

HAAG Weekly Report (Simplified) – Omar Moursy – 3D Modeling

Time-Log

What did you do this week?

- Updated Ongoing projects page with 3D Modeling project <https://sites.gatech.edu/human-augmented-analytics-group/on-going-projects/>
- Uploaded the Weekly reports and meeting recordings for Week 5.
- Had a progress update meeting with Nikita and Steve where we went through understanding of CPD algorithm and maths behind it.
- Read through Textbook chapters, videos and online resources explaining Gaussian Mixture Models, PCA, SVD and related methods such as ICP.
- Tested the deformable point cloud registration on the 3D rabbit and fish examples from the original repo.
- Worked with team on presentation documents explaining goals and current understanding for comp. advisors

What are you going to do next week

- Meet with researchers and distribute the kernel replacement and testing functions between us.
- Meeting with Dr. Porto on Tuesday to discuss progress and next steps

Blockers, things you want to flag, problems, etc.

- None for this week

Abstracts:

Accurate and Robust Non-rigid Point Set Registration using Student's-t Mixture Model with Prior Probability Modeling

<https://www.nature.com/articles/s41598-018-26288-6>

Abstract

A new accurate and robust non-rigid point set registration method, named DSMM, is proposed for non-rigid point set registration in the presence of significant amounts of missing correspondences and outliers. The key idea of this algorithm is to consider the relationship between the point sets as random variables and model the prior probabilities via Dirichlet distribution. We assign the various prior probabilities of each point to its correspondences in the Student's-t mixture model. We later incorporate the local spatial representation of the point sets by representing the posterior probabilities in a linear smoothing filter and get closed-form mixture proportions, leading to a computationally efficient registration algorithm comparing to other Student's-t mixture model based methods. Finally, by introducing the hidden random variables in the Bayesian framework, we propose a general mixture model family for generalizing the mixture-model-based point set registration, where the existing methods can be considered as members of the proposed family. We evaluate DSMM and other state-of-the-art finite mixture models based point set registration algorithms on both artificial point set and various 2D and 3D point sets, where DSMM demonstrates its statistical accuracy and robustness, outperforming the competing algorithms.

What did you do and prove it

Uploaded the missing [weekly reports](#) and [meeting recordings](#).

We had a team meeting to discuss the our understanding of GMM and PCA and how they're used in CPD algorithm. The recording is also on the website.

Read through some related works to the CPD paper, videos and textbook chapters on GMM and PCA such as Bishop's Pattern Recognition and Machine Learning chapter on GMM, [code visualization of GMM](#) and [Principal Component Analysis](#).

Replicated GitHub repo and tested the 3D fish and rabbit examples

