Objective
To combine high compute performance with low power requirements for an ever-growing array of vision applications on embedded processors.

Approach
An optimized vision library that accelerates pixel-intensive tasks while providing sufficient flexibility to developers. Key design considerations include:

High granularity: small & well-understood operations

Fixed-point: optimal use of Single-Instruction-Multiple-Data features of embedded DSPs, e.g.,

Data traffic: Direct Memory Access friendly APIs

Example: Moving Object Segmentation

Overview of functions

Background modeling & subtraction
- Luminance Extraction from YUV:422
- Exponentially-Weighted Running Mean & Variance
- Uniformly-Weighted Running Mean & Variance
- Statistical Background Subtraction
- Mixture of Gaussians Background Modeling & Subtraction
- Morphological Operations (Erosion & Dilation)
- Connected Components Labeling

Feature extraction
- Harris Corner Score (7x7)
- Hough Transform for Lines
- Histogram Computation for Integer Scalars
- Weighted Histogram for Integer Scalars
- Legendre Moments
- Canny Edge Detection
- Non-Maximum Suppression
- Hysteresis thresholding

Low-level pixel processing
- Color Conversion YUV:422 interleaved to:
  - YUV planar
  - RGB
  - LAB
  - HIS
- Integral image
- Image Pyramid (2x2 block averaging)
- Non-Maximum Suppression (3x3, 5x5, 7x7)
- Gaussian Image Pyramid (5-tap)
- First-Order Recursive IIR filters (horiz., vert.)
- SAD-based disparity for stereo

Tracking, recognition, etc.
- Lucas-Kanade Feature Tracking (7x7)
- Kalman Filtering
- Neiter-Heid Simplex optimization
- Bhattacharya distance

Summary
- VLIB accelerates computer vision applications for high performance embedded systems. Pixel-intensive computations are addressed through:
  - More than 60 functions optimized on the C64x DSP core
  - Fixed-point implementation
  - APIs friendly to Direct Memory Access operations
- Provides more headroom for innovative algorithms, and enables processing of more channels at higher resolutions.
- Available for free – to request a copy: www.ti.com/vlibrequest

Background modeling & subtraction
Luminance Extraction from YUV:422
Exponentially-Weighted Running Mean & Variance
Uniformly-Weighted Running Mean & Variance
Statistical Background Subtraction
Mixture of Gaussians Background Modeling & Subtraction
Morphological Operations (Erosion & Dilation)
Connected Components Labeling

Feature extraction
Harris Corner Score (7x7)
Hough Transform for Lines
Histogram Computation for Integer Scalars
Weighted Histogram for Integer Scalars
Legendre Moments
Canny Edge Detection
Non-Maximum Suppression
Hysteresis thresholding

Low-level pixel processing
Color Conversion YUV:422 interleaved to:
- YUV planar
- RGB
- LAB
- HIS
Integral image
Image Pyramid (2x2 block averaging)
Non-Maximum Suppression (3x3, 5x5, 7x7)
Gaussian Image Pyramid (5-tap)
First-Order Recursive IIR filters (horiz., vert.)
SAD-based disparity for stereo

Tracking, recognition, etc.
Lucas-Kanade Feature Tracking (7x7)
Kalman Filtering
Neiter-Heid Simplex optimization
Bhattacharya distance

www.ti.com/embedded-vision