8DC00 Medische Beeldanalyse

# Project 1 - Registration

## Report

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Group 3

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# Introduction

# Methods

# Results

In the following table 1 the target registration error (TRE) are mentioned after affine transformation of the moved image.

#### Table 1. Point-based affine image registration

|  |  |
| --- | --- |
| **Intra-modal registration** | **TRE** |
| 1\_1\_t1 vs 1\_1\_t1\_d | 22.80 |
| 3\_3\_t1 vs 3\_3\_t1\_d | 12.27 |
| **Inter-modal registration** |  |
| 1\_1\_t1 vs 1\_1\_t2 | 10.65 |
| 3\_3\_t1 vs 3\_3\_t2 | 8.76 |

In table 2 the values of the normalized cross-correlation (NCC) or mutual information (MI) are mentioned of affine intensity-based registration. The values are mentioned based on the standard parameters of the rigid transformation ([0, 0, 0]) or affine transformation ([0, 1, 1, 0, 0, 0, 0]). Also, the values of NCC or MI based on the optimal transformation calculated after the gradient ascent are mentioned. The TRE is also metioned in table 2. A complete overview with the values of the learning rate and the resulting optimal transformation matrix is shown in appendix A.

#### Table 2. Intensity-based image registration (NCC = normalized cross-correlation, MI = mutual information)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Registration method** | **Used images** | **Result NCC or MI**  **Before optimalization** | **Result NCC or MI**  **After optimalization** | **TRE** |
| Rigid Intra-modal | 1\_1\_t1 vs 1\_1\_t1\_d | NCC = 1 | NCC = 1 | 5.10 |
| Affine Intra-modal | 1\_1\_t1 vs 1\_1\_t1\_d | NCC = 1 | NCC = 1 | 18.21 |
| Affine Inter-modal | 1\_1\_t1 vs 1\_1\_t2 | NCC = 0.53 | NCC = 0.54 | 213.02 |
| Affine Inter-modal | 1\_1\_t1 vs 1\_1\_t1\_d | MI = 3.02 | MI = 1.92 | 2.20 |
| Affine Inter-modal | 1\_1\_t1 vs 1\_1\_t2 | MI = 0.72 | MI = 0.85 | 157.95 |
|  |  |  |  |  |
| Rigid Intra-modal | 3\_3\_t1 vs 3\_3\_t1\_d | NCC = 0.60 | NCC = 0.63 | 444.88 |
| Affine Intra-modal | 3\_3\_t1 vs 3\_3\_t1\_d | NCC = 0.60 | NCC = 0.74 | 193.38 |
| Affine Inter-modal | 3\_3\_t1 vs 3\_3\_t2 | NCC = 0.56 | NCC = 0.60 | 118.94 |
| Affine Intra-modal | 3\_3\_t1 vs 3\_3\_t1\_d | MI = 0.63 | MI = 0.83 | 122.35 |
| Affine Inter-modal | 3\_3\_t1 vs 3\_3\_t2 | MI = 0.71 | MI = 0.82 | 97.27 |

# Discussion

The discussion section should contain the analysis of the results

# Appendix

### Appendix A – A complete overview of the values used for the optimalization of the intensity-based registration

*Table 3 – The used learning rate (mu) and resulting initial parameter vector for the optimalization of the intensity-based registration*

|  |  |  |  |
| --- | --- | --- | --- |
| **Registration method** | **Used images** | **Learning rate (mu)** | **Best initial parameter vector** |
| Rigid Intra-modal | 1\_1\_t1 vs 1\_1\_t1\_d | 0.0001 | [1.55e-06, 2.24e-06, -2.19e-06] |
| Affine Intra-modal | 1\_1\_t1 vs 1\_1\_t1\_d | 0.0001 | [0, 1, 1, -9.31e-08, -8.34e-08, 3.19e-07, 5.03e-09] |
| Affine Inter-modal | 1\_1\_t1 vs 1\_1\_t2 | 0.00001 | [0, 1, 1, 0.0024, -0.0025, 0.0019, -0.0019] |
| Affine Inter-modal | 1\_1\_t1 vs 1\_1\_t1\_d | 0.00001 | [0, 1, 1, 2.32e-03, 8.89e-04, 1.16e-03, 1.22e-04] |
| Affine Inter-modal | 1\_1\_t1 vs 1\_1\_t2 | 0.001 | [0, 1, 1, 0.058, -0.050, -0.30, -0.078] |
|  |  |  |  |
| Rigid Intra-modal | 3\_3\_t1 vs 3\_3\_t1\_d | 0.0015 | [-0.031, -0.088, -0.015] |
| Affine Intra-modal | 3\_3\_t1 vs 3\_3\_t1\_d | 0.0015 | [0, 1, 1, 0.0033, -0.081, -0.021, -0.094] |
| Affine Inter-modal | 3\_3\_t1 vs 3\_3\_t2 | 0.001 | [0, 1, 1, 0.047, -0.044, -0.053, -0.079] |
| Affine Intra-modal | 3\_3\_t1 vs 3\_3\_t1\_d | 0.001 | [0, 1, 1, 0.0030, -0.080, -0.042, -0.10] |
| Affine Inter-modal | 3\_3\_t1 vs 3\_3\_t2 | 0.001 | [0, 1, 1, 0.051, -0.061, -0.069, -0.066] |

# References

<http://library.msri.org/books/Book46/files/07kostelec.pdf>

<https://link.springer.com/content/pdf/10.1007%2F978-1-4471-7320-5.pdf>

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