INVESTIGATION ASSIGNMENT

PART 1: ENTROPY IN IMAGE REGISTRATION

<u>Brief Introduction on Image registration:</u>

We have to deal with the fundamental problem of image (signal) alignment and investigate different techniques to solve the problem using ideas that reside on the boundary of image processing, computer vision and information theory.

Alignment is typically performed on functions defined in a two- or three-dimensional domain, where space is the independent variable. As commonly done in the literature, these functions will be called images. Moreover, the alignment problem will generally be referred to as image registration.

Definition of entropy :
In layman's term entropy can be defined as the lowest possible average number of bits per pixel. It is a quantity which is used to describe the `busy ness' of an image, i.e. the amount of information which must be coded for by a compression algorithm. Low entropy images, such as those containing a lot of black sky, have very little contrast and large runs of pixels with the same or similar DN values. An image that is perfectly flat will have an entropy of zero. Consequently, they can be compressed to a relatively small size. On the other hand, high entropy images such as an image of heavily cratered areas on the moon have a great deal of contrast from one pixel to the next and consequently cannot be compressed as much as low entropy images.

IN CONTEXT WITH IMAGE REGISTRATION

In image registration as we know, there is a processing that aligns two or more images of the same scene taken from different times, different viewpoints, or even different sensors.

To orientate two images by matching corresponding pixels or regions that are considered identical. Based on this concept, it proposes a novel image registration method that applies the information theorem on intensity difference data.

An entropy-based objective function is developed according to the histogram of the intensity difference. The intensity difference represents the absolute gray-level difference of the corresponding pixels between the reference and sensed images over the overlapped region. The proposed registration method is to align the sensed image onto the reference image by minimising the entropy of the intensity difference through iteratively updating the parameters of the similarity transformation.

While implementing the transform function, entropy is being used to resample the target image to the geometry of the reference image.

The information content, namely (Shannon's) entropy of a discrete random variable X that has a probability distribution $pX = (p1,...,pn)$ is then defined as:

$$H(X) = H(pX), Xni = 1pilog(1/pi)$$

where $0log\infty = 0$ and the base of the logarithm determines the unit, e.g. if base 2 the measure is in bits, if it's the natural number e then it's in nats, etc. The term log 1/pi indicates the amount of uncertainty associated with the corresponding outcome. It can also be viewed as the amount of information gained by observing that outcome. Thus, entropy is merely a statistical average of uncertainty or information.

REFERENCES:

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[3] B. Ma, A. Hero, J. Gorman, and O. Michel, “Image registration with minimum spanning tree algorithm,” Proc. of ICIP ’00, vol. 1, pp. 481–484, 2000.