

Andrew C. Rice, Alastair R. Beresford and Robert K. Harle

Cantag is a marker-based machine vision system designed to allow the user to select, and compare, different tag designs and tracking algorithms. It allows investigation into fundamental properties and limitations of particular 2-dimensional marker tag designs. Cantag is open source software written in C++.

1: Tag Design and Algorithm Selection

Many possible tag designs and symbolic coding schemes are available. Cantag has been used to examine the tradeoffs between payload size, decoding error and transformation accuracy.

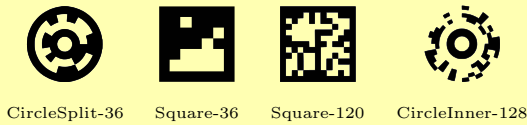


Figure 1: Example tag designs

One important metric is the *minimum sample distance*—the minimum distance from the centre of any data cell to the cell’s perimeter in the camera image. The smaller the minimum sample distance, the more difficult it is to decode the data on the

tag. Figure 2 shows the minimum size in pixels that tag can be reduced to before the minimum sample distance is less than one pixel.

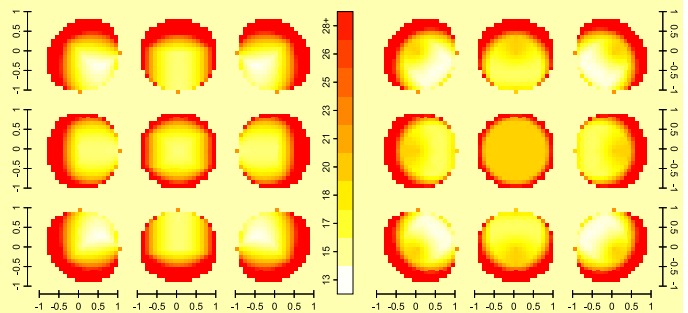


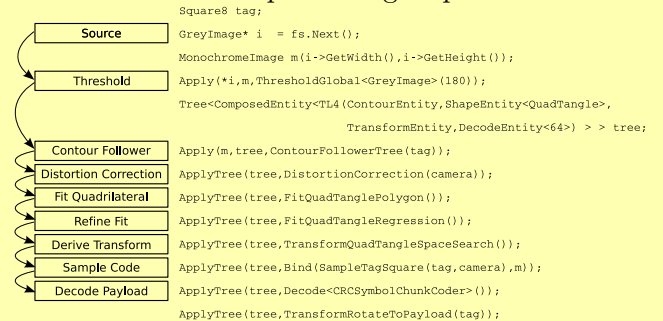
Figure 2: Maximum read distance for Square-36 tags (left) and CircleInner-36 tags (right)

2: Image Sources

Cantag supports multiple types of image source for use with the testing and deployment of the final application. The use of generated images from the OpenGL test harness permits comparison between different tag designs and processing algorithms and iterative refinement of the system. Real-time processing may be applied to image data from video cameras, or batch processing from images and movies stored on disk.

3: Implementation

The programmer writes approximately one line of C++ code for each processing step.



4: Applications

The results from the image processing pipeline have many possible applications. Cantag allows the system designer to use the same algorithm implementation used in testing the tag design to deploy the application. Applications include: barcode reading for object identification, visual overlay onto the image and camera location estimation.



Figure 3: Nine tags are decoded for barcode information

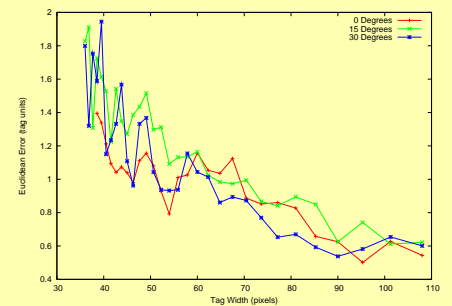


Figure 4: Location Error in 3D position for a circular tag

Papers

- [1] Andrew Rice, Christopher Cain, and John Fawcett. Dependable Coding for Fiducial Tags. In *Ubiquitous Computing Systems, LNCS 3598*, pages 259–274, Springer-Verlag, November 2004.
- [2] Andrew C. Rice, Alastair R. Beresford, and Robert K. Harle. Cantag: an open source software toolkit for designing and deploying marker-based vision systems. In *Proceedings of the Fourth IEEE International Conference on Pervasive Computing and Communications (PERCOM'06)*, March 2006.