Cast Registration

Bruno 7/10/2008

Goal

- Register the Cast (CT) in MRI

Approaches

- Manual registration
- Semi-automated registration
- Fully-automated registration

Approaches

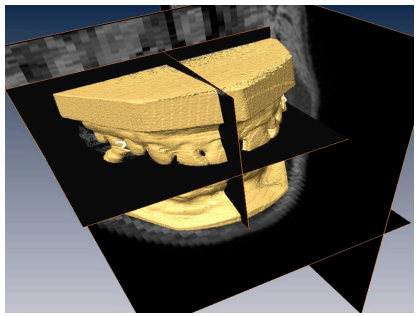
1. Hand aligned (manual)
2. Hand Selected markers (semi-automated)
    1. MRI data
    2. CT data

➡Manual registration

Registration

1- Hand Aligned

Hand Aligned



Merge

MRI + CT

1

2

➡ Semi-automated registration

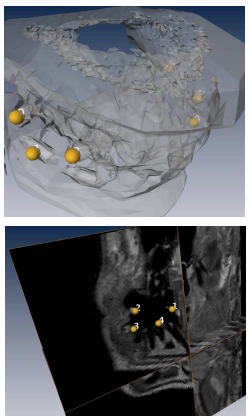
Registration

2- Hand Selected Markers

Manual

Selected Markers MRI

Selected Markers CT



1

A - Rotation

T - Translation

S - Scaling

Rigid body Least Square

Find A,T,S

2

Transform A, T, S

Apply A,T,S

3

Automated

Merge MRI + CT

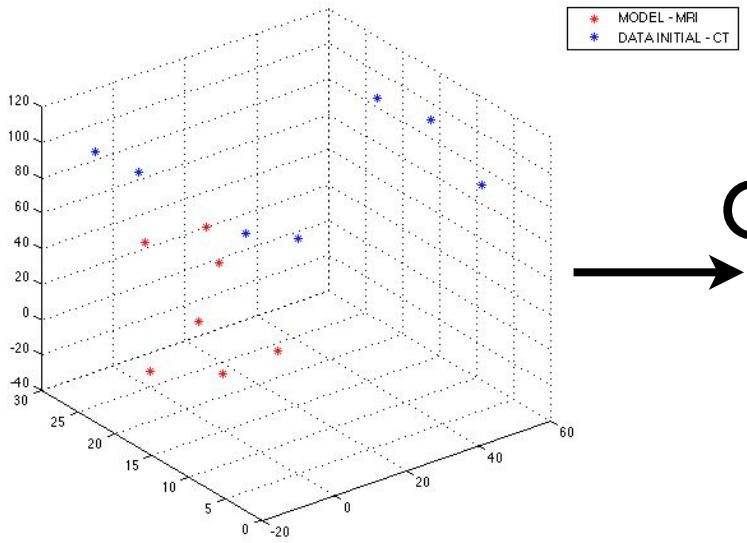
4

➡Semi-automated registration

Registration

2- Hand Selected Markers

2

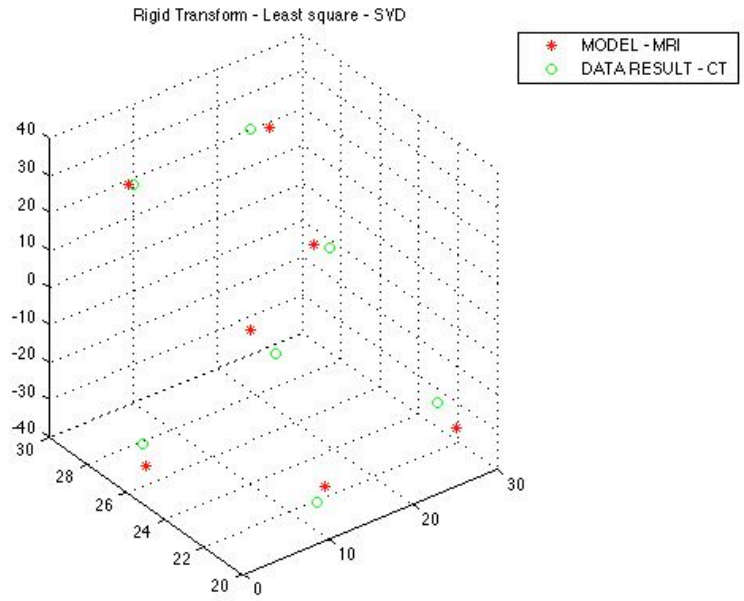


Input

Rigid body transform

Optimization

Least Square



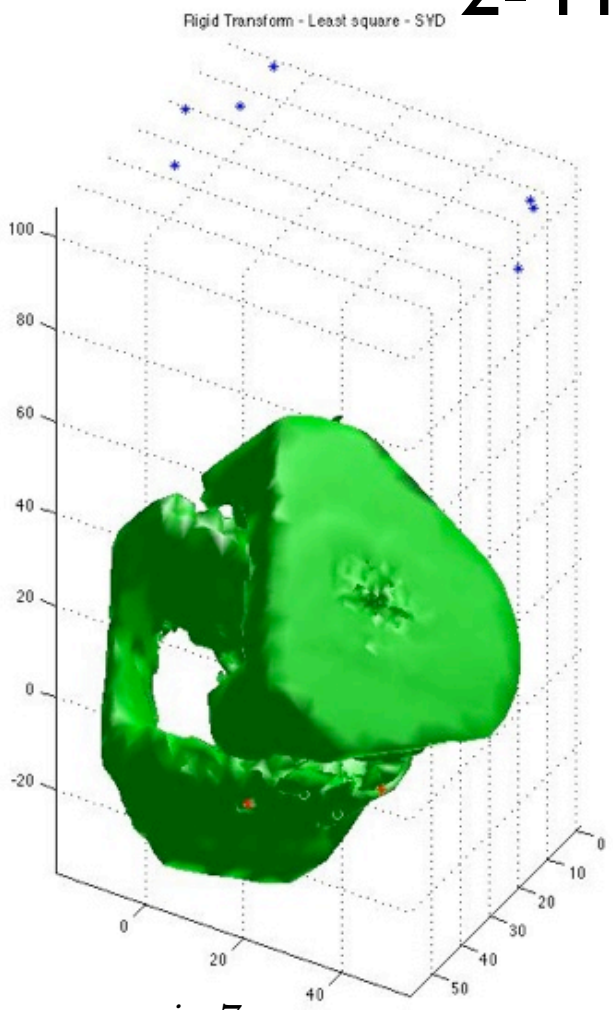
Output

➡ Semi-automated registration

Registration

2- Hand Selected Markers

3



$$A = \begin{bmatrix} -0.0553 & -0.9917 & 0.1161 \\ -0.0152 & -0.1154 & -0.9932 \\ 0.9984 & -0.0567 & -0.0087 \end{bmatrix}$$

$$T = \begin{bmatrix} 16.3909 \\ 120.9540 \\ -18.0446 \end{bmatrix}$$

$$S = 0.9408$$

?

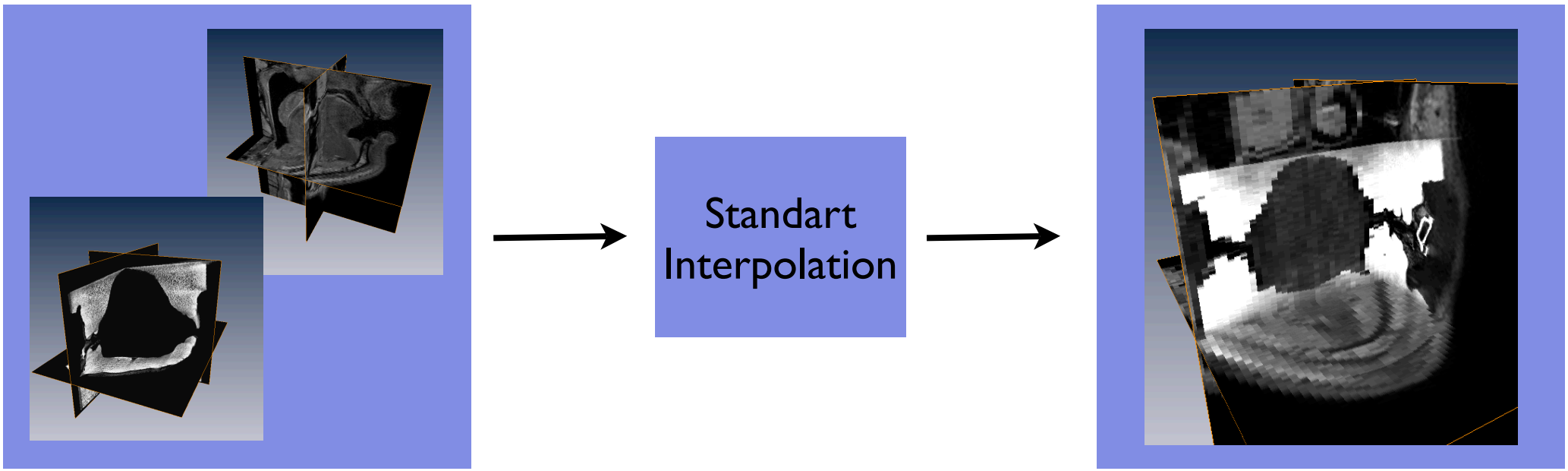
$$error = \sum_{i=1}^{i=7} \sqrt{(p_{ixmri} - q_{ixct})^2 + (p_{iymri} - q_{iyct})^2 + (p_{iymri} - q_{iyct})^2)} = 7.004$$

➡Semi-automated registration

Registration

2- Hand Selected Markers

4

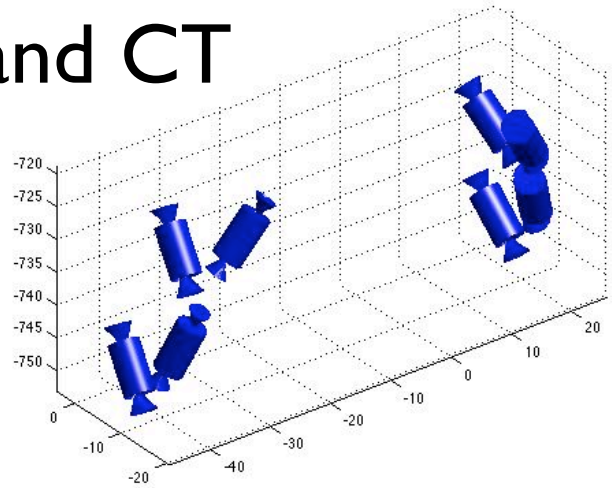


Results

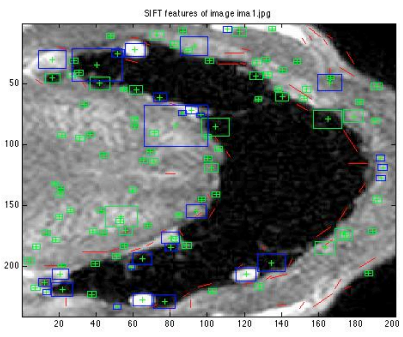
Future Work

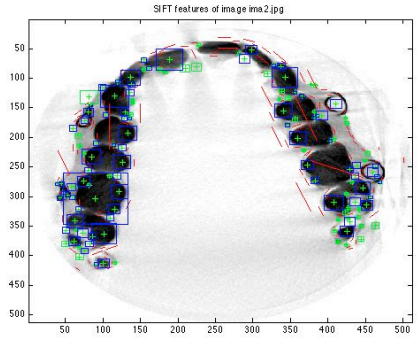
➡ Fully-automated registration

- Find Centroids of markers in MRI and CT
  - All data;
  - markers areas;



- Find SIFT features in CT and MRI
  - All data;
  - markers areas;

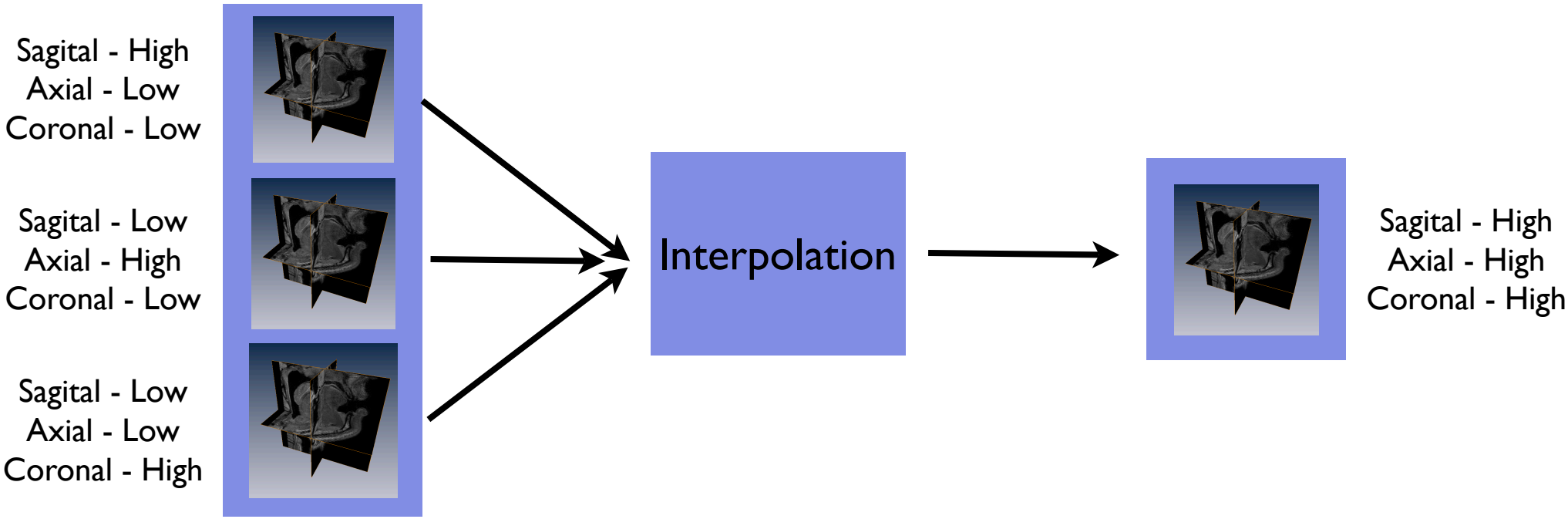




Future Work

- ITK toolbox or Amira Registration - Mutual Information - Correlation - Euclidean

- ITK - MRI interpolation



References

[1] Chetverikov et al., 2005. "Robust Euclidean alignment of 3D point sets: the trimmed iterative closest point algorithm". Image and Vision Computing. v23. 299-309.

[2] Kaneko et al., 2003. "Robust matching of 3D contours using iterative closest point algorithm improved by M-estimation". Journal of the Pattern Recognition Society. v36. 2041-2047.

[3] Shinji Umeyama. "Least-Squares Estimation of Transformation Parameters Between Two Point Patterns." IEEE Transactions onPattern Analysis and Machine Intelligence. Vol. 13, No. 4, April 1991.