Translational Alignment

The simplest way to establish an alignment between two images or image patches is to shift one image relative to the other

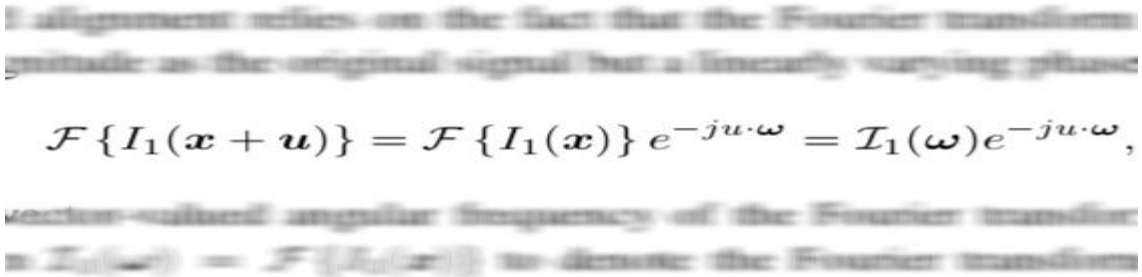
$$E_{\mathrm{SSD}}(\boldsymbol{u}) = \sum_i [I_1(\boldsymbol{x}_i + \boldsymbol{u}) - I_0(\boldsymbol{x}_i)]^2 = \sum_i e_i^2,$$

Hierarchical Motion Estimation

an image pyramid is constructed and a search over a smaller number of discrete pixel is first performed at coarser level.The motion estimate from one level of the pyramid is then used to initialize a smaller local search at the next finer level Alternatively, several good solutions from the coarse level can be used to initialize the fine-level search. While this is not guaranteed to produce the same result as a full search, it usually works very well and is much faster.

Fourier Based Alignment

Fourier-based alignment relies on the fact that the Fourier transform of a shifted signal has the same magnitude as the original signal but a linearly varying phase



$$\mathcal{F}\{I_1(\boldsymbol{x}+\boldsymbol{u})\} = \mathcal{F}\{I_1(\boldsymbol{x})\}\, e^{-ju\cdot\boldsymbol{\omega}} = \mathcal{I}_1(\boldsymbol{\omega})e^{-ju\cdot\boldsymbol{\omega}},$$

Incremental Refinement

To obtain better sub-pixel estimates,This Technique is used. In general, image stabilization and stitching applications require much higher accuracies to obtain acceptable result. This is based on a Taylor series expansion of the image function.

Spline Based Motion

> Most image motion is too complicated to be captured by parametric motion model (low dimensional model) Represent the motion field as a two-dimensional spline controlled by a smaller number of control vertices.

$$u_i = \sum_j \hat{u}_j B_j(x_i) = \sum_j \hat{u}_j w_{i,j}$$

where B is basis functions and only non-zero over finite support interval and

w_{ij} are the weigths to emphasize the motion field region

Spline Based Motion⇒ Advantage

>> Coarse-to-fine Strategy reduces computational time.

>> Excel at representing smooth elastic deformation fields.

>> That is why it is used in Medical Imaging.