Demo: Investigating algorithms in the machine vision pipeline

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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. This demonstration shows a number of possible techniques for recognising square tags. The image processing pipeline may be reconfigured dynamically by displaying the relevant marker tag to the camera.

The following table shows a number of possible configurations of the Cantag pipeline. Each row highlights a particular aspect of the processing pipeline (labelled in the centre column). For example, the row containing cells 3,4,5,6 details the thresholding stage. Cells connected vertically show different stages of the chosen processing pipeline. For example, cells 9,11,13 show the output of a pipeline incorporating (computationally expensive) lens distortion correction. These cells may be compared to cells 7,10,11 which show the output of the pipeline without distortion correction.

The Projective algorithm (direct linear equations) will exactly fit image noise by distorting the object co-ordinates of the overlay

Varying lighting intensity across the image causes false-negatives

Tags on the edge of the image are most affected by lens distortion

Shape fitting quality could be increased by activating the linear regression algorithm to refine the corner estimates

Accumulated error from previous stages causes inaccuracy in the sample points for the data payload

The SpaceSearch algorithm maintains an orthogonal 3D co-ordinate frame

A small window size amplifies noise in the solid regions of the tag

Simple correction (middle) shows little benefit compared to Full correction (right) for the current lens

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