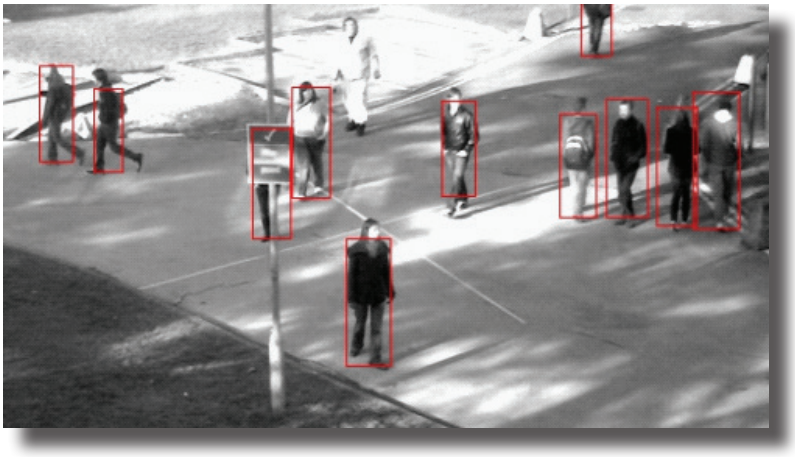
VisionKit™

an application for graphically designing, building, and testing complex intelligent systems

charles river analytics

CAPABILITIES

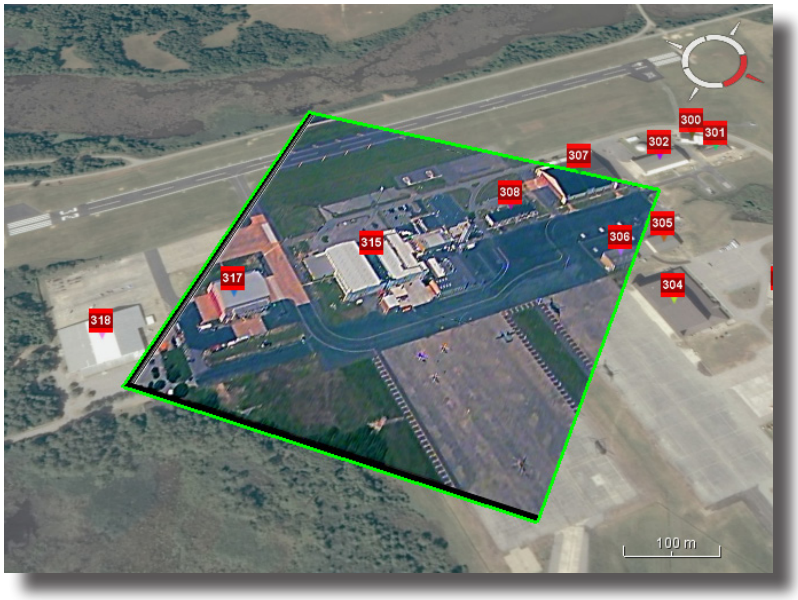


VisionKit™ is a software toolkit for developing real-time sensor processing applications. It provides data acquisition and streaming, along with a broad array of processing and analysis algorithms, specializing in imagery data such as full motion video, sonar, and radar. VisionKit accelerates development time by providing a simple and intuitive application programming interface (API) to complex sensor processing algorithms. While it uses several free software libraries internally, its standards-based, consistent interface frees the application developer from the effort that would be otherwise spent tying together disparate sets of APIs. VisionKit is distributed as a set of cross-platform C++ libraries, currently available for Windows, Linux, and iOS. The first commercial release (v1.0) was announced on June 1, 2007, and includes a subset of the functionality available in our in-house library. Recent examples of applications we have developed using VisionKit include computer vision-based command and control of a mule robot, automatic anomaly detection for video surveillance, and precise real-time geo-registration for intelligence, surveillance, and reconnaissance (ISR) sensors.

ARCHITECTURE

- **Core:** Foundational classes for persistence, networking, timing, data compression, and multi-threading.
- **Math:** Mathematical data structures such as vectors and matrices, linear algebra, numerical algorithms, optimization, and statistics.
- **Image:** Image container classes, streaming, file I/O, resampling/scaling, compression, and image processing (e.g., convolution, morphology).

- **Object Detection:** Framework for creating detectors for arbitrary types of objects using supervised learning techniques.
- **Tracking:** Algorithms to track moving objects, such as particle filtering and multiple hypothesis tracking.
- **Classifier:** Pattern recognition techniques for classifying data, supervised and unsupervised learning, and dimensionality reduction.



VisionKit development began in 2001 as an avenue for Charles River engineers to re-use common algorithms between multiple applications. Some of these early applications included document image enhancement, autonomous robot navigation, and automatic target recognition. While each application had its own unique requirements, (e.g., sensor type, data formats, user interfaces, computer hardware and operating system), a number of commonalities were evident. For example, sensor processing algorithms are often reliant on linear algebra, so we created vector and matrix container classes and common operations such as singular value decomposition and eigenvector extraction. While high-quality free software was available for numeric computations, most were derived from solutions developed decades previously in FORTRAN, before modern object-oriented programming was popularized.

VisionKit was carefully designed in accordance with modern object-oriented design principles. The design also uses conventions in the C++ Standard Library and Standard Template Library (STL). In particular, we discovered that the powerful idiom of containers and iterators is perfectly suited for processing of imagery of varying types using generic programming techniques (i.e., templates). In VisionKit, you can create an image containing arbitrary pixel types, along with iterator types to facilitate efficient processing. Because templates are used to generate code at compile-time, this results in far greater run-time performance than would otherwise be possible. This has allowed VisionKit application developers over the years to consistently deliver high performance real-time solutions for low-cost commodity hardware. For example, Charles River pioneered real-time frame-rate video tracking; VisionKit enabled our complex algorithms to run efficiently on standard notebook processors.

Charles River Analytics Inc. (www.cra.com)
625 Mount Auburn Street, Cambridge, MA 02138
For more information, please contact visionkit@cra.com

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