## Multi-Device Head Tracking Alignment

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### Introduction

Multi-device head tracking alignment involves synchronizing the head tracking data across multiple devices to ensure consistent and accurate tracking of a user’s head movements. This is particularly important in applications such as virtual reality (VR), augmented reality (AR), and motion capture, where accurate head position and orientation are crucial for an immersive experience.

![Image of Magic Leap 2 (on the left) and DMS (on the right)]

### Research & Learning Process

In this project, we aligned 3D coordinate systems between Augmented Reality glasses (Magic Leap 2) and a DMS (Driver Monitoring System) sensor through heterogeneous head tracking data.

- **3D Geometric Transformation**
- **Kabsch-Umeyama Algorithm for data points alignment**
- **Least Squares Regression for rotation alignment**

![Diagram showing 3D coordinate systems and alignment process]

### Methods & Results

- **Visualization before alignment (DMS = Red, Magic Leap = Blue)**
- **Visualization after Kabsch-Umeyama position**
- **Final Visualization after Least Squares Regression rotation alignment**

### Advice for Future SHINE Students

If you are truly passionate on your research topic, spending time on problem solving is going to be very rewarding. Through the challenges faced, you realize how much you are truly learning and improving your skills. Additionally, there will always be your research mentor to guide you into the path of the solution.

This project helped me solidify my interest for data analysis and computer science. Spending time on problem solving regarding something I’m truly passionate was an amazing experience.

### Objective & Impact of Professor’s Research

Prof. Govindan’s research focuses on scalable and robust routing infrastructures in large networks such as the Internet; on structural properties of the Internet; and on the architectures and programming systems for wireless and mobile networks.

My mentor’s research focuses on Mobile AR, with the goal of making AR experiences more immersive, accessible, and ubiquitous.

![Image of 360º spin from Magic Leap]]

### Skills learned include:

- Hands-on experience with commercial hardware
- Unity/C# programming for data collection
- Python (NumPy, SciPy, Matplotlib) for data analysis/visualization
- Algorithm design for unsynchronized data

### Acknowledgements

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### Citations