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

## Time-Log

What did you do this week?

- Uploaded the Weekly reports for Weeks 7 and 8.
- Had a progress update meeting with Nikita and Steve where we talked about tuning the hyperparameters of the PCA method to try and beat the vanilla cpd method.
- Read through Dr. Arthur Porto's ALPACA paper.
- Added more relevant performance metrics based on the ground truth data from Dr. Porto by testing the rmse of the transformed landmarks and the aligned landmarks.
- Tuned the PCA constrained point cloud registration on the mouse dataset from Dr. Porto.

What are you going to do next week

- Meet with researchers and discuss why the pca method is not showing the expected results.
- Meet with Dr. Porto to discuss next steps including starting work on the publication.
- Meet with comp. advisors to get feedback on current roadblocks and how we can get past them.

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

- Tests for pca registration method are not showing as much improvement as expected in landmark registration

## Abstracts:

# Multi-Body Neural Scene Flow

https://arxiv.org/abs/2310.10301/

## Abstract

The test-time optimization of scene flow - using a coordinate network as a neural prior - has gained popularity due to its simplicity, lack of dataset bias, and state-of-the-art performance. We observe, however, that although coordinate networks capture general motions by implicitly regularizing the scene flow predictions to be spatially smooth, the neural prior by itself is unable to identify the underlying multi-body rigid motions present in real-world data. To address this, we show that multi-body rigidity can be achieved without the cumbersome and brittle strategy of constraining the SE(3) parameters of each rigid body as done in previous works. This is achieved by regularizing the scene flow optimization to encourage isometry in flow predictions for rigid bodies. This strategy enables multi-body rigidity in scene flow while maintaining a continuous flow field, hence allowing dense long-term scene flow integration across a sequence of point clouds. We conduct extensive experiments on real-world datasets and demonstrate that our approach outperforms the state-of-the-art in 3D scene flow and long-term point-wise 4D trajectory prediction. The code is available at: this https URL.

## What did you do and prove it

Uploaded the missing weekly reports.
We had a team meeting to discuss about tuning the hyperparameters of the PCA method to try and beat the vanilla cpd method.
Tested the pca reg method by transforming the mean landmarks and comparing them to the aligned landmarks.

```
--- Registration Comparison ---
RMSE before registration: 0.368227
RMSE after PCA registration: 0.227374 (took 162.89 seconds)
RMSE after standard deformable registration: 0.258480 (took 75.79 seconds)
PCA registration improved RMSE by 38.25%
Standard deformable registration improved RMSE by 29.80%
PCA registration performed better by 12.03%
```