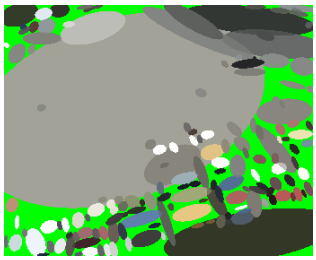
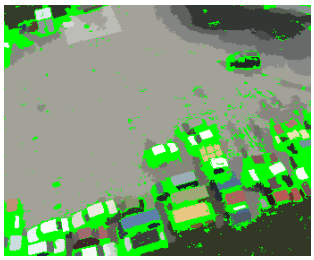
KEEL Technology with Vision Systems
For Image Feature Interpretation

Vision Systems:

Vision Systems extract features from images by various means: sometimes by counting pixels in blobs, sometimes by matching contours, sometimes by measuring dimensions. High speed algorithms process information frame by frame. In some cases, multiple frames are analyzed to detect movement, speed, or changes in the environment.

Sample:

These features can be given names and values representing size, location, and potentially type. This data can be used in real-time control, or can be saved in a database for further analysis and interpretation.

In dynamic, adaptive systems, the vision system may need to adapt to its environment. This is more than just adapting to changing lighting conditions. In some cases the feature extraction “rules” may need to be changed. The vision system may need to change what it is looking for.

In this kind of application, KEEL technology should function as an “expert vision systems operator” and be able to modify the system to achieve the desired results. KEEL Technology should also be helpful in interpreting the vision system’s extracted features along with other information.

A common concept in the use of Vision Systems is to extract a series of features from an image.

These features can be exposed as values that fall within a range of acceptable values, or they can be used to adjust the perspective of the image so other filters can be used. For example, some features may be used to detect the orientation of an object. Once the orientation is known, other features can be extracted for further evaluation.

Once features have been extracted and measured from an image, the next step is to interpret them.

The interpretation process attempts to determine what to do with the observations.

The features themselves are, at least sometimes, independent values, even if they are the result of rotations or extrusions of a part of the overall image.

When interpreting the features, one might be looking for specific patterns. The objective would be to search an image for something. When interpreting an image, however, it is not sufficient to look for features justifying a specific interpretation. One must interpret features that would negate any specific interpretation.

In this light, interpretation is a combination of: a) including reasons supporting an interpretation and at the same time, b) including reasons not supporting an interpretation. This is a balancing act that maps well with the capabilities of KEEL Technology.

When interpreting image features it may be appropriate to include external knowledge or information in the interpretation process.

KEEL provides a mechanism for fusing information from multiple sources when making judgmental decisions about an image.

Some of these external sources may include an assessment of "risk", which could be used to adjust the thresholds for certain decisions or actions.

Another case would integrate "trust", which could be an assessment of external information. It could also be the result of the interpretation of image information.

One of the key outputs of the interpretation of the image information could be the formal establishment of a "trust" value or a confidence value associated with the interpretation of a specific feature set.

While vision systems commonly use the concept of “thresholds” in the detection process, KEEL might be used to control those thresholds. Alternatively, features with confidence factors might be supplied to KEEL Engines so judgment could be applied to an overall solution.

KEEL Technology:

KEEL Technology supports the information fusion needs by allowing a domain expert to model how information should be interpreted in dynamic situations. Qualified features from vision systems can easily be integrated with other information sources to make judgmental decisions.

KEEL models are created using a “dynamic graphical language”, completely without higher level mathematics. This can greatly accelerate the development process, making many applications economically feasible.

KEEL Engines, the cognitive engines that interpret the information, can be integrated into almost any application. These are small footprint, high performance functions that are provided in the source code language of choice. (C, C++, C++.NET, C#, Java, Visual Basic, VB.NET, Flash, Flash Object Model, and PLC Structured Text)

To summarize, KEEL Technology can be used to fuse information from various sources along with the features extracted from an image to validate information and determine courses of action.

Since the KEEL model will be completely explainable and auditable, any model created using KEEL Technology will be correctable and extensible.

This is assumed to be important as new "image features" will be added to image processing systems over time and the effort required to keep the systems up to date must be minimized.

Disclaimer:

KEEL Technology is an information fusion technology. It may or may not be applicable to all vision system / feature interpretation tasks. Any organization attempting to integrate KEEL Technology into a real-time vision based application would be expected to fully evaluate KEEL Technology for the task.

If there are any questions about KEEL Technology and how it might be applied, please contact Compsim at the email address or phone number below.

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