Determining Video Quality Requirements for Public Safety Applications

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“Putting First Responders First”
Outline

• Introduction
• Scope
  • Video applications for Public Safety
  • Parameters of Quality
• Measurement of Quality
• Future work
• Conclusions
Introduction

• SoR: Statement of Requirements for Public Safety Communications Interoperability
  • Volume 1
    – Developed for DHS by SAFECOM, NIST/OLES and NTIA/ITS
    – Contained qualitative requirements for video
    – No quantitative requirements for video
    – Latest version released October 2006.
  • Volume 2
    – ITS tasked with determining quantitative requirements for video
    – First version released August 2006
Scope

• SoR Goal: specify network performance parameters to meet these applications' [mission-critical video] quality of service needs.

• To make the project realistic, we must determine
  – Application areas to be covered
  – Parameters of quality to be addressed
  – Measurement system to be used
Public Safety Video Applications

• Tactical – remotely directing events
  – SWAT
  – US&R robots (PerMIS)
  – Fire fighting (visible spectrum cameras)
• Live Surveillance – real-time monitoring
  – In-car police cameras (IACP)
  – Commercial (SWGIT)
  – Sporting events
• Forensics – recorded evidence (LEVA)
• Future: Telemedicine, IR cameras, other??
Quality Parameters

What do we mean by “quality?”

• Content
  – Acting, composition, lighting

• Optics
  – Dynamic range, focus, resolution

• Channel: capture and transmit
  – Frame rate, compression, network loss

• Display
  – Pixel aspect ratio, color map
Quality Parameters, con’t

What is the intended use for the video?
• Level of discrimination required
  – General elements of the action
  – Class recognition
  – Positive ID (face, object, alpha-numeric)
• Relative size of the targets (object, head) of interest
  – Percentage of the frame occupied
• Relative complexity of the scene
  – How much motion
  – How many objects
Measuring Quality

• The ITU has published many standards for measuring and modeling video quality
• These methods are based on the application of passive entertainment
  – Randomly selected viewers report perceived quality
• Public Safety video is used to perform recognition tasks
• ITS has developed, and submitted to the ITU, a test method to measure the quality of task-oriented video
• Subjective tests are being performed at ITS
  – Expert viewers perform tasks
Quality measurement test method

• Viewers are asked to perform tasks:
  – Detect target presence
  – Report target characteristics
  – Target positive ID

• Methods:
  – Multiple choice
  – Alpha-numeric entry
  – Real-time vs. playback controlled

• Video impairments
  – Compression, network errors
Example
Test Output

• Example with three parameters
  – Scene complexity [low/high]
  – Target size [small/large]
  – Network packet loss rate [none/low/high]
  – One set compression rate
Plan for SoR Volume 2

• Given the application’s:
  – Target size
  – Complexity of scene
  – Level of discrimination required

• SoR V2 will provide guidelines for:
  – Compression requirements
  – Network (packet loss) requirements
Future Work

• Biometrics
  – Observer facial recognition
  – Automatic facial recognition
• Telemedicine
• Fire
  – IR and night vision
  – Specific testing for “smoke reading”
• Emerging technology
  – Error concealment
  – Compression algorithms
Viewers Needed

• Experts in
  – Forensic video (February ’08)
  – Live surveillance
  – Fire

• Details
  – Free trip to beautiful Boulder, CO
  – Travel paid, but not time
  – Test takes approximately 2 hours
  – More details at www.its.blrdrc.gov/psvq
Conclusions

• SoR Volume 2 will assist Public Safety organizations determine their video equipment requirements.
• Goal is to prevent agencies from over- or under-specifying video equipment purchases.
• Test methods and scenes can be provided for equipment evaluation.
• Many organization’s efforts can be coordinated (IACP, PerMIS, SWGIT, etc).
• Need first responders for subjective testing.