IARPA SINTRA Lightning Talk
Kitware, Inc.

Website: https://kitware.com/expertise

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Kitware Computer Vision Team

Kitware Company Overview

- **Open-source software R&D:** algorithms & applications,
  image & data analysis, training data, integration, & testing
- **202 employees:** ⅓ PhD, ⅓ masters
- **Offices:** Albany, NY; Chapel Hill, NC; Santa Fe, NM; Arlington, VA, Minneapolis, MN; Lyon, France
- **Secure facility:** Albany, NY; 44+ cleared personnel, SCI clearances

Commercial and Government Business Models
- **Commercial: 10% of Revenue**
  - Efficient commercial contract process
  - Commercial business models to suit commercial business needs
- **Government: 90% of Revenue**
  - Efficient government contract process
  - All government-funded software is provided with **unlimited rights** to the government
  - Software released as **open source** when permitted

100% Employee Owned

XAITK

KWIVER

TeleSculptor

VIAME

Computer Vision

ParaView

Scientific Computing

Data & Analytics

Resonant

VTK Visualization Toolkit

Girder

Medical Computing

Software Solutions

iMSTK

3D Slicer

Insight Toolkit

Pulse Physiology Engine

CDash

CMake

kitware.com
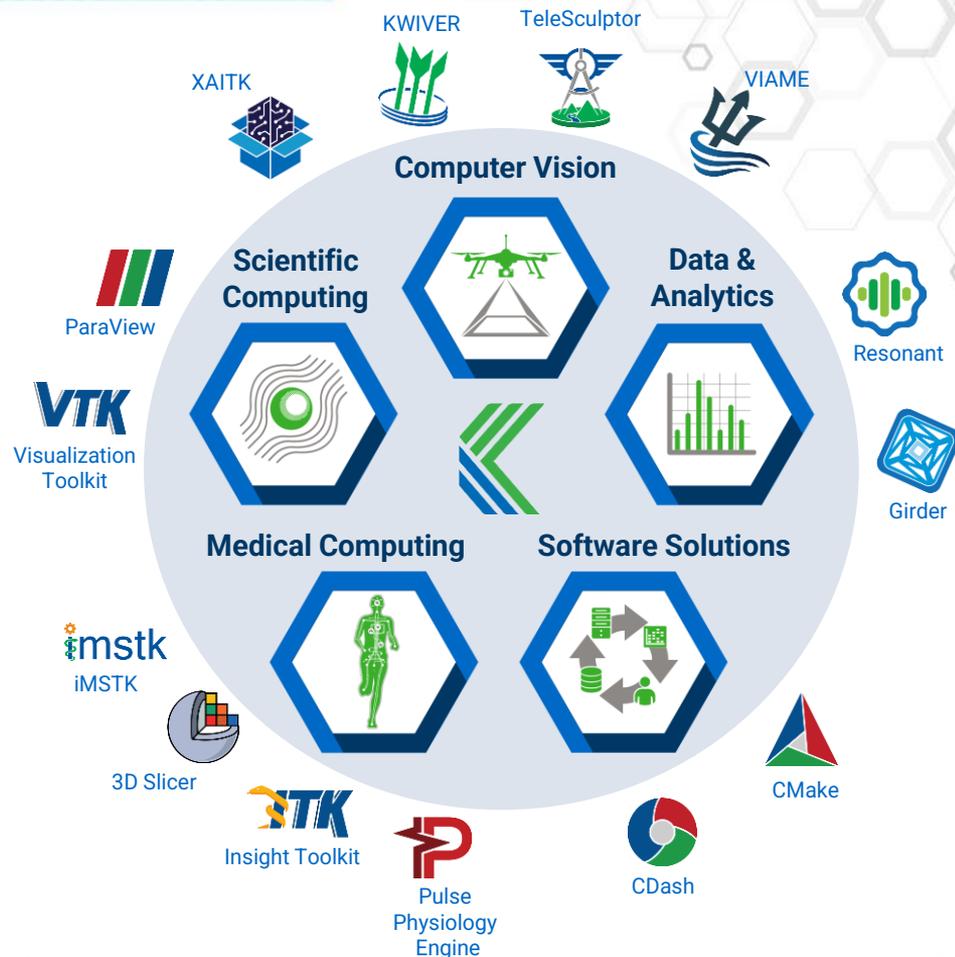
Relevant Experience

Established leader in computer vision and ML R&D for IC and military applications, including 3D vision

- **Extensive CV and ML expertise**
  - 30+ PhDs, 14 years
  - $70M+ in CV/ML R&D contracts from DOD and IC
- **Program Experience**
  - Prime on IARPA SMART, BRIAR, DIVA, CORE3D; DARPA URSA, SemaFor, MediFor, SAIL-ON
  - Multiple SBIRs and programs using event-based sensing: IARPA, AFRL, MDA
- **Data Focus**
  - Satellite imagery, UAV video, and surveillance video
  - Collection, curation, and annotation of large datasets
- **Open IP Business Model**
  - Kitware delivers all program-developed software and algorithms to the government with unlimited rights.

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Detecting Subtle Motion Signatures

- Spatio-temporal deep learning approach, applicable to many sensor modalities
- Temporal gradients (3D convolutions) are critical for detecting movers that are not evident in a single frame
- 3D Sliding Window: each window predicts probability the center pixel is a mover
- Successfully applied to sub-pixel movers in OPIR, improving PD by 10X at same FAR vs. traditional approaches

Volume of Video Frames (e.g. 256 x 250 x 250)

3D Slice DxHxW

3D CNN

Detect the people

LAIR WAMI

Class Probs

Focal Loss

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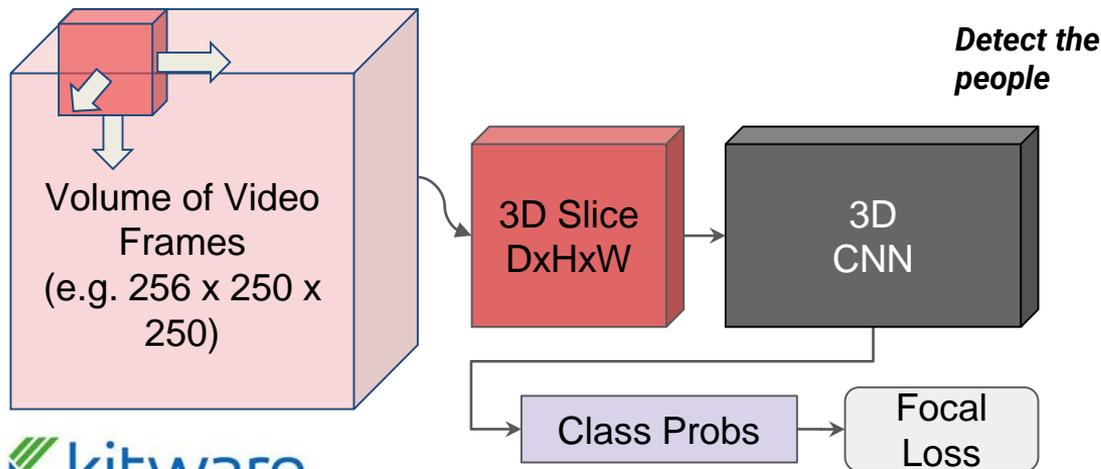
Event Cameras for High-speed Imaging with Low Data Rates and Power Consumption

What does a meteor look like to a(n)...

Low-speed Framing Camera	**High-speed Framing Camera**	**Event Camera**

Low-contrast smear on a dark background, with ambiguities:
- Direction of travel
- Infinite combinations of velocity and brightness that result in the same image.
- Lots of temporal aliasing

Captures phenomenological details, but at high cost in terms of power and data storage.
Downstream analytics struggle with:
- Low SNR
- High data volume
- Low spatial resolution
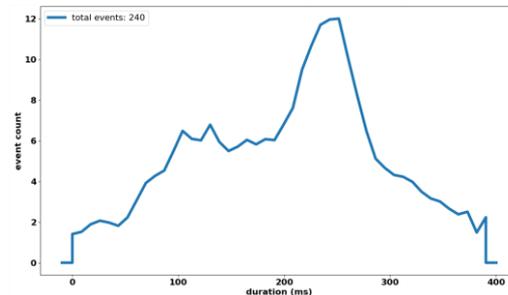
- Captured in sparse, small event stream.
- High temporal resolution resolves ambiguities around direction and brightness/speed.
- Fast temporal response captures phenomenology.

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Teaming Pursuits

<Tentative - subject to BAA details>

Looking to subcontract on a team with:

- ⬡ **a platform and integration experience for space applications and**
- ⬡ **complementary sensing approaches.**

Kitware Mission

Advance the frontiers of understanding by developing innovative open-source software platforms and integrating them into research, processes, and products.

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