Video Analytics?

- **Real Time Detection, Classification and Tracking of Objects** in Video Streams
- **Actionable Information to add value**, e.g.,
  - **Real Time Alerts** upon Violation; Forensics and Statistical Processing
- **Intelligence in Video surveillance leads to a More Productive, More Responsive, More Reliable System**
- **Video Analytics is a proven tool; solutions exist even in mission-critical systems**
  - However, not a Panacea!
System Architecture View

- Central Server -
  - Remote
  - Local

- Network Edge -
  - Lower Density Server
  - Within the Camera

- Other Configurations May Be Desirable Due To System Reliability and Bandwidth Considerations

Video Analytics Deployment @
Video Analytics @ the Edge

Advanced And Open Video Analytics Architecture

Video Source: MJPG/MPEG4 formats or RGB/YUV Image
API: C/Java/Socket Interface for Metadata from Framework and Image Transfer
Metadata: Output Byte streams provided to ease applications development; Customer Applications: Developed by Customers, 3rd parties.
Applications Results. VMS Integration
Communications Manager*: Protocol-Specific
A Sensible Video Analytics System Provides..

- Single Framework Unifies All Core Video Analytics Requirements; Delivers a Versatile Video Analytics Platform
- Architecture Drives Flexibility and Scalability at Central Server, Network Edge including Camera-embedded Single Camera, Multiple Applications
- Framework/APIs
  - Designed to Integrate With Any System
  - Pre-Specified Metadata Eases New Customer Specific Applications
- Automated Modeling for Sensors, Light Conditions & Cameras
- Compatible with most video formats: MJPG, MPEG4, RGB,YUV,....
- Efficient Environment For integration of 3rd Party Video Management System
- OS Platform independent – Windows, Linux/Unix, Embedded Systems, etc.

Need for Standards is Critical!

- Almost all OEM and Software Companies, today, use Proprietary and Manufacturer Specific Specifications and APIs to Interface to Their Product Offerings
  - IP Cameras (including PTZ...) or Encoders
  - DVRs/NVRs/Servers
  - Video Analytics Products
  ......
- Many Larger Vendors Require Use of Proprietary SDKs!
- Growth in Business and Products in Recent Years Has Led to a Unsustainable Present-Day State For For Both End-Customers and Product Vendors
Emerging Standards for Video Surveillance

• Two Standards Organizations Since 2008
  ONVIF: Open Network Video Interface Form, and
  PSIA: Physical Security Interoperability Alliance

Have Proposed or Released Compliance Specifications

• Considerable Overlap Between the Competing Bodies

• Scope, Applicable to Any Networked Device, Includes:
  - Discovery of Device (via a VMS)
  - Device Management/Settings (PTZ, IP addresses..)
  - Image Configuration (Frame, Resolution..)
  - Streaming (Video, Audio, Metadata..)
  - Events (Video analytics..)

Unique Characteristics of Video Analytics Software

• Pixel Level Processing
  (FG/BG modeling, 2-D filtering, morphological operations)
  – Locality; smaller data memory
  – Similar operations
  – Suitable for parallel processing at macro-block level

• Object Level Processing
  (Segmentation, tracking, histograms)
  – Computationally less demanding
  – Random access to bigger memory
  – Suitable for scalar processing

• Much Less MAC Intensive Algorithms Relative to Voice, Broadband Modems, etc.
**Video Analytics: Application Examples**

**People Detection and Tracking**

- People Detection and count: Number of people entering and exiting a zone; Foot-fall mode (overhead camera)
- People approaching a restricted area
- Intrusion detection or zone monitoring; Multiple zones
- Persons in unauthorized zones
- Single or multiple tripwires
- Loitering in designated locations
- People/Object tracking
- Automated face detection and capture for access control or security log; multiple camera views
- Tailgating through secure access area
- Crowd and Queue Monitoring, Statistical Counting

**Video Analytics: Application Examples**

**Vehicle Detection and Tracking**

- Presence of vehicles via vloops, Example: automated traffic signal control
- Illegal or unauthorized parking
- Vehicle moving in wrong direction
- Traffic congestion
- Traffic statistics data collection
- Vehicle approaching unauthorized area
- Stop-line violation
- Other traffic applications

License Plate Reader and Verification:

- Residential or enterprise access
Video Analytics: Application Examples

Objects Detection and Tracking

- Object, left unattended in designated area
- Artifact protection- theft or disturbance
- Obstructions in designated rail or traffic areas
- Smoke and fire detection

General

- Security camera tampering
- Network tampering

Video Analytics Management Server System

- Video Analytics Enabled Video Server & Management Event Triggered Indexing, Viewing, Archiving and Retrieval; Higher Productivity and Responsiveness
- Logical Grouping of Cameras Image Stitching; Saves BW
- Access to Live or Recorded Video- Anytime, Anywhere via Internet/Intranet; Browser Interface
- Event Based Alert: Via communications manager- SMS, Email, Phone
- Database: Statistical Analysis, Forensics, etc.
- Access/Administrative Controls
Video Analytics for Indian Traffic Signal and Management

Traffic Management

US and European Roads  Moulali Junction, Kolkata
Indian Traffic Conditions

Indian Traffic Conditions Are Challenging

• Challenges
  Dusty air, Unstable power….
  – Reduced Visibility, Image clarity, Flickering
  – Scattering of Light is Random
  – High information contents are also highly noisy

  Disciplined Driving, Strict Lane Rules/Concept Rare

• Traditional Traffic Offerings, suitable for Western roads, are Ineffective

• Innovation and Customization Required For A Zero or Low Error Tolerance System
### Video Analytics Example: A Solution in Demanding & Mission Critical Applications

#### Ingredients for A Sustainable Solution

- First Hand Awareness of the Environment/Challenges
- Accessibility & Focus; Development & Operational Teams
- Technology Provisions for Customized and Adaptable Solutions

### Innovations That Led To A 24X7 Automated Traffic Control Solution

- Customizations in Background Modeling
- Customizations in Edge Segmentation & Object extraction
System Diagram For ATCS @ Each Junction

- IP-Cameras
- Switch
- Server
- Junction TL Controller
- Traffic Signals
- Traffic Control Room
- Vehicle Detection Module
- Traffic Control Modules

R²A Vehicle Authentication DEMO

- License Plate No.
- Event Log
- Brand Details
Summary

• Video Content Processing is in its infancy
  Applications Have Only Been Deployed Since ~ 2005

• This Technology Has An Enormous Strategic Value, as
  Applications Proliferate in Diverse Areas
  Transportation, Robotics, Medical, etc.

• Off the Shelf Analytics Was Over-Hyped In Early Years
  Leading to Disappointments

  There Is A Better Alignment Today Due To
  Improved Products from the Industry and End Users Expectations

• High Value Applications Require Focused Execution

Thank you

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