Time Series Algorithm Development For Long Wavelength Video-Based Fire Detection for Volume Sensor

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Advanced Volume Sensor Program

- Real Time Detection System
- Optical and Acoustic Data
- Detect: Fire, Explosion, Pipe Rupture, Flooding
- Detect events faster than conventional detectors with fewer false alarms
- "Data Fusion" computer receives data/analysis from multiple sensors/computers
- Meet Damage control requirements on future ships with established manpower
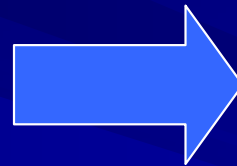
Long Wavelength Video-Based Fire Detection

- Fires give off much more red and near-infrared radiation than their surroundings

- Use cameras that only detect long-wavelength radiation so that fires stand out

- Luminosity: Sum of pixel intensities in a frame of video

- Basic Algorithm Requirements:
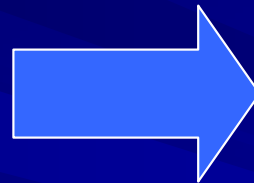 - Threshold
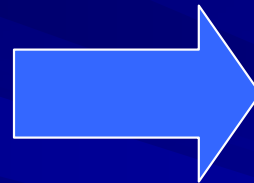 - Persistence

Fire in FOV
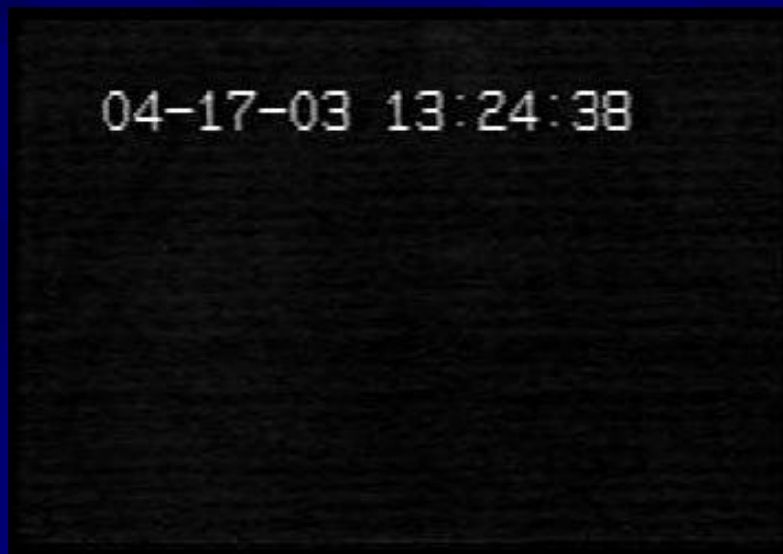
CVNX-51B

Reflected Fire

VS1-09A

Fire In Adjacent Compartment
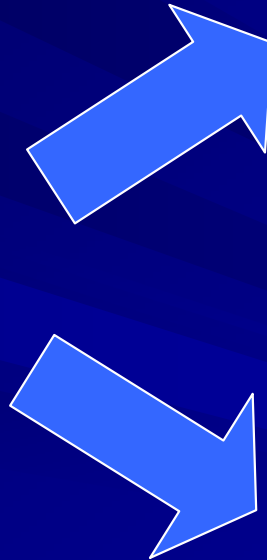

CVNX-46B

Smoldering Fire

VS1-01B

Bright Nuisances

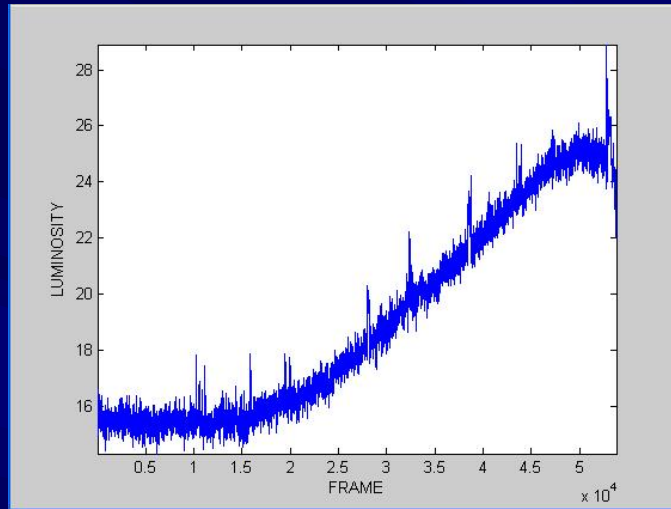VS1-19A

04-23-03 10:50:55

04-23-03 10:47:12
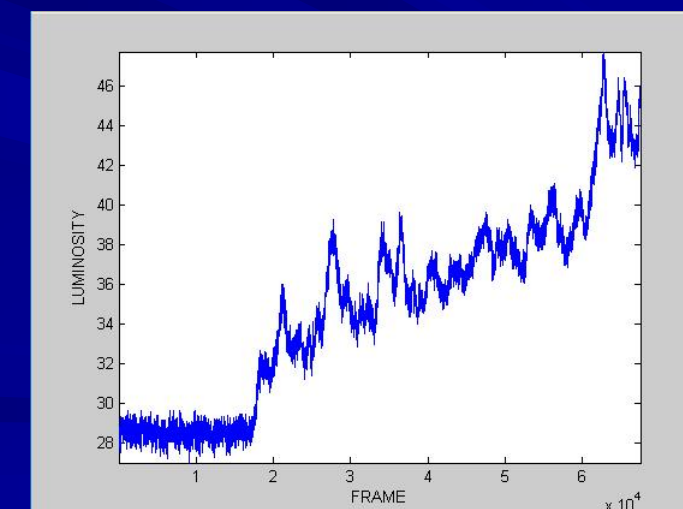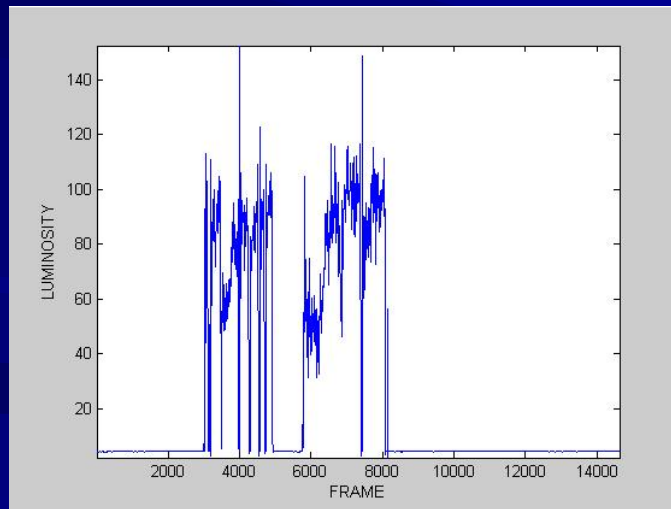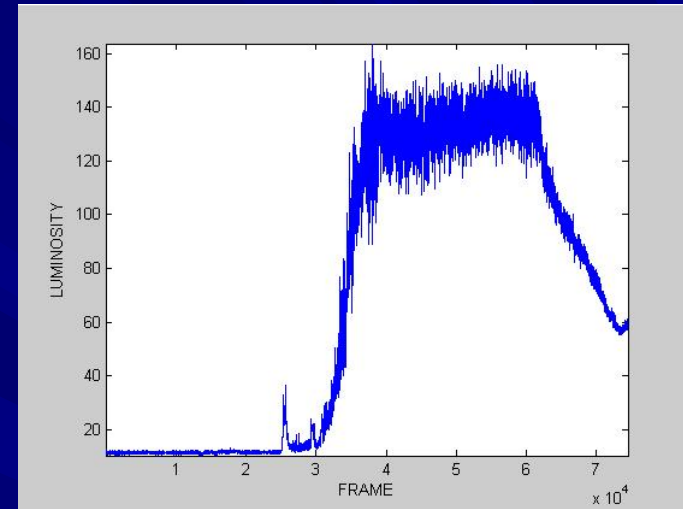
VS1-19A

04-23-03 09:25:55

VS1-16A

Luminosity Profiles

Hot Object (CVNX-48B)

Fire (CVNX-51B)

Welding (VS1-19A)

Smoldering Fire (VS1-01B)

Data Analysis

Calculate Background Luminosity

↓

Read Current Frame and Find Its Luminosity

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Calculate Current Values of Standard Deviation and Average Difference

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Use current values to tentatively classify event and increment the appropriate count

↓

Use event counts to update event classification

OR

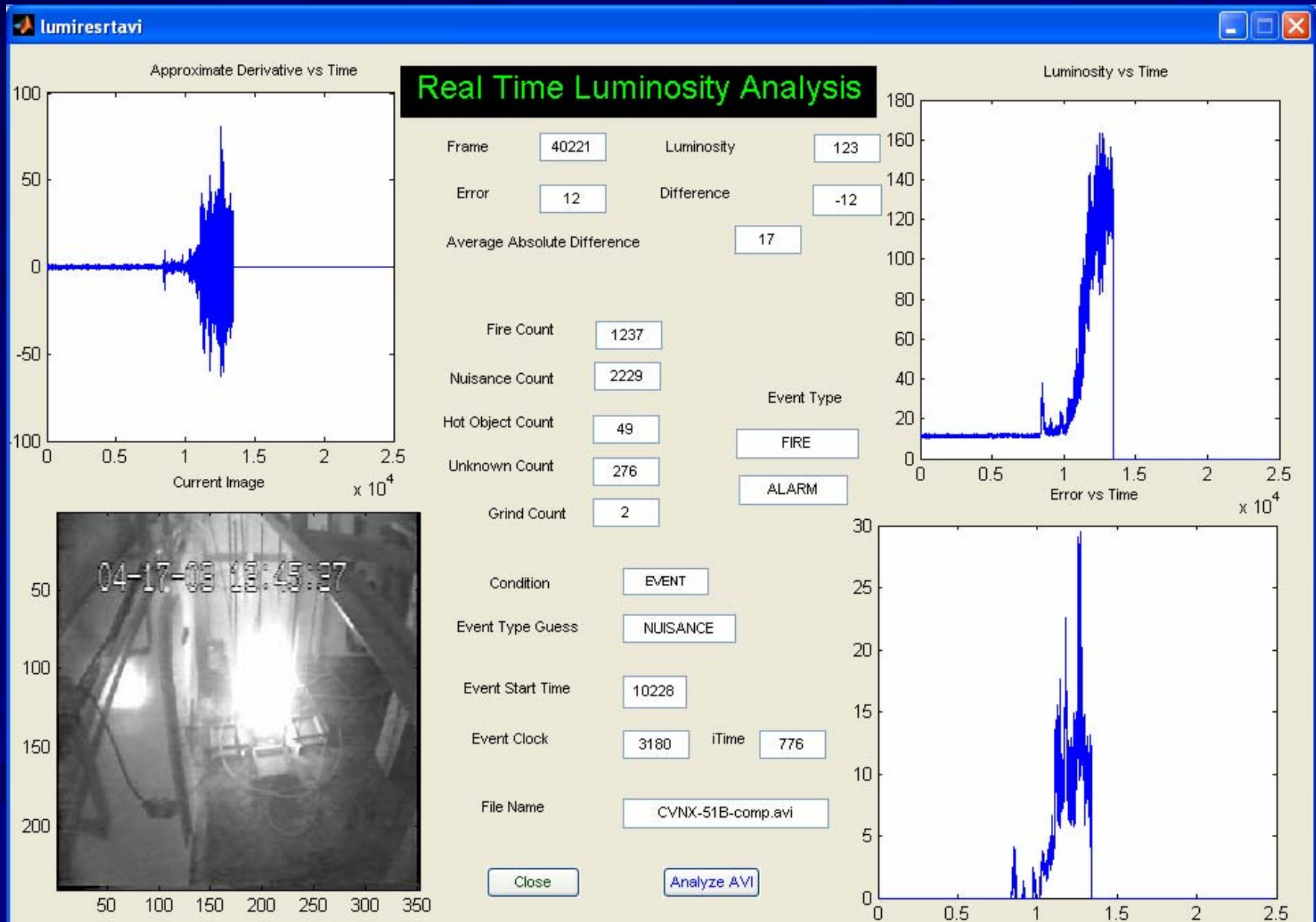Check for alarm conditions and trigger alarm if necessary

↓

If there are more frames, read the next frame

OR
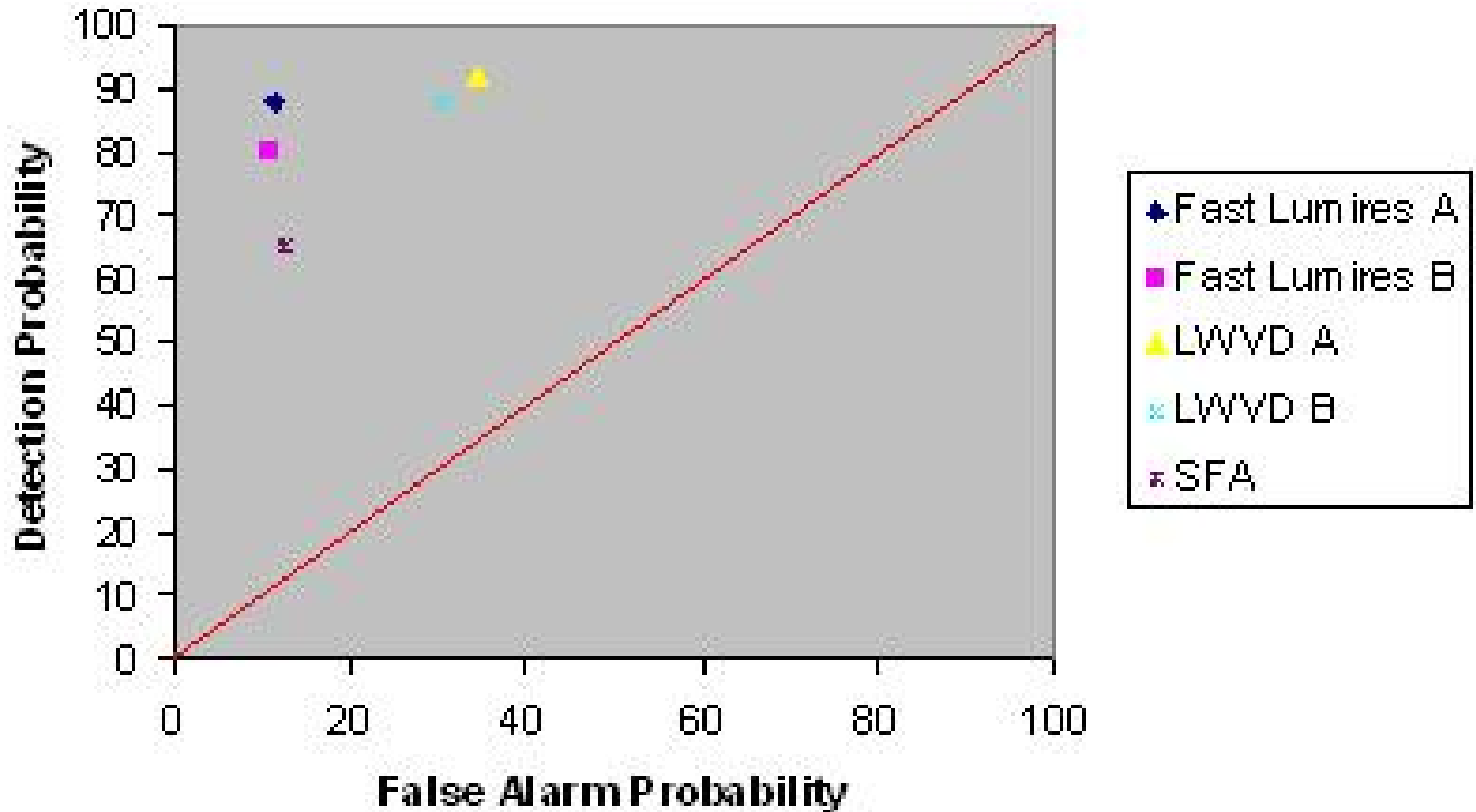
If there are no more frames in the video, output alarm data

GUI

Test Results

System	False %	Detected %
Fast Lumires A	11.5	88
Fast Lumires B	10.7	80
LWVD A	34.4	92
LWVD B	30.4	88
SFA	12.5	65

Performance

Summary

- Developed a time series algorithm for long wavelength video detection.
- Improved fire detection
- Improved nuisance discrimination
- Faster response times
- Separate alarms for different event types

Acknowledgements

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  - Dr. Susan Rose-Pehrsson, Mentor
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  - SEAP Program