

## **EE/CprE/SE 4910 WEEKLY REPORT #8**

**4/16/25 - 4/22/25**

**Group number 15**

### **Vision Based Camera Motion Tracking**

**Advisor: Ashraf Gaffar**

#### **Team Members:**

Andrew Gooding

Eric Wittrock

Isaac Kenyon

Will Ernatt

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#### **Weekly Summary**

In the last two weeks, our focus was on the experimentation of different tools and techniques, for example, a new point detection algorithm, ORB-SLAM, and also improved camera mathematics. This week we finished our transitions to these new tools and worked on integrating them with our existing code. Our work also entailed miscellaneous experimentation, namely, trying different configurations to enhance ORB-SLAMs performance.

#### **Past Weekly Accomplishments**

##### **Eric Wittrock**

- Finished optimization implementation using new camera class
  - In previous weeks, I overhauled the code for the camera, which maps 3d points to 2d points on screen. This week I finalized the integration between the camera class and the optimizer class.
- Worked on debugging tools
  - This week I continued to work on the 3d renderer to ensure correctness with a visual model

##### **Isaac Kenyon**

- Compared the Photometric Error Minimization algorithm to the Inverse Compositional Image Alignment
  - Used in image registration and template tracking.
  - Efficient algorithm for minimizing photometric error between a template and a target.
  - Related to the Lucas-Kanade method but optimized for speed.

- Tested prototype at different frame sizes up to 4k.
- Working on some ideas for the presentation.

### **Will Ernatt**

- Continued working on ORB-SLAM algorithm for camera motion estimation
  - Migrated from ORB-SLAM2 to ORB-SLAM3, which boasts real-time performance, ideal for our case.
  - Still moderately inaccurate, and struggles on the Windows environment vs. Linux.
  - Algorithm now allows users to input camera parameters (focal length, video dimensions, etc.)

### **Andrew Gooding**

- Continued working on script to automate the process of eliminating errors during blender camera tracking.

### **Pending Issues**

- **Eric Wittrock:** While I greatly improved the performance with a large number of points this week, the performance is still hindered by a large number of frames.
- **Isaac Kenyon:** Presentation idea, merging the algorithm with the blender UI. Work on the website that is needed, I can work on that.
- **Will Ernatt:** Fix OpenCV Windows environment.
- **Andrew Gooding:** May not be able to get the error deletions process to automate the way I need it too.

### **Individual contributions**

<b>Name</b>	<b>Individual Contributions</b>	<b>Hours This Week</b>	<b>Hours Cumulative</b>
Eric Wittrock	Worked on rendering/debugging tool and finalized integration between new camera code and optimizer code	5	49
Will Ernatt	Continued working on ORB-SLAM algorithm, migrating	6	49

	from ORB-SLAM2 to ORB-SLAM3		
Andrew Gooding	Continued work to improve error detection for blender script written to automate camera tracking process.	4	40
Isaac Kenyon	Tested prototype at different frame sizes up to 4k. Working on some ideas for the presentation. Compared the Photometric Error Minimization algorithm to the Inverse Compositional Image Alignment	7	48

### **Plans for the upcoming week**

#### **Andrew Gooding**

- Working on making my script better to be able to delete errors automatically.

#### **Eric Wittrock**

- Run experiments to improve the optimization algorithm. Compare the two strategies: alternating between tuning camera position and lens distortion v.s. tuning all variables at the same time. Run miscellaneous other experiments.

#### **Isaac Kenyon**

- As a team, we decide what we want to do for our presentation. Gather input from the team on what is needed on the website as it is something I can put together.

#### **Will Ernatt**

- Continue work on ORB-SLAM3 implementation, research and implement potential optimizations.