

HAAG Weekly Report

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Week 8

Time-Log

- What did you do this week?
 - Experimented with testing implementation for the new PCA Kernel method, but unfortunately no success yet, was aiming to do in vs. out of sample test for the included data samples.
 - Met with program seminars team to organize first seminar.
 - Hosted and managed AV for the first seminar for the programs team.
- What are you going to do next week
 - Continue trying to implement testing using the included pycpd methods, but also open to exploring new methods to verify the new method accuracy.
 - Implement Bayesian cpd to test against the existing and new methods
- Blockers, things you want to flag, problems, etc.
 - Just time and some code problems to figure out

Abstracts:

Landmark and Intensity-Based, Consistent Thin-Plate Spline Image Registration

https://user.engineering.uiowa.edu/~n-morph/publications/pdfs/Consistent_Thin-Plate_Spline_Image_Registration.pdf

Abstract: . Landmark-based thin-plate spline image registration is one of the most commonly used methods for non-rigid medical image registration and anatomical shape analysis. It is well known that this method does not produce a unique correspondence between two images away from the landmark locations because interchanging the role of source and target landmarks does not produce forward and reverse transformations that

are inverses of each other. In this paper, we present two new image registration algorithms that minimize the thin-plate spline bending energy and the inverse consistency error—the error between the forward and the inverse of the reverse transformation. The landmarkbased consistent thin-plate spline algorithm registers images given a set of corresponding landmarks while the intensity-based consistent thinplate spline algorithm uses both corresponding landmarks and image intensities. Results are presented that demonstrate that using landmark and intensity information to jointly estimate the forward and reverse transformations provides better correspondence than using landmarks or intensity alone.

Summary: This paper introduces novel image registration algorithms leveraging thin-plate splines (TPS) for medical image analysis. Traditional landmark-based TPS registration suffers from inconsistencies between forward and reverse transformations. **The authors present two algorithms minimizing TPS bending energy and inverse consistency error:** a landmark-based consistent TPS (CL-TPS) and a landmark and intensity-based consistent TPS (CLI-TPS). The consistent algorithms jointly estimate forward and reverse transformations, improving correspondence compared to using landmarks or intensity alone. **Experimental results demonstrate the CLI-TPS method enhances image alignment by incorporating intensity information alongside landmark data,** which leads to improved registration results.

What did you do and prove it

This week unfortunately couldn't get to commit much, as I was strained on time, and couldn't get any working solution up, so on the research side next week will definitely have more to show. Other than that, I have included a link to the youtube upload of the first seminar, which we worked hard to organize this week with Apratim, Kaushika and Evan.

Link to meeting with Seminar: <https://youtu.be/JV1ZitXEOZQ?si=Gbb2nrmwdDXbTTIN>