human, animals, cars, etc).
- Detection of directional traffic violation.
- Intrusion detector.
- Waiting time estimation

# References

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- Vis-a-Pix (http://www.visapix.de/en/)