Course notes, CS664, 9/9/04

GENERALIZATIONS OF MOTION AND STEREO

- Topics:
  1. Registration
  2. Image restoration, and pixel-labeling problems
  3. Feature-space analysis

REGISTRATION

- Algorithms essentially rely on a similarity measure between images. Consider a set of transformations T; we want to find

$$\arg\min_{t \in T} |I_1 - t(I_2)|$$

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- Image similarity measures have lots of other uses (such as image search). We will see a few algorithms (correlation, color histograms, mutual information, distance transforms)

- A transformation implies a *joint histogram*, which is an important structure. For each pixel $p \in I_1$ there is a paired intensity

$\langle I_1(p), I_2(t(p)) \rangle$. The result is a 2-D histogram.

- With similar (identical?) camera internal parameters and Lambertian surfaces, you expect to see a line with slope 1 at the "right" t.

- Many image comparison algorithms can be viewed as functions of the joint histogram. Simple ones compute the distance from the line of slope 1. Example: L_2 distance.

- Under lots of circumstances you don't really get this line, even at the right t. Example: camera gain and bias, or non-lambertian surfaces. One solution is to fit a line and measure distance from it (you expect slope to be positive — why?) Many statistical methods more or less do this.

- Mutual information is essentially a measure of joint histogram "density". It doesn't care what the line is, or even if there is a line. Very powerful for medical imaging, where the real image transform is so complex.