VISUAL FUSION 3-D Motion Analysis

VISUAL FUSION is the world’s premier motion analysis system. The VISUAL FUSION 3D motion analysis system is designed to automatically detect and track moving objects in a series of images, and provide position, size, shape, and intensity data as a function of time.

Applications include automotive crash test, airbag deployment, missile flight analysis and radiometric signature analysis, particle flow and blast or fragmentation analysis, and biological motion studies (micro and macroscopic).

Tracking & Analysis
VISUAL FUSION can automatically detect and initiate track on many classes of targets. For most other targets (e.g. quad patterns), an initial user target designation will allow auto-tracking throughout the remaining images. Auto-tracking can follow multiple targets on curving trajectories and even through temporary obscuration. Of course manual frame-by-frame target designation and tracking is available as a back-up.

For each target, a time history is saved, including position, size, shape, intensity, and orientation. Track editing features include the ability to combine broken tracks and edit splitting objects.

Powerful Options
In addition to the basic package, optional modules allow you to add application specific functionality in a cost effective manner. These include multi-sensor 3D analysis, single sensor 6DOF, airbag deployment analysis, radiometric calibration, and geometric lens distortion correction.

Easy to Use
VISUAL FUSION is a complete, easy to use motion analysis software package. The highly informative user interface makes it easy for users at any level of sophistication to perform powerful target tracking and motion analysis. Real-time feedback shows the user the status of each tracked object and allows the user to stop and adjust tracking parameters at any point.

Features
- Auto-track over 100 targets even on curving & crossing trajectories.
- Sub-pixel tracking
- Targets may be light or dark contrast, quad pattern, or arbitrary patterns.
- Auto-detect contrast targets.
- Target histories of position, orientation, size, shape, and intensity vs time
- Harmonic analysis of position, intensity
- Derivatives for velocity, acceleration
- Fit to line, for data or sub-regions.
- Multi-target analysis: separation distance, velocity, and angular rates.
- Import external data and plot on same time axis as motion data.
- Lens distortion correction module
- Sophisticated, interactive image and plot display capability.
- High quality, hyper-text user manual.
- Airbag outline shape, leading edge position & velocity, area vs. time.
- Multiple sensor capability for 3D position and orientation.
- Single sensor 6DOF for rigid bodies.
- Blast / Fragmentation analysis: Histogram of radial distribution and speed.
- Radiometric calibration for IR imagery
- Supports TIFF, AVI, Matlab, and raw binary data formats.
- Export data as ASCII files for use in other applications.

Applications
- Automotive Crash & Airbag Deployment
- Animal locomotion studies
- Missile Flight Analysis
- Stores separation
- Particle flow analysis
- Blast / Fragmentation analysis

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VISUAL FUSION was developed by analysts, for analysts. This is evident in every aspect of VISUAL FUSION, from the wealth of image visualization techniques and the flexibility in tracking different targets or editing track files, to the analysis capability inherent in the plotting functions. Technical leadership in the field of motion analysis is demonstrated by the list of publications below.

Automatic Track Initiation

Front provide vivid demonstrations of the ability of VISUAL FUSION to automatically detect and track many objects which change shape and direction on a frame by frame basis. The long red lines indicate prior positions of the targets. To process this imagery, the user tells the software to detect contrast objects but does not specify individual objects. The user may then select any target by simply clicking on it to obtain graphs of position, intensity, or size versus time. Curve fitting or Harmonic analysis (FFT) of the data can be performed with a click of a button. Other options include plotting histograms of speed or radial distribution.

Airbag Analysis

The airbag analysis module allows VISUAL FUSION to track the outline shape of an airbag as it deploys. With a simple button click, the user can overlay the outline shape of the airbag at several different times, plot the leading edge position, either letting the software find the absolute leading edge, or in a user specified direction, and plot the area versus time of the airbag.

3D Analysis

VISUAL FUSION was the first motion analysis package to offer true 3D analysis, using imagery from multiple sensors to triangulate a 3D position and orientation of arbitrary objects. For well characterized rigid bodies, the 6DOF package can compute similar quantities from a single camera.

Data Visualization & Understanding

In addition to state-of-the-art tracking and motion analysis capabilities, VISUAL FUSION provides the user with extensive tools for image viewing and understanding. These include row and column plots, surface relief plots, cursor position and pixel value read-out, image zoom and a magnifier, image or region statistics, and edge enhancement and other filters.

Technical References

- **Transportable Algorithm TestBed (TATB) A software architecture for real-time target detection, tracking, and signature extraction**, J.N. Sanders-Reed, Proc SPIE 2468, April 1995
A Solution for Every Budget

**Visual Fusion** is our flagship product, offering a complete solution for your most sophisticated motion analysis needs.

Begin with our 2D auto-detection, auto-tracking module capable of automatically tracking in excess of 100 targets. This basic package includes full track editing, plotting, and display capability. Add additional modules as needed:

- **Multi-sensor 3D** tracking to obtain 3D position and orientation of unknown or arbitrary targets.

- **6DOF single sensor** tracking to obtain 3D position and orientation of a known, rigid target from a single sensor.

**Visual Fusion Lite** is ideal for the cost conscious, low volume user. VF-lite offers manual target designation and tracking on a frame-by-frame basis, combined with the sophisticated display, plotting, and analysis capability of VISUAL FUSION.

**XgMovie** is our lowest cost product, providing image sequence display and simple manual measurement tools. This provides an ideal image viewer for image sequences.

**VideoAcq** video digitizing system provides DV quality capture of full motion video, better than VHS, S-VHS, or Hi-8.

All members of the VISUAL FUSION family are fully compatible with high speed digital cameras from major suppliers such as RedLake, Phantom, and Weinberger. VISUAL FUSION is also fully compatible with film digitizers, such as the Visual Instrumentation CVS-16. VISUAL FUSION runs on Windows 95/98/NT/2000.

If your needs run more to real-time image processing and tracking, please contact us about our line of precision, real-time trackers used on some of the nation’s most sophisticated programs.

Radiometry module for radiometric calibration and black body equivalent temperature estimation.

Stores Separation

**Airbag analysis** module for shape, leading edge position and velocity, and area versus time analysis.

**Lens distortion** module to correct arbitrary geometric aberrations.

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VISUAL FUSION has been designed to meet the needs of users ranging from casual to expert. It provides the occasional user a simple, easy to use interface, allowing him to immediately obtain results for many standard applications.

VISUAL FUSION provides the more advanced user the ability to adjust and control most of the advanced image processing parameters (e.g. edge enhancement, thresholds, sensor location & pointing), allowing the user to tailor VISUAL FUSION to solve the most demanding problems. Similarly, with minimal information, VISUAL FUSION can provide simple target position in image coordinates (pixels) versus frame number. As more supporting data is made available to VISUAL FUSION, the software can yield more sophisticated results, including 3D position and orientation of targets, radiometric values of targets (radiance, equivalent black body temperature), or correct image defects due to lens distortion.

VISUAL FUSION provides not only advanced automatic detection and tracking options, but also a complete analyst’s toolkit of track editing and target analysis capabilities. Following initial target tracking the user can select a target for detailed analysis in which plots of position or intensity versus time are generated. Additional time series data from external sources, such as accelerometers, can be imported and plotted on the same graphs. Advanced graphical features include Fourier transforms, curve fitting, and derivatives. A data cursor allows read-out of exact data point values.

VISUAL FUSION provides extensive interactive feedback during track processing. Various overlays, such as the centroid position, peak intensity location, x-y extents of the target, outline shape, and second moments, can be toggled on and off. Target position in previous frames is indicated by a line extending from the target.

VISUAL FUSION can read most standard file formats (AVI, TIFF, BMP, binary), and interfaces with most standard cameras and film readers. It works with both IR and visible image sequences. Graphing functions can import files of ASCII x-y data and can export ASCII data for use in other software.

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