Image Registration Tutorial

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Objective

• Guiding you step-by-step through the process of automatically registering two structural MR datasets acquired on two different subjects using rigid and non rigid registration

• This tutorial is built upon the Registration Case Libray 31 tutorial available at http://www.na-mic.org/Wiki/index.php/Projects:RegistrationLibrary:RegLib_C19
Registration algorithms bring multiple image data sets into spatial alignment, in order to achieve anatomical agreement.
By applying the registration transform to the initial volume $I_1$, we’ll generate a new volume spatially aligned with the volume $I_2$. This allows the extraction of complementary information from the two volumes.
Dataset

• The dataset includes two T1-weighted and T2-weighted MR scans acquired on two healthy subjects.

• The dataset is Registration Case 19 of the NA-MIC registration case library (P.I. Dr. Dominik Meier, Ph.D.)
Registration pipeline

Step 1:
Subject A, T2 to T1 registration

Step 2:
Subject B, T2 to T1 registration

Step 3:
Subject B, T1 to Subject A, T1 registration

Image courtesy of Dominik Meier, Ph.D.
Subject A: Data loading

Welcome

Load DICOM Data
Load Data
Customize Slicer

Feedback
Share your stories with us about how 3D Slicer has enhanced your work.
We are always interested in improving our software. Your feedback is essential.
See more at http://www.3dslicer.org

About
The Main Window
Loading and Saving
Display
Mouse & Keyboard
Data Probe

Subject A
Subject B
Subject A_T1.nrrd
Subject A_T2.nrrd

3D Slicer 4.4.0-2015-05-21
Subject A: Data loading
Subject A: Data loading
Subject A: Data loading

Welcome to Slicer

Load DICOM Data
Load Data
Customize Slicer
Download Sample Data

Welcome

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L
F
B
Subject A: Initial mis-registration
Subject A: Initial mis-registration
Subject A: Data registration
Subject A: Data registration

- **Diffusion MRI Analysis**
  - **Sonia Pujol**, Ph.D.
  - NA-MIC ARR 2012-2014

**3D Slicer**

- **Module**: General Registration (BRAINS)
- **Fixed Image Volume**: SubjectA_T1
- **Moving Image Volume**: SubjectA_T2
- **Slicer Linear Transform**: Xf0_SubjectA_T2_to_T1

Output Setting:
- **Output Image Volume**: None

Transform Initialization Settings:
- **Initialization transform**: None
- **Initialize Transform Mode**: Off

Status: Idle
Set Initialization mode to **UseCenterOfHeadAlign**

Set Registration Phases to **Rigid** and **Affine**
Subject A: Data registration

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Subject B: Data Loading
Subject B: Data Loading

Select a reader to use for your data:

Any Data

OK Cancel

Scene Model: Transform
Filter:
- MRML Node Inspector
- DataProbe
Subject B: Data Loading

Add data into the scene

Choose Directory to Add

Choose File(s) to Add

[ ] Show Options

File

Volume

Volume

Nodes

Scene

View1

Red

Yellow

Green

Default Scene Camera

SubjectA_T1

X0_SubjectA_T2_to_T1

SubjectA_T2

Scene Model: Transform

[ ] Display MRML ID's

[ ] Show Hidden nodes

Filter:

MRML Node Inspector

Data Probe

Red  RAS: (-32.5, -188.9, 64.0)  Axial Sp: 1.2

None

F SubjectA_T1 (32, 189, 64) 42

B SubjectA_T2 (40, 194, 38) 267

F: SubjectA_T1 (30%)  B: SubjectA_T2
Subject B: Initial mis-registration
Data Registration

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Subject B: Data Registration

- Diffusion MRI Analysis

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Parameter settings:
- Fixed Image Volume: SubjectB_T1
- Moving Image Volume: SubjectB_T2
- Percentage of Samples: 0.002
- B-Spline Grid Size: 14,10,12
- Slicer Linear Transform: Xf1_SubjectB_T2_to_T1
- Slicer BSpline Transform: None
- Output Image Volume: None

Transform Initialization Settings:
- Initialization transform: None
- Initialize Transform Mode: Off

Status: Completed 100%

Restore Defaults | AutoRun | Cancel | Apply
---|---|---|---

Data Probe L F B
Subject B: Data Registration

Set Initialization mode to **UseCenterOfHeadAlign**

Set Registration Phases to **Rigid** and **Affine**
Subject B: Data Registration

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Subject B: Data Registration
Co-registration of Subject B to Subject A
Non rigid registration of Subject B to Subject A

Set the Percentage of Samples to 0.2
Set the B-Spline Grid size to 3,3,3
Non rigid registration of Subject B to Subject A

Set Initialization mode Off
Set Registration Phases to Bspline
Co-registration of Subject B to Subject A
Visualizing the transform

Select the module **Transforms**

Click on the **Display** tab and select **Visible in 3D view**

Select the Region **SubjectB_T1_Xf3_transformed**
Visualizing the transform
Visualizing the transform
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