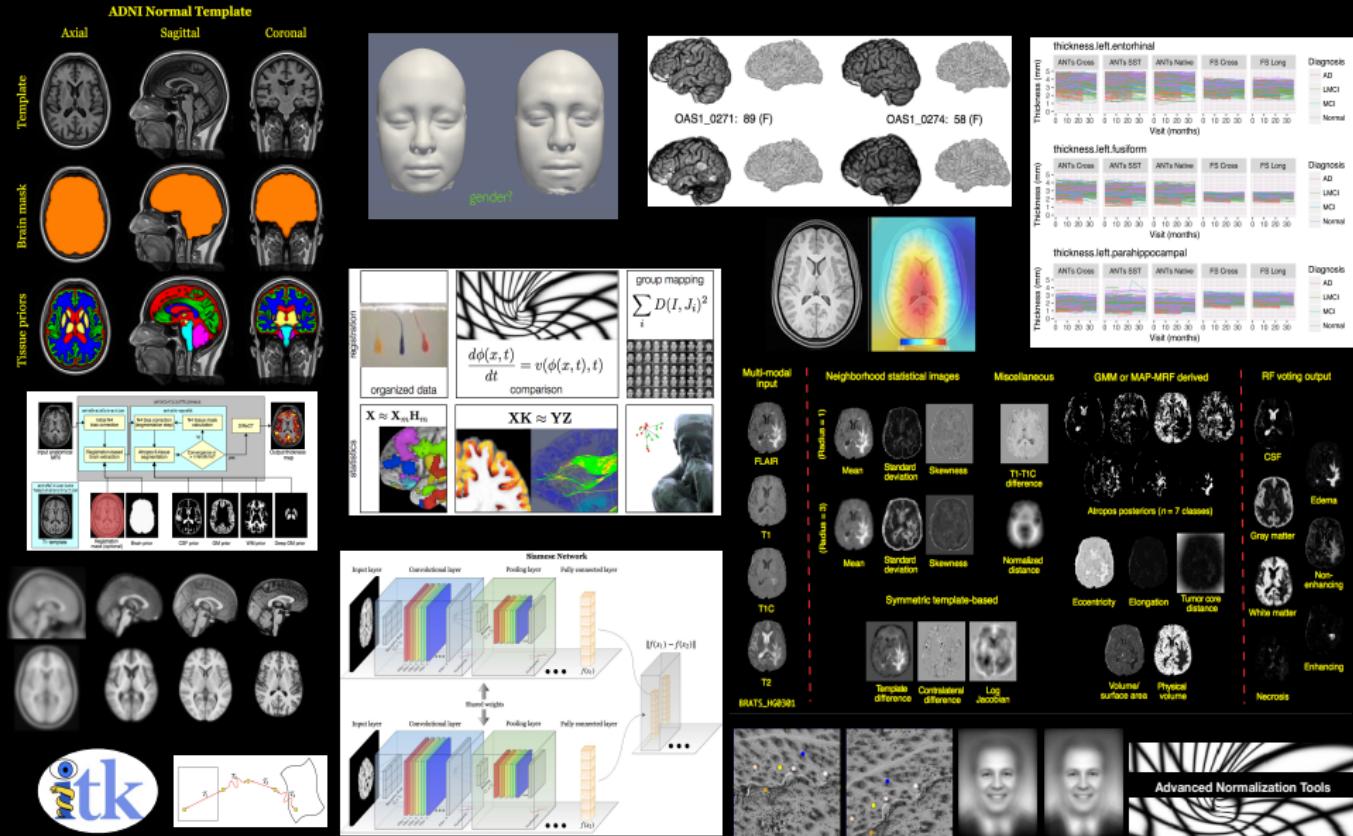


Longitudinal mapping of cortical thickness measures

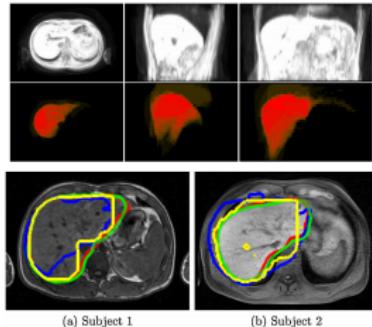
The ANTs longitudinal cortical thickness pipeline

ANTs for large-scale neuroimage quantitative analysis

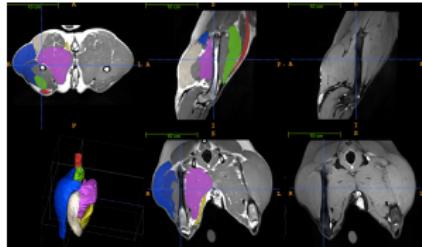


General purpose core

Liver registration/segmentation*

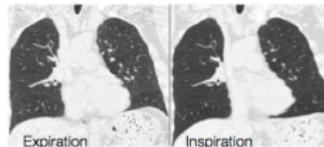


7,000+ multivariate registrations



Multiple modality canine MRI: segmentation

Lung: EMPIRE 10 Challenge

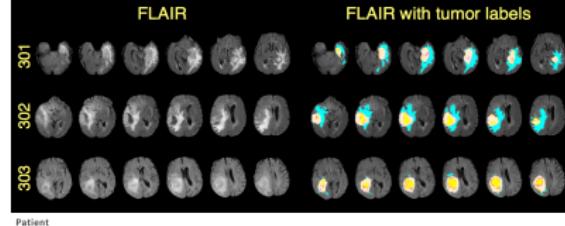


- Register pairs of thoracic CT volumes
- Part of MICCAI 2010 Grand Challenges: <http://empire10.uva.nl>
- First round offline competition finished on June 21, 2010
- ANTS by picis/gsynn : 1st place among 34 teams



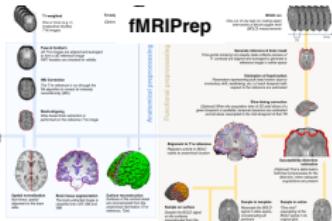
Brain tumor segmentation

BRATS 2013 challenge results



Position	User	Gross	Positive Predictive Value	Sensitivity	Kappa	Cumulative Success Rate	Tumor core	Enhancing tumor
1	Nick Tustison	0.89(12) 14	0.79 0.74	0.74 0.73	0.89(9) 12	0.88 0.81	0.89(2) 12	0.87 1.00
2	Reichardt Miller	0.88(10) 14	0.79 0.73	0.76 0.72	0.89(9) 12	0.83 0.73	0.79(9) 12	0.84 0.90
3	Syed Nizam	0.88(10) 14	0.79 0.73	0.88(8) 12	0.88 0.80	0.88(8) 12	0.88(8) 12	0.88 0.92
4	Liang Zhao	0.88(10) 14	0.80 0.74	0.88(8) 12	0.87 0.80	0.88(8) 12	0.79 0.88	0.83 0.92
5	Monica Cardillo	0.88(10) 14	0.80 0.74	0.88(8) 12	0.88 0.80	0.88(8) 12	0.88 0.92	0.88 0.92
6	Jenna Reina	0.73(5) 14	0.68 0.67	0.71(5) 12	0.77 0.70	0.72(5) 12	0.68 0.79	0.66 0.70
7	Simeon Boyle	0.73(5) 14	0.66 0.62	0.66(5) 12	0.56 0.50	0.67(5) 12	0.68 0.55	0.60 0.64

User base (industry and academia)



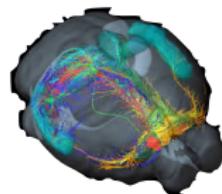
Stanford University



USC Laboratory
of Neuro Imaging



Princeton Neuroscience Institute



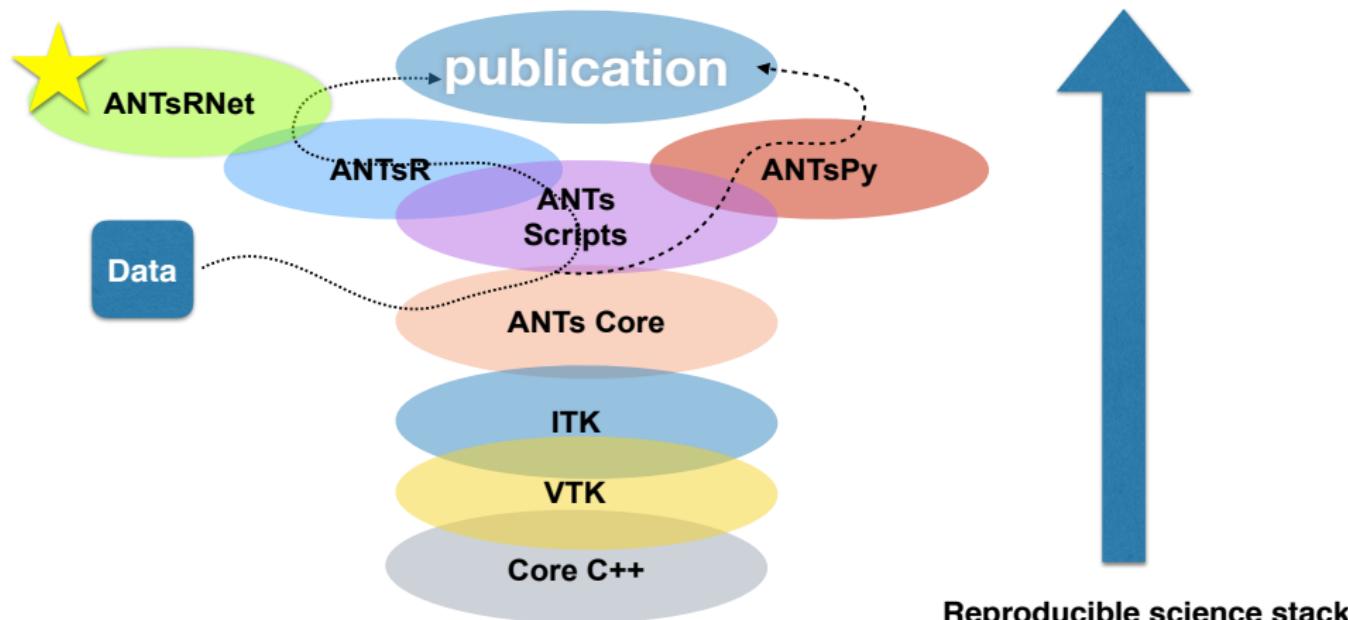
Google



C-PAC



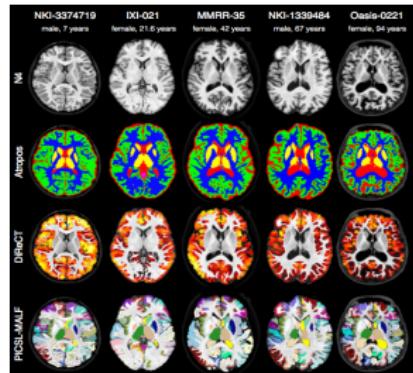
ANTsR & ANTsPy



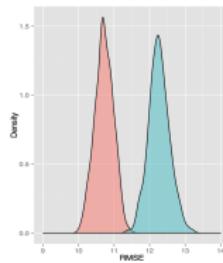
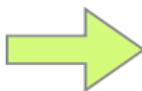
DiReCT: cortical thickness

DiReCT cortical thickness

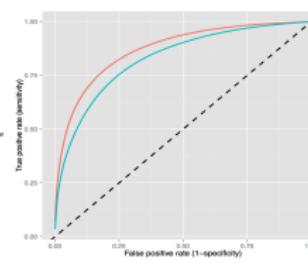
Column1	Column2
Tetris-playing ability	chronic pancreatitis
Huntington's disease	obsessive-compulsive disorder
schizophrenia	ADHD
bipolar disorder	obesity
Alzheimer's disease	heritable depression
frontotemporal dementia	elderly depression
Parkinson's disease	age
Williams syndrome	gender
multiple sclerosis	handedness
autism	intelligence
migraines	athletic ability
chronic smoking	meditative practices
alcoholism	musical ability
cocaine addiction	tendency toward criminality
Tourette syndrome in children	childhood sexual abuse in female adolescents
scoliosis in female adolescents	traumatic brain injury
early-onset blindness	untreated male-to-female transsexuality



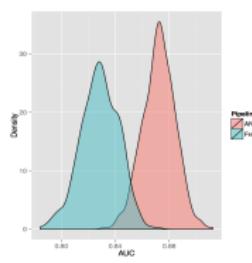
How do we evaluate?



Age



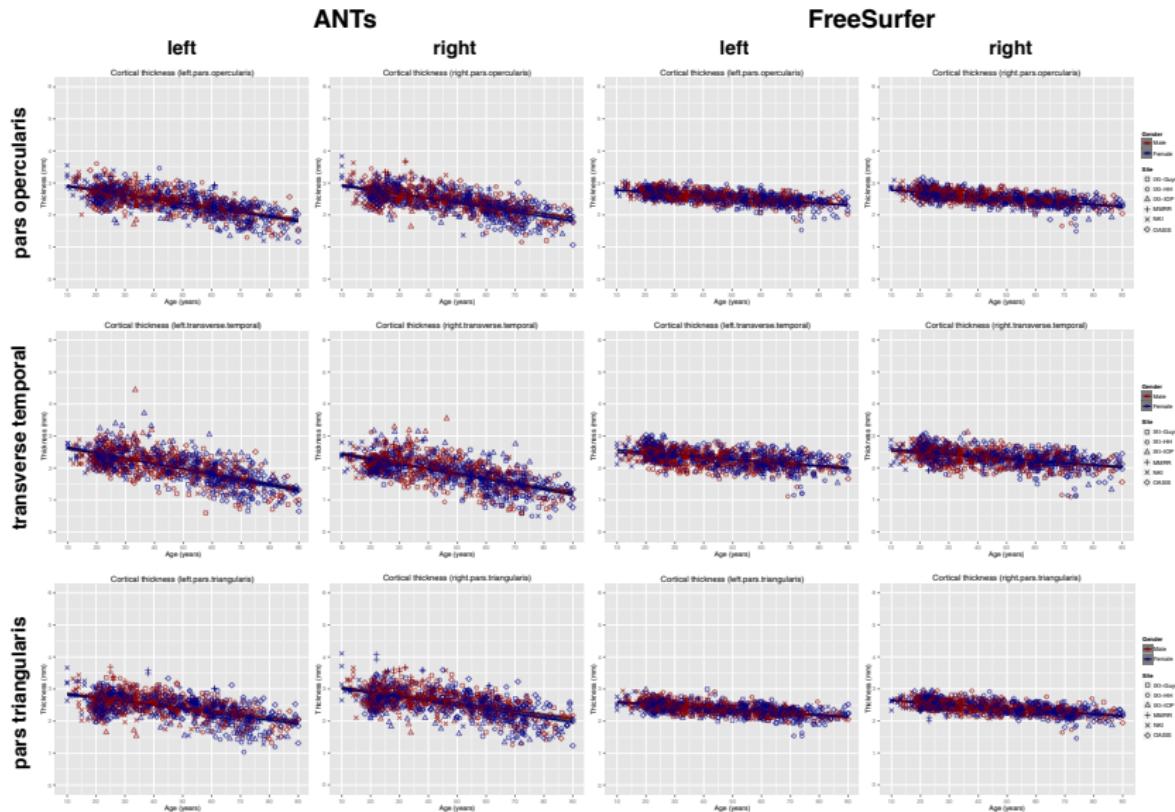
Gender



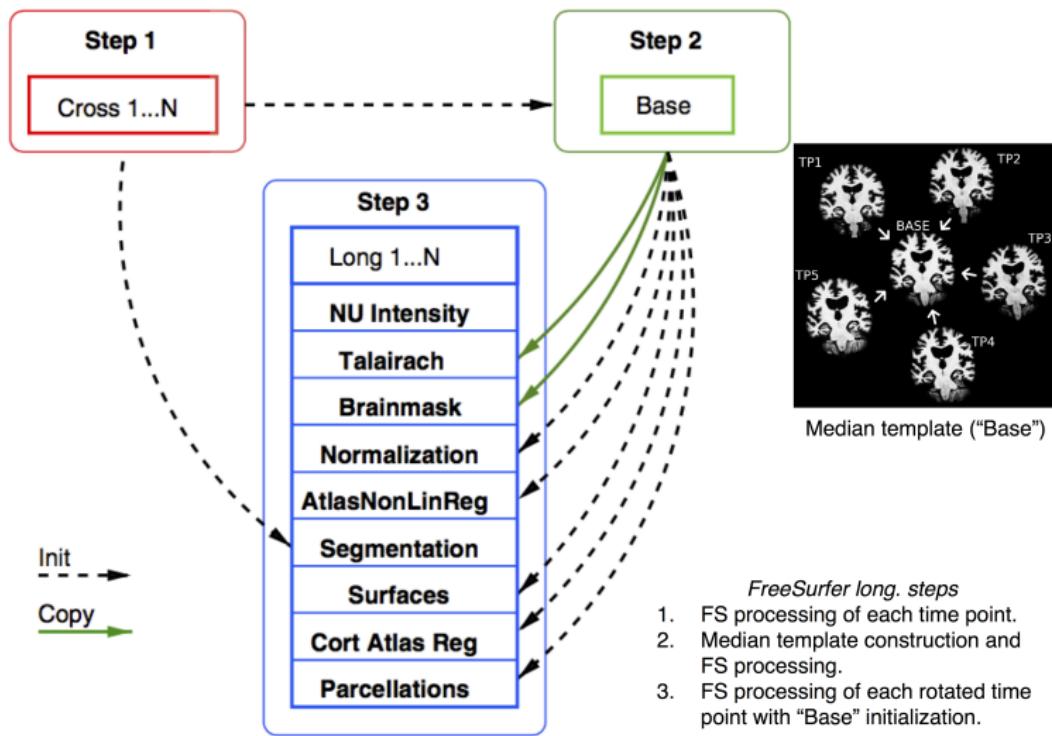
Repeatability:
 $ICC_{FS} = 0.97$, $ICC_{ANTS} = 0.98$

Large-Scale Evaluation of ANTs and FreeSurfer Cortical Thickness Measurements. NeuroImage, 2014.

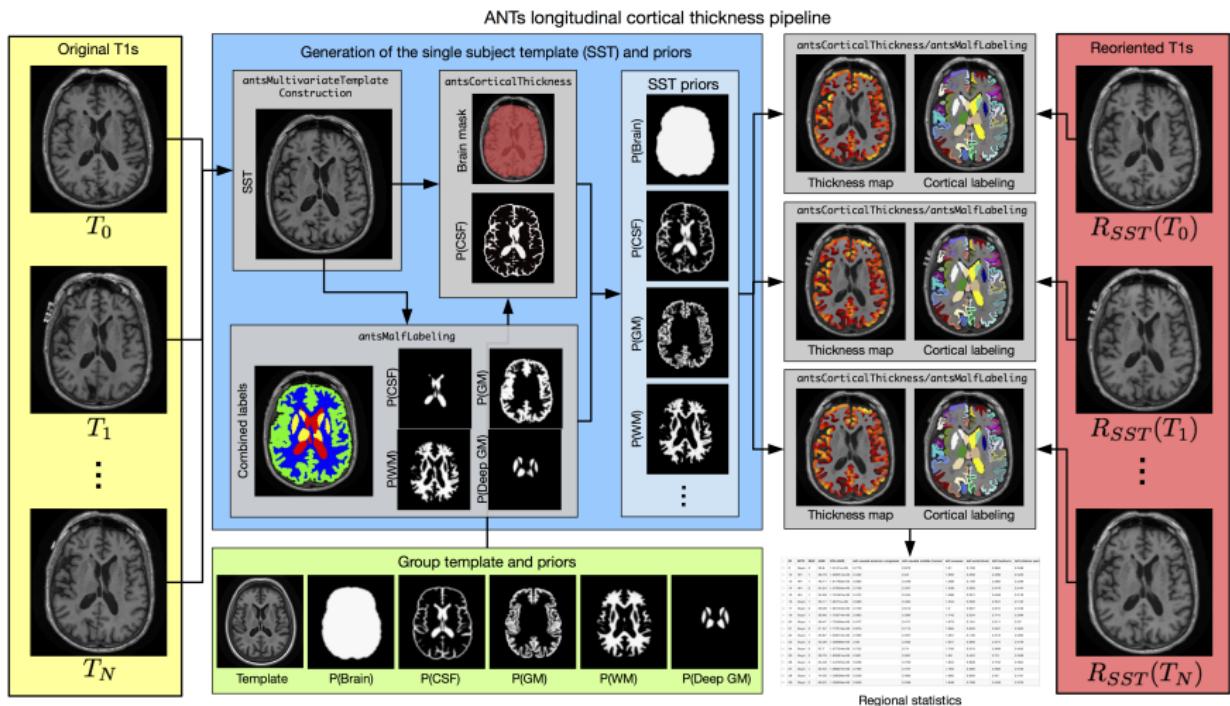
Cross-sectional comparison



FreeSurfer longitudinal pipeline



ANTs longitudinal pipeline



Evaluation?

After all this developmental effort¹:

- is the extra longitudinal processing worth it? I.e., is it better than just processing data through the cross-sectional pipeline?
- And, if so, do we process in native space or SST space?

Although ANTs processing has certain advantages (just as FreeSurfer has advantages),

- can we determine if the cortical thickness measures are somehow “better” than FreeSurfer’s?
- And can we do it in a more general way than has been done previously?

¹First GitHub commit Aug. 27, 2014. Most recent Feb. 28, 2019.