**Affine Transformation** on Images - Translation, Scaling and Interpolation

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Point (Geometric) Operations；做图像transformation

Similarity: 缩小transformation；Euclidean：旋转transformation

Diagram

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An **affine transformation** is an important class of linear 2-D geometric transformations which maps variables into new variables (e.g., from x1, y1 to x2, y2) in an output image by applying a linear combination of **translation, rotation, scaling** and/or **shearing(菱形变型)** operations.

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以上是translation的式子

Graphical user interface

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以上是图片scaling的式子，它与translation不同的是，它用到**乘法**

What are **affine transformations**？

解：就是图片transformation，可以进行**旋转，增大，缩小**，**变型**等等

**DARTEL**：Diffeomorphic Anatomical Registration Through Exponential Lie Algebra）

也是affine transformation的一种

DARTEL提供more accurate inter-subject registration of brain images.

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此为DARTEL VBM；左上为原图，下面一堆都是算法；当原图+算法，会得到output，然后经过下一层

做VBM的步骤：

Reorientation，Segmentation，Run DARTEL，Normalization + smoothing，Statics

**Molecular imaging**

Visualization，characterization，and quantification of **biological processes** at the cellular and molecular levels

把图片弄成像分子一样，来学习

**Image registration**

Bringing two or more images into spatial correspondence；就像图像合并

Graphical user interface, website

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Image registration大概图

**Similarity** measures

找出图片的共同点

Text, letter

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以上都是常见的similarity measures的公式

T = transformation

Correlation：共同点

**Intensity**：图片里的信息集中部分

Graphical user interface

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一般如何找出图片的共同点？

解：如果两张图片非常不一样，我们可以**先把他们进行transform**/改变；然后在那两张进行改变后的图片里，找出共同点

Calendar

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三种不同类型的transformation；图片第二种就是Affine Transformation

Interpolation：插入信息

Image intensities always results in **loss of information** except under very special conditions.

**ResNet** (Residual Network)

Residual Network (ResNet) is a Convolutional Neural Network (CNN) architecture that overcame the “**vanishing gradient**” problem, making it possible to construct networks with up to thousands of convolutional layers, which outperform shallower networks.

为什么添加越多的layers，就不会增加accuracy呢？

解：因为添加越多的layers，会有**vanishing gradient**的出现

A screenshot of a computer

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左边是最优化的路径，当你添加更多的layers(变成图右)，就会降低准确性，并会出现vanishing gradient

如何解决vanishing gradient？

解：利用**normalization initialization**

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Description automatically generatedDiagram

Description automatically generated

如果我们当左图是最优解，当我们再添加layers会降低accuracy，那么我们要做的就是如右图ResNet，走shortcut路径，不是走中间那条