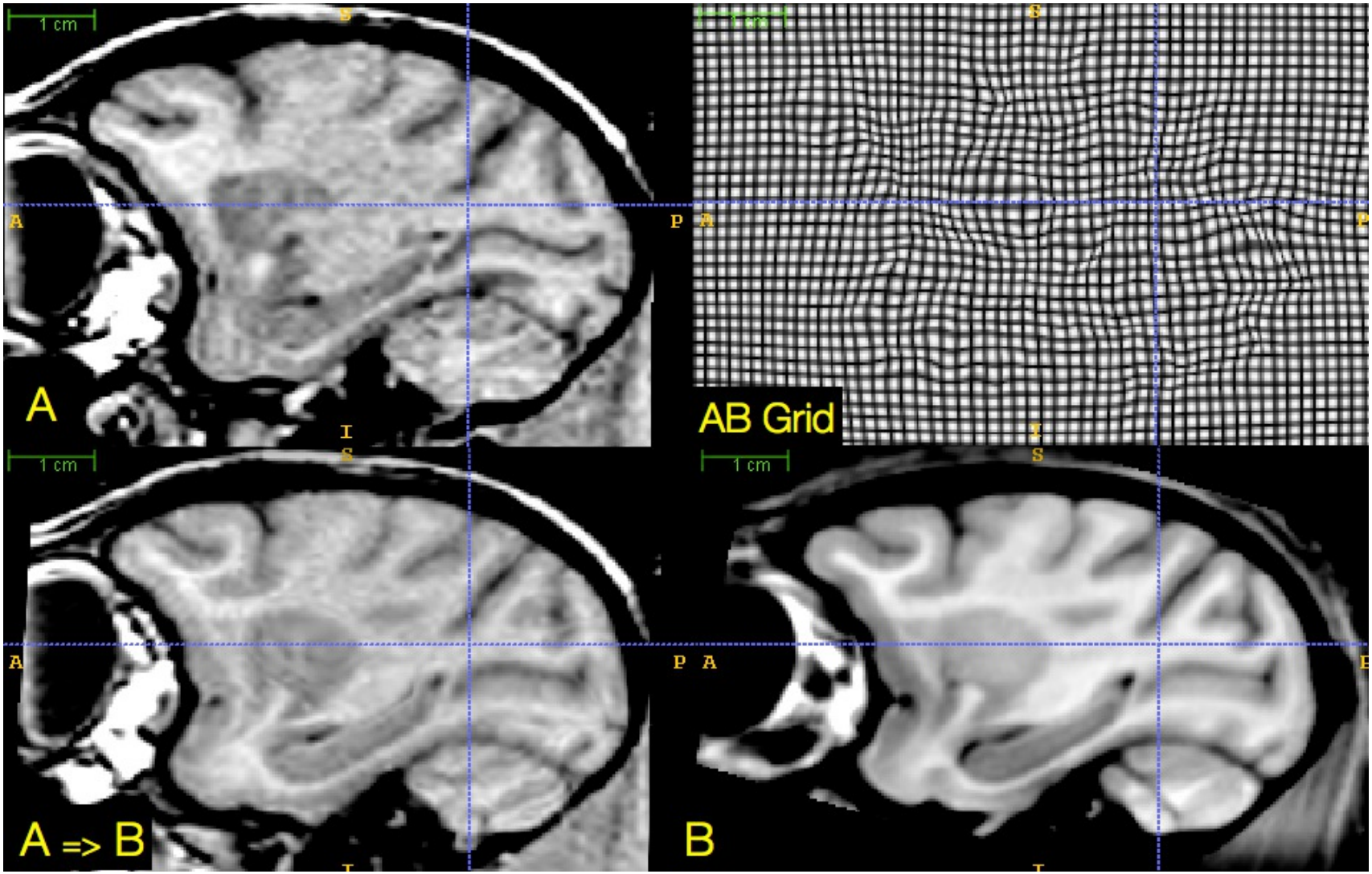
ANTs and WMHs

James Stone and Nick Tustison

ANTs beginnings: image registration



ANTs tools

- MRI bias correction
- image denoising
- image and point set registration
- n-tissue segmentation
- template building
- multi-atlas label fusion
- brain extraction
- cortical thickness estimation
- ANTsR for statistics and visualization

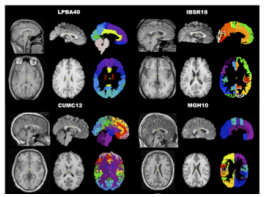
publicly available: https://github.com/stnava/ANTs

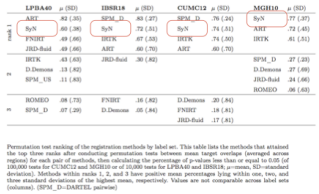
Competitions

Independent Evaluation of ANTs Methods

Klein Evaluation 2009

"Would you like to participate in an unbiased evaluation of deformable registration?"
- Arno Klein, Nov 2008



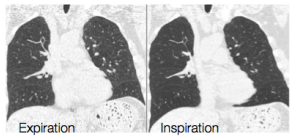


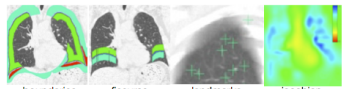
Permutation test ranking of the registration methods by label set. This table lists the methods that attained the top three ranks after conducting permutation tests between mean target overlaps (averaged across regions) for each pair of methods, then calculating the percentage of p-values less than or equal to 0.05 (of 100,000 tests for CUMC12 and MGH10 or of 10,000 tests for LPBA40 and IBSR18). μ—mean, SD—standard deviation). Methods within ranks 1, 2, and 3 have positive mean percentages lying within one, two, and three standard deviations of the highest mean, respectively. Values are not comparable across label sets (columns). (SPM_D=DARTEL pairwise)

2008

Murphy Evaluation 2010/2011

"Brian, should we participate in this lung registration challenge?"
- Gang Song





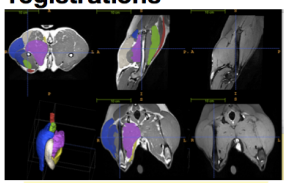
Team Name	Lung Boundaries Avg Score	Lung Boundaries Avg Rank	Fissures Avg Score	Fissures Avg Rank	Landmarks Avg Score	Landmarks Avg Rank	Folding Avg Score	Folding Avg Rank	Overall Avg Rank	Placed	Last Update	Method Type
picsl gsyn	0.12	8.00	0.03	9.52	0.75	3.65	0.00	13.77	8.73	1	25 Jun 2010	Fully Auto
Nifty Reggers	0.00	7.57	0.27	12.30	0.75	7.25	0.00	12.50	9.90	2	26 Jun 2010	Fully Auto
linwa sstvd											26 Jun	Fully

- Register pairs of thoracic CT volumes
- Part of MICCAI 2010 Grand Challenges: http://empire10.isi.uu.nl
- First round offline competition finished on June 21, 2010
- **ANTS** by *picsl gsyn* : 1st place among 34 teams

SATA Challenge MICCAI 2013: Standardized Registration

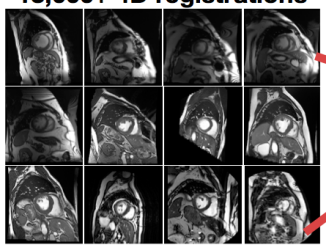
1,600 registrations

7,000+ multivariate registrations

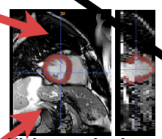


Expected Results for challenge participants ~ Dice = 0.8+

13,000+ 4D registrations

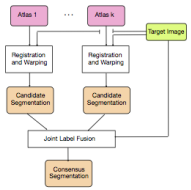


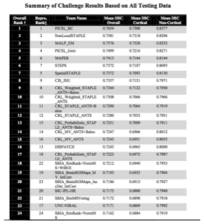
I wouldnt be surprised if getting "reasonable" & "consistent" registrations for this data is difficult or impossible.



Expected Results for challenge participants ~ Dice = 0.7

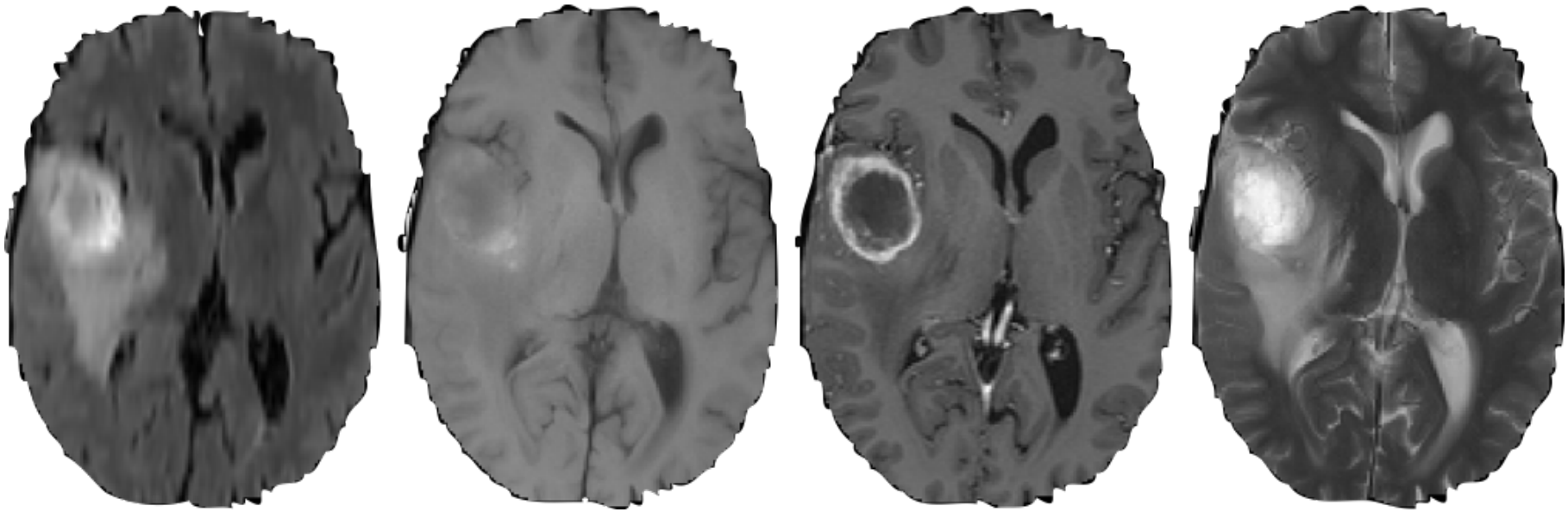
SATA Challenge MICCAI 2012





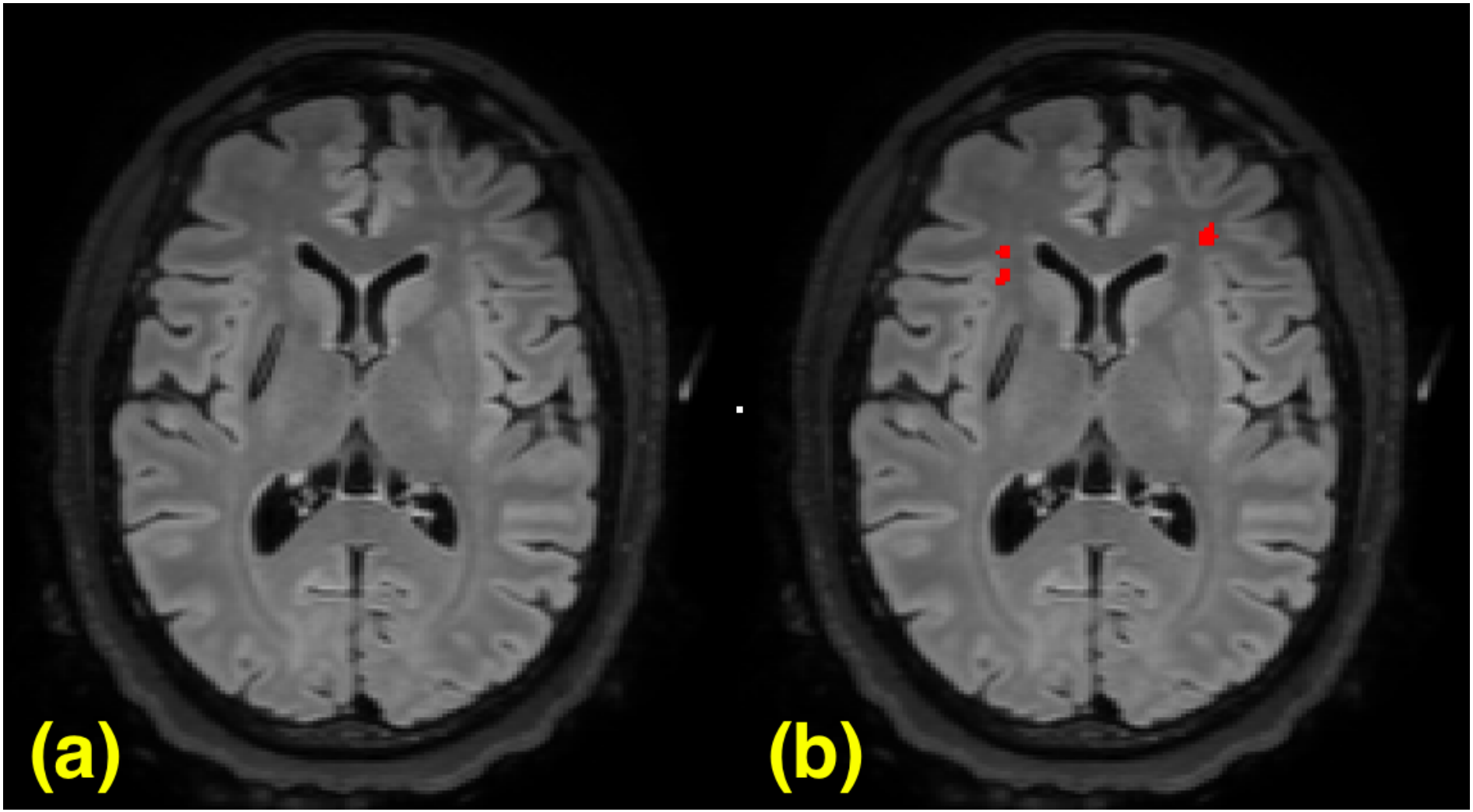
Present

Competition: BRATS 2013



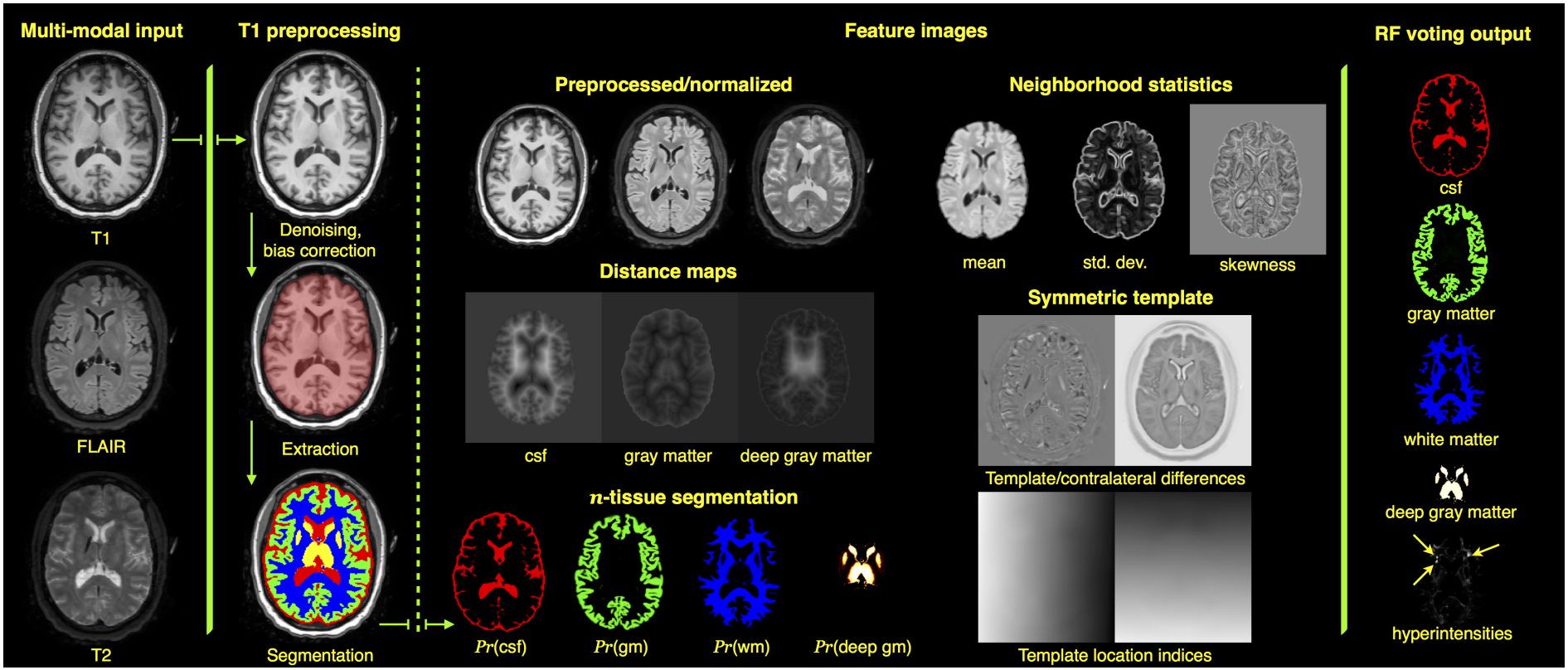
*only team out of 20 to make code publicly available.

WMH segmentation



Feature images

$$label \sim_{RF} feature_1 + \ldots + feature_n$$



Feature importance

Sample results