Determination of distances from a 2D picture

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27. maj 2003

Background

With a camera we are taking pictures of a round shaped object. The picture could for example look like this:



Figur 1: Picture

The object appears as areas where the light intensity is highest. A cut from the center of the image and out, is showed in fugre 2. The picutre can be quite noisy. The distance from the center of the picture, to the object correspondes with a physical size of the object. Parts of the object close to the center of the image, has a large physical distance, and parts of the object far away from the center of the image, corrospondes to a small psyical distance. The function that takes the distance in the image and returns the physical distance (called the distance function), is determined by comparing images, of an object, with the object itself.



Figur 2: Intensity plot

Goal

The goal of the study group is to find a method to determine the shape of the object. The shape of the object is represented by a list of points, (x, y), called a frame. The resolution of the shape must be greater than the pixel resolution - eg. we must find a subpixel resolution method. We are taking 25-30 pictures every second, and the calculation is done in real time, so the method must be fast.

Futhermore we want to be able to combine several frames into a 3D model. By using an electromagnetic tracking system, we obtain position and orientation for each frame. This information is used to place each frame in space, so we get a 3D model of the obejct.